Program Educational Objectives (PEO)
Master of Science (M. Sc.) Biotechnology
Academic Year – 2023-24

M.Sc. Biotechnology

PEO1: To impart ability to pursue careers in the industry, agriculture, and applied research.

PEO2: To inculcate domain specific skills and impart knowledge in interdisciplinary areas of biotechnology.

PEO3: To instil professional skills, communication and scientific writing skills and ethics in global scenario.

PEO4: To be able to demonstrate innovative ability, entrepreneurship skills, for contributing to social and national development.

PEO5: To engage in lifelong learning with knowledge of contemporary and futuristic issues related to biotechnology.

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AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

M.Sc Biotechnology (Four Semesters)

PROGRAM OUTCOMES OF M. SC. BIOTECHNOLOGY

PO1. General Output: Programme outcome of M.Sc. Biotechnology is to develop competent human resource, the bright biotechnologist's that can cater the growing demand of global biotechnology professionals. The biotech professionals can implement their knowledge base in premium processes and applications which will profoundly influence or utilized for existing paradigm of agriculture, industry, healthcare and restoration of degraded environment to provide sustainable competitive edge to present society.

PO2. Knowledge: Students will imbibe and demonstrate most contemporary and latest knowledge in Biotechnology. This will help students to fill the growing need of professionals by various sectors of pharmaceutical and biotechnological industry.

PO3. Exposure: The sole aim of this course is to provide industrial exposure to the student pertaining to principles adopted and practices followed in industrial/ pharmaceutical sector.

PO4. Research: The sole aim of this course is to familiarize student as to how to carry out problem solution-based research experiments and also to learn skills of research based technical writing.

PO5. Effective Communication: Ability to communicate effectively and develop scientific writing.

PO6. Lifelong learning: Ability to engage in life-long learning in the context of technological change.

PO7. Independent thinking: Inculcation of ability to think independently for problem solving.

PO8. Team bonding: Ability to work in a team towards achieving a common goal and solving broad societal and national issues.

PO9. Ethics: Understanding of professional and ethical responsibility among students to conduct at their workplace.

PO10. Interpretation: Ability to design and conduct experiments in biotechnology and analyze data.

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PROGRAMME SPECIFIC OUTCOMES OF M. SC. BIOTECHNOLOGY

PSO1: Students will be able design, conduct experiments, analyze and interpret data for investigating problems in Biotechnology and allied fields.

PSO2: Higher studies (M.Phil, Ph.D) can be pursued in order to achieve research positions. Various competitive examinations such as CSIR-NET, ARS-NET GATE, ICMR, DBT offers promising career in research.

PSO3: Students can become Junior Production Officer and Technical Assistant in biotechnology, pharmaceutical Companies, bio fertilizer industry, aquaculture industries, environmental units, crop production units, food processing industries, national bio-resource development firms, banking and KPO.

PSO4: Entrepreneurship ventures such as consultancy and training centers can be opened. **PSO5:** Some of the major pharmaceutical and drug companies' hire biotechnology professionals include Dabur, Ranbaxy, Hindustan Lever and Dr. Reddy's Labs, food processing industries, chemical industry and textile industry as well. Beside this industries also employ bio- technological professionals in their marketing divisions to boost up business in sectors where their products would be required.

PSO6: Beside industrial sector there are ample opportunities in academics as well.

PSO7: Students will be able to understand the potentials, and impact of biotechnological innovations on environment and their implementation for finding sustainable solution to issues pertaining to environment, health sector, agriculture, etc.

PSO8: Several career opportunities are available for students with biotechnology background abroad especially in countries like Germany, Australia, Canada, USA and many more where biotechnology is a rapidly developing field.

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Amity Institute of Biotechnology

Amity University Madhya Pradesh

PO Mapping of M.Sc. Biotechnology syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	**PO-1**	General Output: Programme outcome of M.Sc. Biotechnology is to develop competent human resource, the bright biotechnologist's that can cater the growing demand of global biotechnology professionals. The biotech professionals can implement their knowledge base in premium processes and applications which will profoundly influence or utilized for existing paradigm of agriculture, industry, healthcare and restoration of degraded environment to provide sustainable competitive edge to present society.	SDG 4 Quality Education
2	**PO-2**	Knowledge: Students will imbibe and demonstrate most contemporary and latest knowledge in Biotechnology. This will help students to fill the growing need of professionals by various sectors of pharmaceutical and biotechnological industry.	SDG 4 Quality Education
3	**PO-3**	Exposure: The sole aim of this course is to provide industrial exposure to the student pertaining to principles adopted and practices followed in industrial/ pharmaceutical sector.	SDG 9 Industry, Innovation and Infrastructure
4	**PO-4**	Research: The sole aim of this course is to familiarize student as to how to carry out problem solution-based research experiments and to learn skills of research based technical writing.	SDG 4 Quality Education
5	**PO-5**	Effective Communication: Ability to communicate effectively and develop scientific writing.	SDG 10 Reduce Inequalities
6	**PO-6**	Lifelong learning: Ability to engage in life-long learning in the context of technological change.	SDG 3 Good Health and Well Being
7	**PO-7**	Independent thinking: Inculcation of ability to think independently for problem solving.	SDG 17: Partnerships for the Goals
8	**PO-8**	Team bonding: Ability to work in a team towards achieving a common goal and solving broad societal and national issues.	SDG 17: Partnerships for the Goals
9	**PO-9**	Ethics: Understanding of professional and ethical responsibility among students to conduct at their workplace	SDG 17 Partnerships for the Goals
10	**PO-10**	Interpretation: Ability to design and conduct experiments in biotechnology and analyze data.	SDG 9: Industry, Innovation, and Infrastructure

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Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	M.Sc. Biotechnology	III	MSB-305	DRUG DESIGN AND DEVELOPMENT	National Biopharma Mission
2.	Amity Institute of Biotechnology	M.Sc. Biotechnology	III	MSB-306	DRUG DELIVERY SYSTEMS	National Biopharma Mission
3.	Amity Institute of Biotechnology	M.Sc. Biotechnology	III	MSB-307	PHARMACEUTICAL BIOTECHNOLOGY	National Biopharma Mission
4.	Amity Institute of Biotechnology	M.Sc. Biotechnology	II	MSB-202	ADVANCES IN GENETIC ENGINEERING	National Mission for BioScience for human Health
5.	Amity Institute of Biotechnology	M.Sc. Biotechnology	II	MSB-204	ADVANCED GENOMICS AND PROTEOMICS	National Mission for BioScience for human Health

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PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
MSB101	*Advanced Biochemistry*	*3*	1	-	4	
MSB102	Advanced Microbial Technology	3	-	-	3	
MSB103	Biophysics & Bioanalytical Techniques	3	-	-	3	
MSB104	Advanced Cell Biology & Genetics	3	1	-	4	
MSB105	Advanced Biostatistics for Biologists	3	-	-	3	
CSE 103	Computer Applications	3	-	-	3	
MSB120	Biochemistry Lab	-	-	4	2	
MSB121	Advanced Microbial Technology Lab	-	-	2	1	
MSB122	Cell Biology & Genetics Lab	-	-	2	1	
CSE 123	Computer Applications Lab	-	-	2	1	
BCP141	Advanced Communication - I	1	-	-	1	
BSP143	Behavioural Science – I	1	-	-	1	
	TOTAL				**27**	

SECOND SEMESTER

MSB201	Advanced Molecular Biology	4	-	-	4	
MSB202	Advances in Genetic Engineering	4	-	-	4	
MSB203	Bioprocess Technology	4	-	-	4	
MSB204	Advanced Genomics & Proteomics	4	-	-	4	
MSB205	Computational Biology	3	-	-	3	
MSB206	Environmental Biotechnology	3	-	-	3	
MSB220	Advanced Molecular Biology Lab	-	-	4	2	
MSB221	Genetic Engineering Lab	-	-	4	2	
MSB222	Bioprocess Technology Lab	-	-	4	2	
MSB223	Advanced Genomics & Proteomics Lab			2	1	
MSB224	Computational Biology Lab	-	-	2	1	
BCP241	Advanced Communication - II	1	-	-	1	
BSP243	Behavioural Science – II	1	-	-	1	
	TOTAL					

SUMMER INTERNSHIP OF 09 -12 WEEKS

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THIRD SEMESTER

MSB301	Advanced Immunology	3	-	-	3	
MSB302	Enzyme Technology	3	-	-	3	
MSB303	Advanced Animal Biotechnology	3	-	-	3	
MSB304	Advanced Plant Biotechnology	3	-	-	3	
 MSB305 MSB306 MSB307 MSB308 MSB309 MSB310 MSB311	**Elective (Select any One)** • Drug Design & Development • Drug Delivery Systems • Pharmaceutical Biotechnology • IPR, Biosafety & Bioethics • Clinical Biotechnology • Nanobiotechnology • Entrepreneurship In Biotechnology	3	-	-	3	
MSB320	Advanced Immunology Lab	-	-	2	1	
MSB321	Enzyme Technology Lab	-	-	2	1	
MSB322	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
MSB350	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**30**	

FOURTH SEMESTER

MSB460	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

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Course structure: Advanced Biochemistry–MSB 101

Course Title: Advanced Biochemistry | Credit Units: 04
Course Level: PG Level | Course Code: MSB101

Course Objectives:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:	Weightage (%)
Module I	10%
Basics of structures of biopolymers; Carbohydrates, Lipids, Proteins and Nucleic Acids.	
Module II	25%
Carbohydrates Metabolsm – I Anaerobic processes in generating metabolic energy **Glycolysis, fates of pyruvate:**Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown. **Oxidative processes:**Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes. ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling. **Carbohydrate Metabolism – II** Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.	
Module III Lipid Metabolism	15%
Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.	
Module IV: Nitrogen Metabolism	15%
Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.	
Module V: Nitrogen Metabolism	15%
De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyribonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.	
Module VI: Integration of cellular metabolism and hormonal regulation	10%

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Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.	
Module VII: Secondary Plant Metabolism	10%
Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Learn carbohydrate metabolism in detail by analyzing all the pathways.
- Learn the various aspects of lipid metabolism and their regulation.
- Understand the metabolism of Nitrogen and excretion of urea from body.
- Learn Nucleotide metabolism and clinical disorders of purine metabolism.
- Develop advanced knowledge of action of major hormones and principles and application of primary and secondary metabolites.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:
Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), LubertStryer

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Course structure: Advanced Microbial Technology -MSB 102

Course Title: Advanced Microbial technology — Credit Units: 03
Course Level: PG Level — Course Code: MSB102

Course Objectives:
To acquaint the students to understand thebasic concept of microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:Introduction to microbiology	30%
Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,	
Module II: Control of Microorganisms	20%
Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.	
Module III: Microbial Genetics	30%
Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation.Microbial regulation of gene expression: the trp and lac operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.	
Module IV: Medical Microbiology	20%
Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Recognize and explain the significant role that microbes play in the world around us.
- Explain the similarities and differences of microbes as compared to higher forms of life.
- Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences.
- Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage.
- Explain the basic principles of immunology relating to host resistance.
- Evaluate the physical and chemical methods of microbial control.
- Recognize microbial diseases and their control.

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Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings.

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Course structure: Biophysics and Bioanalytical techniques-MSB 103

Course Title: Biophysics and Bioanalytical techniques — Credit Units: 03
Course Level: PG Level — Course Code: MSB103

Course Objectives:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:Membrane Biophysics	20%
Genesis of membrane potential in nerve & membrane, Nerst& Goldman equation, Patch Clamp and Voltage –Clamp techniques for measuring membrane potential.	
Module II: Radiation Biophysics	20%
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.	
Module III: Non-Radioactive tracer Technology	15%
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.	
Module IV: Spectroscopy and X –ray crystallography	15%
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.	
Module V: Electrophoresis	15%
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.	
Module VI: Chromatography and Centrifugation	15%
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential.
- Learn about the radiation biophysics and its uses such as tracer techniques etc.
- Learn about various spectroscopic techniques and X –ray crystallography.
- Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein.
- Learn different chromatography and centrifugation techniques for separation of bio-molecules.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

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Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.

***References*:**

- Bioinstrumentation, Webster.
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

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Course structure: ADVANCED CELL BIOLOGY AND GENETICS -MSB 104

Course Title: **Advancedcell biology and genetics** Credit Units: 04

Course Level: PG Level Course Code: MSB104

Course Objectives:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporate elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	30%
Mendelian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over. Extrachromosomalinheritance:,Mitochondrial and chloroplast genetic code Chromosomal aberration and polyploidy Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon &nutron) Benzer's work on r II locus in T2 bacteriophage. Population genetics- Hardy Weinberg selection , k and r selection	
Module II: Cell organelles	20%
Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.	
Module III:	10%
Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.	
Module IV:	20%
Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase,Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.	
Module V: Cancer Biology	10%
Types of cancer; development of cancer, cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.	
Module VI: Cell Cycle	10%

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Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Analyse hereditary data and apply fundamental knowledge in genetic calculations and chromosomal aberrations.
- Understand various cellular organelles, its structure, function, phenomenon of protein sorting and targeting and also the transport across these organelles.
- Understand molecular mechanisms of how and why cells move?
- Understand the molecular structure and function of various receptors and mechanism of cell signalling.
- Understand different molecular mechanisms that bring about cell death or factors that lead to cancer.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation,
Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

Text & References:

***Text*:**

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.

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Course structure: ADVANCED BIOSTATISTICS FOR BIOLOGISTS-MSB 105
Course Title: A**dvanced Biostatistics for Biologists** Credit Units: 03
Course Level: PG Level Course Code: MSB105

Course Objectives:
The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.
Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I: Descriptive statistics	30%
Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)	
Module II:	20%
Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.	
Module III: Inferential statistics	30%
Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)	
Module IV:	20%
Applications of statistical methods using statistical software	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:
- Fundamental knowledge of basic statistical Techniques.
- Various Statistical Tools used in data presentation and interpretation
- Probability and various distributions.
- Formulation and testing of hypothesis
- Correlation & Regression analysis.
- Analysis of variance(ANOVA)
- Applications of various statistical methods using statistical softwares like SPSS, SAS etc.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

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Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand& Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. VisweswaraRao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

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COMPUTER APPLICATIONS

Course Code: CSE 103 **Credit Units: 03**

Total hours:30

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers (6 Hours)

Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office (5 Hours)

Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.

Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system (7 Hours)

Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce (5 Hours)

Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language (7 Hours)

Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical

structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF ..

ELSE statements – Looping concepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Course Outcomes:

The student will learn

- Work effectively with a range of current, standard, Office Productivity software applications.
- Evaluate, select and use office productivity software appropriate to a given situation.
- Apply basic adult learning and assessment principles in the design, development, and preser [illegible] l produced by office productivity applications.
- Demonstrate employability skills and a commitment to professionalism.

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- Operate a variety of advanced spreadsheet, operating system and word processing functions.
- A basic idea of computer programs and its database.

Examination Scheme:

Components	A	CT	S/V/Q/HA	ESE
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj & Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

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Course structure: BIOCHEMISTRY LAB-MSB 120

Course Title: **Biochemistry Lab** Credit Units: 02
Course Level: PG Level Course Code: MSB120

Course Objectives:

The objective of the present course is to elaborate the concept of different biochemical tests related to proteins and enzymes. The lab experiment explains the estimation and separation of nucleic acid, carbohydrate and lipids.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:Proteins	30%
Identification of protein by Biuret test. Quantization of protein by Bradford method Separation of proteins by SDS-PAGE	
Module II: Enzymes	15%
Enzyme activity study of serum alkaline phosphates	
Module III: Nucleic Acids	30%
Biochemical estimation of DNA Biochemical estimation of RNA Separation of DNA on Arose gel.	
Module IV: Carbohydrate	15%
Biochemical estimation of blood sugar	
Module V: Lipids	10%
Blood Cholesterol estimation.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Estimate and separate the nucleic acids such as RNA and DNA
- The estimation of proteins and enzymes
- Estimate the lipid concentrations along with separation of proteins using vertical gel electrophoresis.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: ADVANCED MICROBIAL TECHNOLOGY LAB-MSB 121

Course Title: **Advanced Microbial Technology Lab** Credit Units: 01
Course Level: PG Level Course Code: MSB121

Course Objectives:

The objective of the present course is to elaborate the concept of advanced technology of microbiology and microbiological procedures for the identification of microbes. Apart from that the understanding of biochemical and molecular characterization of microbes are also enhanced.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	30%
Aseptic techniques: preparation of culture media for cultivation of specific microorganism. Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi	
Module II:	15%
Biochemical test - Indole test. methyl red test. vogesproskaeur lest. citrate utilization. starchhydroysis, protease. catalase test and oxidase test.	
Module III:	30%
Isolation of special microbes from environment by isolation and enrichment techniques Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD Soil microbiology: Isolation of rhizospheremicroflora (actinomycetes, azotobacter, bacteria and fungi)	
Module IV:	15%
Antibiotic sensitivity test by disc diffusion assay	
Module V:	10%
Biochemical and molecular characterization of micro organisms Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Isolate bacterial and fungal cultures on soild and liquid media.
- The biochemical testing related to bacterial and fungal biochemical properties.
- Biochemical and molecular characterization of microbes for their identification.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	10	5	70

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Course structure: CELL BIOLOGY AND GENETICS LAB-MSB 122

Course Title: **Cell Biology and Genetics lab** Credit Units: 01
Course Level: PG Level Course Code: MSB122

Course Objectives:

The objective of the present course is to elaborate the concept of cell fractionation and separation along with chloroplast study. This also includes the mitochondrial isolation and to understand the concept of apoptosis. Objectives also include the elaboration of different stages of cell cycle.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	15%
Cell fractionation and separation of cell organelles byultra-centrifugation.	
Module II:	15%
Isolation of chloroplast from spinach and study of electron transport chain.	
Module III:	20%
Isolation of mitochondria and study of electron transport chain.	
Module IV:	50%
Study of apoptosis by TUNEL method. Site directed mutagenesis Mutation detection and analysis Mitosis Meiosis	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Isolate chloroplast and mitochondria from cells.
- Understand the concept of separation and centrifugation of cell organelles.
- Mitosis and meiosis stages during cell division.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

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COMPUTER APPLICATIONS LAB

Course Code: CSE 123 **Credit Units: 01**
Total hours: 20
Course Contents:
Module I: Ms-Office (8 Hours)
Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.
Module II: MS – Access 2003 (4 Hours)
Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.
SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language (8 Hours)
Implementation of different c Programs using if, switch case, loops, Array, functions and structure.
Course Outcomes:
The student will learn
- To operate MS word and its operations and functions
- To know the concepts of DBMS and its query execution.
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs

Examination Scheme:

IA			EE			
A	PR	Practical Based Test	Major Experim ent	Minor Experim ent	LR	Viva
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record,
  V – Viva.

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ADVANCED COMMUNICATION-I

COURSE CURRICULUM

PG 1

Course Title: Advanced Communication-I
Credit Units: 1
Course Code: BCP 141
Course Objective: The Course is designed to enhance vocabulary skills and make students fluent, thereby improving receptive and expressive skills.
Prerequisites: NIL

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Contents / Syllabus:

	Module I Fundamentals of Communication	**30% Weightage**
	• Role and Purpose of Communication,7 C's of Communication • Barriers to Effective Communication • Forms of Communication: One-to-One, Informal and Formal	
	Module II Oral Communication	**20% Weightage**
	• Effective Listening: Principles and Barriers • Effective Speaking: Pronunciation and Accent	
Module III Building Advanced Vocabulary		**20% Weightage**
	• Word Formation; Synonyms; Antonyms; Eponyms; Homonyms, Homophones & Homographs • One Word Substitution; Phrasal Verbs, Idiomatic Expressions & Proverbs • Foreign Words in English	
	Module IV Non Verbal Communication	**30% Weightage**
	• Principles & Significance • Kinesics, Oculesics, Proxemics,, Para-Language, Artifacts, Chronemics, Tactilics	
	Student Learning Outcomes	
	The students will be able to use the LSRW Skills to communicate effectively in a professional environment. Will be able to develop fluency.	
	Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	Dwivedi Prof. (Dr.) Vinay Dwivedi Director, Amity Institute of Biotechnology Amity University Madhya Pradesh Maharajpura, Gwalior 474005

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Jones, Working in English, 1st ed. Cambridge, CUP 2001***
Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Butterfield, Jeff Soft skills for Everyone, Cengage Learning 2011

Reference: ***Guffey, Ellen Mary, Business Communication, Thomson (South Western)***

Dale Carnegie: Quick and Easy Way of Public Speaking

Business Communication Today – Courtland L Bovee, John V Thill Mukesh Chaturvedi, Pearson 2009

Additional Reading: Newspapers and Journals

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Behavioral Science – I

Course Code: BSP-143 **Course Credit: 01**
Total Hours: 10
Course Objective:
This course aims at imparting an understanding of:
elf and the process of self exploration

- Learning strategies for development of a healthy self esteem
- Importance of attitudes and their effect on work behavior.
- Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self (2 Hours)

- Formation of self concept
- Dimension of Self
- Components of self
- Self Competency

Module II: Self-Esteem: Sense of Worth (2 Hours)

- Meaning and Nature of Self Esteem
- Characteristics of High and Low Self Esteem
- Importance & need of Self Esteem
- Self Esteem at work
- Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power (2 Hours)

- Introduction to EI
- Difference between IQ, EQ and SQ
- Relevance of EI at workplace
- Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence (2 Hours)

- Need and importance of Emotions
- Healthy and Unhealthy expression of emotions
- Anger: Conceptualization and Cycle
- Developing emotional and interpersonal competence
- Self assessment, analysis and action Plan.

Module V: Leading Through Positive Attitude (2 Hours)

- Understanding Attitudes
- Formation of Attitudes
- Types of Attitudes
- Effects of Attitude on
- Behavior
- Perception
- Motivation
- Stress
- Adjustment
- Time Management
- Effective Performance

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Building Positive Attitude.

Student learning outcomes:

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	**Attendance**	**Journal of Success (JOS)**	**Social Awareness Program (SAP) SAP Report/SAP Presentation**	**End Semester Exam**	**Total**
Weightage (%)	**5**	**10**	**15**	**70**	**100**

The above evaluation scheme shall not be applicable for LLM Course. Suggested Readings:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.,
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt.Ltd.,
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

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Course structure: ADVANCED MOLECULAR BIOLOGY–MSB 201

Course Title: Advanced Molecular Biology — Credit Units: 04
Course Level: PG Level — Course Code: MSB201

Course Objectives:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:DNA replication and repair	20%
DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.	
Module II: Transcription of DNA	15%
Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.	
Module III: Processing of DNA	15%
Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation	
Module IV: Translation	20%
Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; translational recoding inhibitors, post translation modification of protein.	
Module V: Regulation of gene expression	20%
Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.	
Module VI: Gene Silencing	20%
RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.	

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Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Learn and develop advanced understanding of mechanism of DNA replication in prokaryotes and eukaryotes.
- Learn the advanced mechanism of transcription in prokaryotes and eukaryotes.
- Develop understanding of various post-transcriptional processes in cell.
- Learn in detail about the mechanism of protein synthesis in prokaryotes and eukaryotes.
- Understand about the advances of gene expression regulation and various mechanisms of gene silencing.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:

- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

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Course structure: ADVANCES IN GENETIC ENGINEERING-MSB 202

Course Title: Advances in Genetic Engineering Credit Units: 04
Course Level: PG Level Course Code: MSB202

Course Objectives:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication andsuccessfulapplication of biotechnology largely depend on these advanced molecular techniques. Thus, theobjective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes.Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis	
Module II	30%
Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction	
Module III	30%
DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert methodMolecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.	
Module IV	20%
Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers

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- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

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Course structure: BIOPROCESS TECHNOLOGY-MSB 203

Course Title: Bioprocess Technology Credit Units: 04
Course Level: PG Level Course Code: MSB203

Course Objectives:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.	
Module II	30%
Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients. Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.	
Module III	15%
Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.	
Module IV	35%
Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B12, riboflavin, fermented dairy products. Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production. Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc. Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.	

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Biomass: Bakers and distillers yeast production using various raw materials, “bio” factors for growth, Crabtree effect, harvesting, different forms and uses. What are mushroom, different forms of common mushroom production from agro based raw materials and uses.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Develop an understanding of the various aspects of bioprocess technology and their basic principles.
- Develop skills associated with controlling of various parameters of bioprocess monitoring.
- Understand principles underlying design of fermentor, fermentation Process and downstream processing.
- Get knowledge of industrial productions of various primary and secondary metabolites.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

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Course structure: ADVANCED GENOMICS AND PROTEOMICS-MSB 204

Course Title: Advanced genomics and proteomics Credit Units: 04
Course Level: PG Level Course Code: MSB204

Course Objectives:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genomes.	
Module II	15%
Transcriptomics and metatranscriptomics: Introduction, method and uses.genetic mapping.	
Module III	15%
Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy	
Module IV	10%
Micro array: DNA micro array marker, computational methods.	
Module V	
Introduction to proteomics Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.	20%
Module VI	
Post translationalprotein modification	10%
Module VII	
Protein-Protein interaction some example	10%

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics

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List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown

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Course structure: COMPUTATIONAL BIOLOGY-MSB 205

Course Title: Computational Biology Credit Units: 03
Course Level: PG Level Course Code: MSB205

Course Objectives:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	10%
Introduction to Computational Biology. History of Bioinformatics	
Module II: Bioinformatics Fundamentals	40%
1. Major information Resources & Databases in Bioinformatics a. Information Resources: NCBI, EBI, ExPasyEntrez& SRS System b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc. c. Derived (Secondry) Databases of Sequences and structure: i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc. ii. SCOP, CATH, DSSP, FSSP, RNAbase, d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL. 2. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.) 3. SequenceSimilarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.) 4. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming. 5. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM &BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices. 6. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance. 7. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, profile construction and its application in Bioinformatics	
Module III: Computational methods	30%

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Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic) Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping. Suffix tree and its applications in Bioinformatics Gene Indentification Methods Predictive Methods using DNA and Protein sequences. Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models. Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.	
Module IV	20%
Software and Programmes for sequence comparision and analysis. Phylogenetics analysis software. Molecular Structure drawing tool. Molecular modeling/Docking. Application of computational biology/Bioinformatics in Agriculture, Human health, Enviroment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the development of computational biology.
- Describe the fundamentals of bioinformatics databases and their application.
- Understand and explain the use of various computational methods for phylogentic studies
- Use and apply the knowledge of different softwares and programs for sequence comparison, molecular modeling
- Explain the applications of computational biology in different fields of sciences

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- *Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.*

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall

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- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

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Course structure: ENVIRONMENTAL BIOTECHNOLOGY MSB 206

Course Title: Environmental Biotechnology Credit Units: 03
Course Level: PG Level Course Code: MSB206

Course Objectives:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Environmental pollution and its major impacts on human beings, plants, animals and climate, concept of Global warming and climate change, Global Ozone Problem, Eutrophication, Land degradation, Biomagnification.	
Module II	10%
Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels	
Module III	20%
Biodegradation, Bioremediation and Phytoremediation of major pollutants (PAH, Pesticides etc), Use of microbial technology for mining of metals (Bioleaching) and Concept of Biomineralisation.	
Module IV	20%
Waste water engineering: physicochemical characteristic of water, waste water treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments	
Module V	20%
Bioassessment of environmental quality: Biosensors and biomarkers, Principles of ecotoxicity.Agriculture Sustainability and Clean agricultural practices: Biofertilizers, Biopesticides and vermi composting	
Module VI	10%
Environmental impact assessment and Environmental audit, Related case studies from India.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the concept of biomining, biodegradation and biomineralization

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- Understand the concept of environmental pollution, its remedy, control along with effects of biopesticides.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications" by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

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Course structure: ADVANCED MOLECULAR BIOLOGY LAB-MSB 220

Course Title: **Advanced Molecular Biology Lab** Credit Units: 02
Course Level: PG Level Course Code: MSB220

Course Objectives:

The objective of the present course is to elaborate the concept of functional gene expression along with PCR amplification. Another course objective includes the blotting experiment and molecular marker analysis.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	20%
Isolation of genomic DNA from prokaryotes and eukaryotes	
Module II:	10%
Isolation of plasmid	
Module III:	10%
Study of DNA protein interaction.	
Module IV:	10%
Study of in-vitro transcription	
Module V	10%
Study of DNA methylation	
Module VI	10%
Study of DNA repair mechanism	
Module VII	10%
Invitro study of translation	
Module VIII	10%
Isolation of RNA	
Module IX	10%
PCR and Gradient PCR	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand the experimentation methodology related to gene amplification and cutting DNA sequences.
- Understand the methodology for transcription and translation.
- Know the methodology and process to perform DNA amplification.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: GENETIC ENGINEERING LAB-MSB 221

Course Title: **Genetic Engineering Lab** Credit Units: 02
Course Level: PG Level Course Code: MSB221

Course Objectives:

The objective of the present course is to elaborate the concept of functional gene expression along with PCR amplification. Another course objective includes the blotting experiment and molecular marker analysis.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	20%
Study of gene expression in E.coli(GFP cloning).	
Module II:	20%
Study of Southern Hybridization.	
Module III:	20%
Study of RFLP/RAPD.	
Module IV:	10%
Study of Western blotting.	
Module V	10%
Study of restriction digestion.	
Module VI	10%
Study of ligation	
Module VII	10%
PCR Amplification	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand the experimentation methodology related to gene amplification and cutting DNA sequences.
- Understand the methodology for molecular marker analysis.
- Know the methodology and process to perform cloning and dot blot hybridization.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: BIOPROCESS TECHNOLOGY LAB-MSB 222

Course Title: **Bioprocess Technology Lab** Credit Units: 02
Course Level: PG Level Course Code: MSB222

Course Objectives:

The objective of the present course is to elaborate the concept of functional gene expression along with PCR amplification. Another course objective includes the blotting experiment and molecular marker analysis.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	20%
Isolation of industrially important microorganisms for microbial processes.	
Module II:	20%
Determination of growth curve of a supplied microorganismand also determines substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.	
Module III:	30%
Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)	
Module IV:	30%
Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Elaborate the understanding of isolation and characterization of industrially important microbes.
- Understand the fermentative upstream and downstream processes for the production of antibiotics and other bioactive compounds.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: ADVANCED GENOMICS AND PROTEOMICS LAB-MSB 223

Course Title: **Advanced Genomics and Proteomics Lab** Credit Units: 01

Course Level: PG Level Course Code: MSB223

Course Objectives:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	20%
Three dimensional Structures – In silico study – large molecular complexes RNA polymerase II, ribosome,unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.	
Module II:	20%
PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation	
Module III:	20%
Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF datausing PDquest software	
Module IV:	20%
Primer designing, Analysis of protein 3D structures and comparison, Micro array and Micro array data analysis, Inference of protein function from structure	
Module V	20%
Two-Hybrid methods	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Elaborate the understanding of DNA isolation, DNA separation and DNA Identification methods.
- Understand the protein-protein interaction and 3D structure comparision.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: COMPUTATIONAL BIOLOGYLAB-MSB 224

Course Title: **Computational Biology Lab** Credit Units: 01

Course Level: PG Level Course Code: MSB224

Course Objectives:

The course will serve to introduce students to the materials and methods for DNA sequence analysis using bioinformatics tools and the computational tools developed for genomics and proteomics in a variety of species

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	20%
Basics of sequence analysis retrieving a sequence –nucleic acid /protein	
Module II:	20%
Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm	
Module III:	20%
Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing	
Module IV:	20%
Phylogenrtic prediction and analysis	
Module V	20%
Docking small molecules/ peptides in active site of protein. Use of automated docking procedures. Free energy calculation.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Elaborate the understanding of algorithms for nucleotide and protein sequence alignment.
- Understand the protein 2D and 3D structure comparison along with phylogenetic analysis.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Advanced Communication-II

COURSE CURRICULUM

PG: Semester II
Course Title: Advanced Communication-II
Credit Units: 1
Course Code: BCP 241

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective:

The course is designed to make the students ready for placement.

Prerequisites: NIL

Course Contents / Syllabus:

	Module I Job Correspondence	**20% Weightage**	
	• Job Applications • Resume & Profile Writing for Social Media • Follow Up Letter		
	Module II Dynamics of Group Discussion	**30% Weightage**	
	• Methodology • Guidelines		
	Module III Speaking for Employment	**50% Weightage**	
	• Types of Interview (Technical & HR Rounds) • Fundamentals of Facing Interviews • Question Answer on Various Dimensions • Non-Verbal Communication Component • Interview Etiquettes		
	Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures **Student Learning Outcomes:** The student will be able to write an impressive resume and face the interview confidently.		

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100`%	NA	70%

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Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Bovee, L Courtland, Mukesh chaturvedi, and John U Thill, Business Communication Today, Pearson***

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Comfort , Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994

Reference: ***Guffey, Ellen Mary, Business Communication, Thomson (South Western)***

Stay Hungry, Stay Foolish: Rashmi Bansal

Business Maharajas: Gita Piramal

How to Make Friends in Digital Age: Dale Carnegie

Business Communication / Making Connections in a Digital World, Raymond V. Lesikar, Marie E Flattey, Kathryn Rentz, Neerja Pande, Mc Graw Hill, 2009

Additional Reading: Newspapers and Journals

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BEHAVIORAL SCIENCE-II

Course Code: BSP-243 **Credit unit: 01**

Total Hours: 10
Course Objective:
This course aims at imparting an understanding of:
- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.
- Enhancing personal effectiveness and performance through effective interpersonal communication
- Enhancing their conflict management and negotiation skills.

Course Contents:
Module I: Conflict Management (2 Hour)
- Meaning and nature of conflicts
- Types of Conflict
- Styles and Techniques of conflict management
- Conflict management and interpersonal communication

Module II: Behavioral & Interpersonal Communication (2 Hours)
- Importance of Interpersonal Communication
- Rapport Building – NLP, Communication mode
- Steps to improve interpersonal communication
- Meaning and Nature of Behavioural Communication
- Relevance of Behavioural Communication

Module III: Relationship Management for Personal and professional Development (2 Hours)
- Importance of relationships
- Maintaining healthy relationships
- Communication Styles
- Types of Interpersonal Relationships

Module IV: Stress Management (2 Hours)
- Understanding of Stress & GAS Model
- Symptoms of Stress
- Individual and Organizational consequences with special focus on health
- Healthy and Unhealthy strategies for stress management
- Social support for stress management and well being
- Stress free, Successful and Happy Life

Module V: Conflict Resolution & Management (2 Hours)
- Conflict Resolution Strategies
- Ways of Managing Conflict (Healthy & Unhealthy)

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- Impact of Conflict Resolution & Management

Student learning outcomes

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme.

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course.

Suggested Readings:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassel.
- Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
- Harvard Business School, Effective Communication: United States of America.
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

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Course structure: ADVANCED IMMUNOLOGY–MSB 301

Course Title: Advanced Immunology Credit Units: 03
Course Level: PG Level Course Code: MSB301

Course Objectives:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function	
Module II:	25%
Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.	
Module III:	25%
Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.	
Module IV:	25%
Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases. Antigen antibody reactions in vitro methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, In vitro methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies.
- Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune respon Students will be able to understand the concept of transplantation and ro'e immunity in transplantation reactions.

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- Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity.
- Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

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Course structure: ENZYME TECHNOLOGY–MSB 302

Course Title: **Enzyme Technology** Credit Units: 03
Course Level: PG Level Course Code: MSB302

Course Objectives:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I: Enzymes	10%
Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.	
Module II: Enzyme Kinetics	25%
Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH and temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.	
Module III: Immobilization of Enzymes	10%
Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects	
Module IV: Enzyme reactors	25%
Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.	
Module V: Bioprocess Design	
Physical parameters, reactor operational stability; Immobilized cells.	10%
Module VI Challenges and future trends	20%
Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and HyperthermophilicArchaea and Bacteria.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action.
- Understand about various modes of inhibition of enzyme actions with example

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- Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text & References:

Text:

- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

***References*:**

- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience

Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

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Course structure: ADVANCED ANIMAL BIOTECHNOLOGY–MSB 303

Course Title: Advanced Animal Biotechnology Credit Units: 03
Course Level: PG Level Course Code: MSB303

Course Objectives:

It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.	
Module II	20%
Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolatereductase,streptokinase	
Module III	20%
DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.	
Module IV	20%
Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.	
Module V:	
Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome	20%

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand conventional and advanced aspects of Animal biotechnology.
- Learn the cell culture media, cell culture methods and their maintenance.
- Identify therapeutic enzymes, strategies of efficient enzyme replacement therapy methods.
- Understand concept of DNA vaccines and other vaccines using animal cell culture.
- Address the concepts and technology behind Gene therapy.
- Learn molecular mechanism of transgenic animal technology, Gene knockout tech.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

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Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

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Course structure: ADVANCED PLANT BIOTECHNOLOGY–MSB 304

Course Title: Advanced Plant Biotechnology — Credit Units: 03
Course Level: PG Level — Course Code: MSB304

Course Objectives:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Plant Cell and Tissue Culture Techniques	20%
Terms & definitions, History of Plant tissue culture, organogenesis embryogenesis and Micropropagation. Tissue Culture as a source of genetic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications, role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.	
Module II	20%
Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation	
Module III	20%
Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening	
Module IV	20%
Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc	
Module V	20%
Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand organogenesis, micropropagation, haploid and Embryo resue.
- Develop knowledge of cloning binary and expression vector, transformation in plants.
- Learn molecular techniques for identification of transgenics.
- Understand plant genome organization, gene families and delay of fruit ripening.
- Get knowledge of different biotic and abiotic stress resistant plant development.

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Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

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Course structure: DRUG DESIGN AND DEVELOPMENT–MSB 305

Course Title: Drug design and Development Credit Units: 03
Course Level: PG Level Course Code: MSB305

Course Objectives:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Drug targets classification	25%
DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).	
Module II	20%
Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.	
Module III	10%
Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.	
Module IV	25%
Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.	
Module V QSAR	20%
Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.

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- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

***References*:**

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

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Course structure: DRUG DELIVERY SYSTEMS–MSB 306

Course Title: Drug Delivery Systems Credit Units: 03
Course Level: PG Level Course Code: MSB306

Course Objectives:
The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.
Pre-requisites: The students must possess fair understanding of ....
Course Contents/Syllabus:

	Weightage (%)
Module I: Basic concept of drug delivery	20%
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.	
Module II: Advanced drug delivery and Targeting	20%
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Variousroutes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basicprinciples).	
Module III: Drug administration	30%
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.	
Module IV: Delivery of Genetic materials	15%
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.	
Module V: New generation technologies in drug delivery and targeting	
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.	15%

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Understand the basic concepts of bioavailability, drug absorption pharmacokinetics and pharmacodynamics.

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- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

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Course structure: PHARMACEUTICAL BIOTECHNOLOGY–MSB 307

Course Title: Pharmaceutical Biotechnology Credit Units: 03
Course Level: PG Level Course Code: MSB307

Course Objectives:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.	
Module II	20%
Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.	
Module III	20%
DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics,Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs.	
Module IV	20%
Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development	
Module V	
Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.	20%

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn the principles and application along with methodology for drug discovery and development.
- Understand about various aspects of drug delivery system and their regulations.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

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Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

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Course structure: IPR, BIOSAFETY AND BIOETHICS–MSB 308

Course Title: IPR, Biosafety and Bioethics — Credit Units: 03
Course Level: PG Level — Course Code: MSB308

Course Objectives:

The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.	
Module II	20%
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification	
Module III	10%
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright	
Module IV	10%
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark	
Module V	
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.	20%
Module VI	
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.	20

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn the principles and application of intellectual property right along with its specifications.
- Understand about various aspects of biosafety and bioethics.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

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Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:

- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

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Course structure: CLINICAL BIOTECHNOLOGY–MSB 309

Course Title: Clinical Biotechnology   Credit Units: 03
Course Level: PG Level   Course Code: MSB309

Course Objectives:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.	
Module II	10%
Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases.Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.	
Module III	20%
Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies. Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections. Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.	
Module IV	10%
Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.	
Module V	
Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.	10%
Module VI	10%
Management of Clinical Data	
Module VII Biosensors	25%
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, SignalTransduction:	

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Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections ofNH4+ cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change inlight reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Learn the genetics behind the disease along with public health control methods.
- Understand about various aspects of clinically important microbes.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3^{rd} edition, Mosby, 1997.
    - Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), LubertStryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

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Course structure: NANOBIOTECHNOLOGY–MSB 310

Course Title: Nanotechnology Credit Units: 03
Course Level: PG Level Course Code:
MSB310

Course Objectives:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I: Introduction to Nanotechnology	30%
Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.	
Module II: Nanostructured Materials	20%
The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.	
Module III Nanobiostructure Systems – Drug Delivery	25%
The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.Epidemiology-epidemics, pandemics and endemics disease.	
Module IV Nanobiostructure Systems – Biosensor	25%
The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn the basics of nanotechnology containg characterization and application of nanoparticles.
- Understand about various aspects of nanomaterials used in different sectors

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Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

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Course structure: ADVANCED IMMUNOLOGY LAB-MSB 320

Course Title: **Advanced Immunology Lab** Credit Units: 01
Course Level: PG Level Course Code: MSB320

Course Objectives:

The course will serve to introduce basic techniques of immunology and their applications in different ways.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	10%
Purification of immunoglobin G.	
Module II:	20%
Study of antigen- antibody pattern (ODD).	
Module III:	20%
Study of sandwich ELISA.	
Module IV:	20%
Study of haemeagglutination.	
Module V	10%
Study of immunoelectrophoresis.	
Module VI	10%
Isolation and identification of rosette cells.	
Module VII	10%
Antigen capture ELISA	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Elaborate the understanding of immunoelectrophoresis and ELISA.
- Understand the purification of immunoglobulins along with ODD.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: ENZYME TECHNOLOGY LAB-MSB 321

Course Title: **Enzyme Technology Lab** Credit Units: 01
Course Level: PG Level Course Code: MSB321

Course Objectives:

The course will serve to introduce basic techniques of upstream and downstream processing based on enzymes.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:	20%
Isolation of industrially important microorganisms for microbial processes.Determination of Thermal Death Point and Thermal death time of microorganisms for design of a sterilizer. Determination of growth curve of a supplied microorganismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.	
Module II:	20%
Comparative studied of ethanol production using different substrates. Microbial production of antibiotics (Penicillin). Production and estimation of alkaline protease. Sauer Krant fermentation	
Module III:	20%
Conventional filtration. Protein precipitation and recovery, Aqueous two-phase separation, Ion exchange chromatography, Gel filtration, Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.	
Module IV:	20%
Isolation of Enzymes from plant and microbial sources.Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.Purification of Enzyme by ammonium sulphate fractionation.Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity. Effect of Temperature and pH on enzyme activity.	
Module V	20%
Production of enzyme on industrial scale using solid and state fermentation, Enzyme immobilization	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Elaborate the understanding of enzyme based technology.
- Understand the procedures for downstream processing.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: ADVANCED ANIMAL BIOTECHNOLOGY& PLANT BIOTECHNOLOGYLAB-MSB 322

Course Title: Advanced animal Biotechnology &Plant Biotechnology Lab

Credit Units: 01

Course Level: PG Level

Course Code: MSB322

Course Objectives:

The course will serve to introduce basics of plant and animal biotechnology in which the animal cell culture, plant cell culture and their maintenance will be elaborated along with toxicity study.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I:Advanced Animal Biotechnology	50%
1. Histological study of important animal tissues. 2. Estimation of enzyme activity from animal tissues. 3. Study of toxicity on invitro model. 4. Culture and maintenance of animal cell lines. 5. Culture of chickenfibroblasts. 6. Invitro expression of proteins in animal cell lines	
Module II: Plant Biotechnology	50%
1. Tissue culture lab and organization. Sterilisation of glasswares, tools and equipments. 2. Preparation of stocks and media. Surface sterilization of various explants 3. Organ culture 4. Callus culture 5. Anther culture 6. Embryo culture, Protoplast isolation and culture	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Elaborate the understanding of animal cell lines, plant cell culture, their culturing and application.
- Understand the methodology of getting enzyme activity from animal and plant tissues.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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SUMMER INTERNSHIP

Course Code: MSB 350 **Credit Units: 12**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate’s name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

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1.4 Certificate
This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements
This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and **Keywords**
This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents
This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables
Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations
All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters
Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography
Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).
Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report
2.1 Report Size
The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size
The standard size of paper of a Report is A4 paper must be used for printing the report.

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2.3 Single-Sided Printing
It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material
Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding
First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report
After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font
For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
3.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title Dwivedi
drawings are large they should be included at the back of the report in a separate poc

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drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of th and any problem that have arisen that may be useful to document for future reference.

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- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

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PROJECT

Course code: MSB 460 Credit Units: 30

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the t

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bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:
(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

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- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should n
every bit of detail in the report, and it should not include support for the report. An introdu

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however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time
- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

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- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.
The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.
It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.
The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly.
Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)?
What are the main findings of the research?
Are there any recommendations?

Future prospects

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State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

<u>References:</u>

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1 1995.

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For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

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Program Educational Objectives (PEO)
Master of Technology (M. Tech.) Biotechnology
Academic Year – 2023-24

M.Tech. Biotechnology

PEO1: To apply theoretical and practical knowledge and skills to achieve greater heights in research and industry.

PEO2: To provide domain knowledge and expertise for successful career in academics, research and industry.

PEO3: To able to perform research work individually and in team in the field of biotechnology.

PEO4: To develop professional attitude with ethics and inculcate effective communication and scientific writing skills in multidisciplinary environment.

PEO5: To engage in lifelong learning with knowledge of contemporary and futuristic issues related to biotechnology.

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AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

M. Tech. Biotechnology (Four Semesters)

PROGRAMME OUTCOMES OF M.TECH. BIOTECHNOLOGY

The course aims to provide an advanced understanding of the core principles and topics of Biotechnology and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a lecture series and a research project. Therefore, the programme envisaged the following main objectives:

PO1: To introduce the basic concepts of Biotechnology and its recent advances.

PO2: For the basic understanding, this course includes advanced biochemistry, cell and molecular biology, immunotechnology, and microbial biotechnology.

PO3: Moreover, several laboratory courses given in the individual sections of the curriculum with detailed information on the importance of biotechnology in basic and applied research.

PO4: This course explains the advanced sections of biotechnology like genetic engineering, nanobiotechnology, computational biology and medical biotechnology.

PO5: This course provides necessary theoretical and practical experience in all divisions of
biotechnology to pursue a professional career in this field.

PO6: Provides broad exposure to various societal, ethical, and commercial issues in the various aspects of biotechnology.

PO7: Ability to demonstrate team building, project management and entrepreneurial skills through life-long learning.

PO8: Ability to communicate effectively and develop scientific writing.

PO9. Inculcation of ability to think independently for problem solving.

PO10. Ability to design and conduct experiments in biotechnology and analyze data.

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PROGRAMME SPECIFIC OUTCOMES OF M. TECH. BIOTECHNOLOGY

Apply their knowledge of biotechnology into high end research.

PSO1: Advanced sections of like Immunology, bioinformatics, nano-biotechnology will give broad information on applications and opportunities in the field of biotechnological research.

PSO2: Identify research gap and provide potential solution using tools and techniques in biochemistry, cell and molecular biology related problems associated animal and plant etc.

PSO3: Ability to work with multidisciplinary subjects in industries and research.

PSO4: Ability to communicate and function effectively in multi-disciplinary team related to the biochemistry and molecular biology.

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Amity Institute of Biotechnology

Amity University Madhya Pradesh

PO Mapping of M.Tech. Biotechnology syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	PO-1	To introduce the basic concepts of Biotechnology and its recent advances.	SDG 4 Quality Education
2	PO-2	For the basic understanding, this course includes advanced biochemistry, cell and molecular biology, immunotechnology, and microbial biotechnology.	SDG 4 Quality Education
3	PO-3	Moreover, several laboratory courses given in the individual sections of the curriculum with detailed information on the importance of biotechnology in basic and applied research.	SDG 9 Industry, Innovation and Infrastructure
4	PO-4	This course explains the advanced sections of biotechnology like genetic engineering, nanobiotechnology, computational biology and medical biotechnology.	SDG 4 Quality Education
5	PO5	This course provides necessary theoretical and practical experience in all divisions of biotechnology to pursue a professional career in this field.	SDG 4 Quality Education
6	PO6	To provide broad exposure to various societal, ethical and commercial issues in the various aspects of biotechnology.	SDG 8 Decent Work and Economic Growth
7	PO7	Ability to demonstrate team building, project management and entrepreneurial skills through life-long learning.	SDG 17: Partnerships for the Goals
8	PO8	Ability to communicate effectively and develop scientific writing	SDG 10 Reduce Inequalities
9	PO9	Inculcation of ability to think independently for problem solving.	SDG 17: Partnerships for the Goals
10	PO10	Ability to design and conduct experiments in biotechnology and analyze data.	SDG 9: Industry, Innovation, and Infrastructure

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Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	M.Tech. Biotechnology	III	MTB-306	DRUG DELIVERY SYSTEMS	National Biopharma Mission
2.	Amity Institute of Biotechnology	M.Tech. Biotechnology	II	MTB-202	RECOMBINANT DNA TECHNOLOGY	National Mission for BioScience for human Health
3.	Amity Institute of Biotechnology	M.Tech. Biotechnology	II	MTB-204	GENOMICS AND PROTEOMICS	National Mission for BioScience for human Health

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PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
MTB101	Biochemistry & Metabolic Regulation	4	-	-	4	
MTB102	Advanced Microbial Technology	4	-	-	4	
MTB103	Instrumentation in Biotechnology	4	-	-	4	
MTB104	Bioinformatics	4	-	-	4	
MTB105	Advance Biostatistics for Biologists	3	-	-	3	
MTB120	Biochemistry Lab	-	-	4	2	
MTB121	Microbiology Lab	-	-	2	1	
MTB122	Instrumentation in Biotechnology Lab	-	-	2	1	
MTB123	Bioinformatics Lab	-	-	2	1	
BCP141	Advanced Communication - I	1	-	-	1	
BSP143	Behavioural Science – I	1	-	-	1	
	TOTAL				**26**	

SECOND SEMESTER

MTB201	Cell & Molecular Biology	4	-	-	4	
MTB202	Recombinant DNA Technology	4	-	-	4	
MTB203	Bioprocess Technology	4	-	-	4	
MTB204	Genomics & Proteomics	4	-	-	4	
MTB205	Pharmaceutical Biotechnology	3	-	-	3	
MTB206 MTB207 MTB208 MTB209 MTB210	**Elective-I (any one)** • Environmental Biotechnology • Biosensors • Artificial Neural Networks • Agriculture Biotechnology • Fundamentals of Computers & Programming in "C" • Bio-energy Engineering	3	-	-	3	

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MTB211						
MTB220	Cell & Molecular Biology Lab	-	-	4	2	
MTB221	Recombinant DNA Technology Lab	-	-	4	2	
MTB222	Bioprocess Technology Lab	-	-	4	2	
MTB223	Genomics & Proteomics Lab	-	-	2	1	
BCP241	Advanced Communication - II	1	-	-	1	
BSP243	Behavioural Science – II	1	-	-	1	
	TOTAL				**31**	

SUMMER PROJECT: 8 - 10 WEEKS

THIRD SEMESTER

MTB301	Immunology & Immunotechnology	4	-	-	4	
MTB302	Enzymology & Enzyme Technology	4	-	-	4	
MTB303	Drug Design & Development	4	-	-	4	
MTB304	Bioprocess Plant Design	3	-	-	3	
MTB305 MTB306 MTB307 MTB308 MTB309 MTB310	**Elective - II (any one)** • Pollution Prevention Fundamentals • Drug Delivery Systems • IPR, Biosafety & Bioethics • Advanced Food Technology • Industrial Safety & Management • Advanced Animal & Plant Cell Technology	3	-	-	3	
MTB320	Immunology & Immunotechnology Lab	-	-	4	2	
MTB321	Enzymology & Enzyme Technology Lab	-	-	2	1	
MTB360	Summer Project (Evaluation)	-	-	-	12	
	TOTAL				**33**	

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FOURTH SEMESTER

MTB460	Project (20-22 weeks)	-	-	-	30	
	TOTAL				**30**	

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Course structure: Biochemistry and Metabolic Regulation- MTB 101

Course Title: Biochemistry and Metabolic Regulation **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 101**

Course Objectives:

The objectives of the Metabolic Biochemistry course are to provide a comprehensive understanding of human metabolism in areas of enzymology and protein structure and function; energy releasing and energy consuming metabolic processes; the regulation of synthesis and breakdown of sugars, lipids, nucleic acids, and amino acids which is necessary for further work in the biochemical/biomedical and biotechnology areas.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Descriptors/Topics Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.	
Module II	25%
Descriptors/Topics : Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.	
Module III Modes of Regulation	25%
Descriptors/Topics : Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation	
Module IV: Regulation of metabolic pathways	25%
Descriptors/Topics Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation, Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies	

Student Learning Outcomes:

- Learn and understand the structure of biomolecules from their monomers to polymers.
- Learn the metabolism of biomolecules at advanced level and they will be able to interconnect these pathways.

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- Learn about different levels of regulation of enzymes in metabolic pathways.
- Develop understanding of role of energy in various biochemical reactions.
- Learn regulation of various metabolic pathways and diseases due to misregulation of metabolic pathways.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry by A. Lehninger revised by Nelson and Cox.
- Biochemistry by Mathews, Van Holde and Ahern. IIIrd Edition.

References:

- "Biochemistry" by White, Handler and R.B. Smith 7th Ed. 1983
- Biochemistry" by L.Stryer Third Edition.
- Biochemistry by Voet and Voet.
- Fundamentals of Biochemistry by Conn and Stumph.

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Course structure: Advanced Microbial Technology - MTB 102

Course Title: Advanced Microbial Technology **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 102**

Course Objectives:

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.	
Module II	20%
Descriptors/Topics : Prokaryotic structure and function - Microbial nutrition and growth - Arithmatic and Geomatric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.	
Module III:	20%
Descriptors/Topics : Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .	
Module IV:	20%
Descriptors/Topics Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission	
Module V	20%
Descriptors/Topics	

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Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics - penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Recognize and explain the significant role that microbes play in the world around us.
- Explain the similarities and differences of microbes as compared to higher forms of life.
- Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences.
- Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage.
- Explain the basic principles of immunology relating to host resistance.
- Evaluate the physical and chemical methods of microbial control.
- Recognize microbial diseases and their control.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill.
- Microbiology by Prescott.

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.

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- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings

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Course structure: Instrumentation in Biotechnology- MTB 103

Course Title: Instrumentation in Biotechnology **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 103**

Course Objectives:

To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Ultracentrifugation	16%
Descriptors/Topics Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.	
Module II: Gel electrophoresis	16%
Descriptors/Topics : Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.	
Module III:	16%
Descriptors/Topics : TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.	
Module IV:	20%
Descriptors/Topics UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.	
Module V	16%
Descriptors/Topics Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.	
Module VI	16%
Descriptors/Topics	

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Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Understand centrifugation machine and their techniques for the separation of biomolecules.
- Know about electrophoresis and their different types and their application.
- Know about chromatography techniques and their different types and their application
- Know different types of spectroscopes and microscopes and their application analysis of different molecules.
- Learn about the radioactivity and their measurement using scintillation counters.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles & Techniques" by Keith Wilson and John Walker.
- Biophysical Chemistry by David Friefelder.

References:

- "Microscopic Techniques in Biotechnology" by Michael Hoppert
- "Principles & Practice of Bioanalysis" by Richard F. Venn
- "Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes" by J.F.
- Van Impe, Kluwer Academic
- "Crystal Structure Analysis" by J.P. Glusker and K.N. Trueblood, Oxford University Press
- "Crystallography made Crystal Clear" by G. Rhodes, Academic Press
- "NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry" by H. Gunter, John
  Wiley and Sons Ltd.

- "Principles of Physical Biochemistry" by K.E. Van Holde, Prentice Hall.

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Course structure: Bioinformatics - MTB 104

Course Title: Bioinformatics **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 104**

Course Objectives:

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Introduction and overview	20%
Descriptors/Topics The NCBI, sequence databases, sequence retrieval, sequence file formats, submitting DNA, protein sequences and sequence assembly.	
Module II:	20%
Descriptors/Topics : construction and application, Databases and rapid sequence analysis –Blast and Fasta , sequence comparison by statistical content; Dynamic programming alignment -The number of alignments, shortest and longest paths in a network, global distance and similarity alignments, Fitting one sequence onto the other, trace backs, parametric sequence comparison	
Module III:	20%
Descriptors/Topics : Global and local alignments, scoring matrices-pam and blosum and gap penalties, filtering, position specific scoring matrices, internet resources , uses of multiple sequence alignment programs and methods pattern searching programs, family and superfamily representation & profit analysis.	
Module IV:	20%
Descriptors/Topics Trees-representation of sequences, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, Bootstrap, maximum likelihood trees , estimating the rate of change, likelihood and trees; analysis software.	
Module V	20%
Descriptors/Topics Annotation, ESTs – databases, comparative genome analysis clustering, gene discovery, protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure	

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prediction in proteins, prediction of buried residues in proteins, RNA secondary structure –minimum free-energy structures, Genome analysis, genome rearrangements with inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand about nucleotide and protein sequence retrieval, submission through NCBI database.
- Understand the nucleotide and protein sequence alignment methods through different types of algorithm used.
- Predict the phylogenetic tree and evolutionary relationship
- Predict the databases related to functional gene sequences and their analysis through identification and classification
- Describe the molecular modeling using protein databank and molecular modeling databank.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformaticsby C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by A.D. Baxevanis and B.F.F Ouellette, Wiley – interscience.

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield, Cambridge University Press
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. Von Heijne and G. Von Heijne, Academic Press.
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Computational Biology: Maps, Sequences and Genomes by M. Waterman, Chapman and Hall

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- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. V. Heijne and G.V. Heijne, Academic Press

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Course structure: Advanced Biostatistics for Biologists - MTB 105

Course Title: Advanced Biostatistics for Biologists **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 105**

Course Objectives:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.
Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I *Descriptive statistics*	25%
Descriptors/Topics Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)	
Module II:	25%
Descriptors/Topics : Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.	
Module III:	25%
Descriptors/Topics : Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)	
Module IV:	25%
Descriptors/Topics Applications of statistical methods using statistical software	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Fundamental knowledge of basic statistical Techniques.
- Various Statistical Tools used in data presentation and interpretation
- Probability and various distributions.
- Formulation and testing of hypothesis
- Correlation & Regression analysis.
- Analysis of variance(ANOVA)

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- Applications of various statistical methods using statistical softwares like SPSS, SAS etc.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. VisweswaraRao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

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Course structure: Biochemistry Lab - MTB 120

Course Title: Biochemistry Lab **Credit Units: 02**

Course Level: PG Level **Course Code: MTB 120**

Course Objectives:

The course aims to develop competency and hand on expertise in the biochemistry methods and applications

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Proteins	50%
Descriptors/Topics Identification of protein by Biuret test, quantitation of protein by Bradford method, Separation of proteins by SDS-PAGE, Enzyme: Determination of serum alkaline phosphatase activity	
Module II: Nucleic Acids	50%
Descriptors/Topics : Biochemical estimation of DNA, RNA. Separation of DNAsamples on Agarose gel. **Carbohydrate:**Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar **Lipids:** Blood Cholesterol estimation.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advancebiochemistry experiments.
- Understanding of biomolecule separation techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA	EE

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Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

Lab Manual

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Course structure: Microbiology Lab - MTB 121

Course Title: Microbiology Lab **Credit Units: 01**

Course Level: PG Level **Course Code: MTB 121**

Course Objectives:

The course aims to develop competency and hand on expertise in the Microbiology methods and applications

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	50%
Descriptors/Topics Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi	
Module II:	50%
Descriptors/Topics : Biochemical test – Indole test, methyl red test, vogesproskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advancemicrobiology experiments.
- Understanding of biochemical tests and techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

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List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Lab Manual

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Course structure: Instrumentation In Biotechnology Lab- MTB 122

Course Title: Instrumentation In Biotechnology Lab **Credit Units: 01**

Course Level: PG Level **Course Code: MTB 122**

Course Objectives:

To demonstrate the techniques used in the biotechnology for purification, characterization and identification of the proteins and other biotechnologically important products

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I : Cell disruption techniques **Descriptors/Topics** Homogenization, sonication	15%
Module II: **Descriptors/Topics :** Centrifugation – low speed and high speed.	15%
Module III : Spectrophotometer techniques **Descriptors/Topics :** Visible and UV spectrophotometry	15%
Module IV : **Descriptors/Topics :** Chromatography-ion exchange, gel filtration and affinity columns, fraction collection, monitoring UV absorbance. Applications in enzyme purification.	15%

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Module V :	15%
Descriptors/Topics : Techniques for removal of salt/solvent from a sample -desalting, dialysis, ultrafiltration, speedvac, lyophilization etc.	
Module VI :	15%
Descriptors/Topics : Electrophoresis –1 D (Polyacryamide gel electrophoresis and agarose) and 2D. Isoelectric focusing.	
Module VII :	10%
Descriptors/Topics : Polarization and fluorescence microscopy	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advanceinstrumentation in handling biology experiments.
- Understanding of Instruments and their handeling.

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

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Course structure: Bioinformatics Lab- MTB 123

Course Title: Bioinformatics Lab **Credit Units: 01**

Course Level: PG Level **Course Code: MTB 123**

Course Objectives:

To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :	
Descriptors/Topics Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein	15%
Module II:	20%
Descriptors/Topics : Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm	
Module III :	20%
Descriptors/Topics : Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing	
Module IV :	15%
Descriptors/Topics : Phylogenetic prediction and analysis	
Module V :	15%
Descriptors/Topics : Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.	
Module VI :	15%
Descriptors/Topics : Finding transcription regulatory signals	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advancetoosl of Bioinformatics
- Understanding and application of bioinformatics tools in dry lab experiments.

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Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

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ADVANCED COMMUNICATION-I

COURSE CURRICULUM

PG 1

Course Title: Advanced Communication-I

Credit Units: 1

Course Code: BCP 141

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective: The Course is designed to enhance vocabulary skills and make students fluent, thereby improving receptive and expressive skills.

Prerequisites: NIL

Course Contents / Syllabus:

Module I Fundamentals of Communication	**30% Weightage**
• Role and Purpose of Communication,7 C's of Communication • Barriers to Effective Communication • Forms of Communication: One-to-One, Informal and Formal	
Module II Oral Communication	**20% Weightage**
• Effective Listening: Principles and Barriers • Effective Speaking: Pronunciation and Accent	
Module III Building Advanced Vocabulary	**20% Weightage**
• Word Formation; Synonyms; Antonyms; Eponyms; Homonyms, Homophones & Homographs • One Word Substitution; Phrasal Verbs, Idiomatic Expressions & Proverbs • Foreign Words in English	
Module IV Non Verbal Communication	**30% Weightage**
• Principles & Significance • Kinesics, Oculesics, Proxemics,, Para-Language, Artifacts, Chronemics, Tactilics	

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Student Learning Outcomes

The students will be able to use the LSRW Skills to communicate effectively in a professional environment.

Will be able to develop fluency.

Pedagogy for Course Delivery

- Workshop
- Presentation
- Group Discussion
- Lectures

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

End Term Examination				
Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Jones, Working in English, 1st ed. Cambridge, CUP 2001***

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Butterfield, Jeff Soft skills for Everyone, Cengage Learning 2011

Reference: ***Guffey, Ellen Mary, Business Communication, Thomson (South Western)***

Dale Carnegie: Quick and Easy Way of Public Speaking

Business Communication Today – Courtland L Bovee, John V Thill Mukesh Chaturvedi, Pearson 2009

Additional Reading: Newspapers and Journals

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Behavioral Science – I

Course Code: BSP-143 **Course Credit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of:

elf and the process of self exploration

- Learning strategies for development of a healthy self esteem
- Importance of attitudes and their effect on work behavior.
- Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self (2 Hours)

- Formation of self concept
- Dimension of Self
- Components of self
- Self Competency

Module II: Self-Esteem: Sense of Worth (2 Hours)

- Meaning and Nature of Self Esteem
- Characteristics of High and Low Self Esteem
- Importance & need of Self Esteem
- Self Esteem at work
- Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power (2 Hours)

- Introduction to EI
- Difference between IQ, EQ and SQ
- Relevance of EI at workplace
- Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence (2 Hours)

- Need and importance of Emotions
- Healthy and Unhealthy expression of emotions
- Anger: Conceptualization and Cycle
- Developing emotional and interpersonal competence
- Self assessment, analysis and action Plan.

Module V: Leading Through Positive Attitude (2 Hours)

- Understanding Attitudes
- Formation of Attitudes

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- Types of Attitudes
- Effects of Attitude on
- Behavior
- Perception
- Motivation
- Stress
- Adjustment
- Time Management
- Effective Performance

  Building Positive Attitude.

Student learning outcomes:

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	**Attendance**	**Journal of Success (JOS)**	**Social Awareness Program (SAP)** **SAP Report/SAP Presentation**	**End Semester Exam**	**Total**
Weightage (%)	**5**	**10**	**15**	**70**	**100**

The above evaluation scheme shall not be applicable for LLM Course. Suggested Readings:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.,
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt.Ltd.,
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

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Course structure: Cell and Molecular Biology - MTB 201

Course Title: Cell and Molecular Biology **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 201**

Course Objectives:

The object of the present course is to develop basic knowledge and skills in cell and molecular biology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. This course will help students to get an understanding of cell function at the molecular level including the fundamentals of DNA They will become aware of the complexity and harmony of the cell. Applications of cellular and molecular biology in Biotechnology will also be presented.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics Protein targeting - Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure, integral and peripheral membrane proteins, biosynthesis of membrane and secreted proteins; targeting of proteins to membranes.	
Module II	20%
Descriptors/Topics : Membrane transport/Cell Cycle - Mechanisms for transport of small molecules across the membrane, including simple diffusion, facilitative diffusion, primary and secondary active transport, action of ionophores. Cell cycle and the events associated with each stage, control of the cell cycle and the proteins involved; know the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations.	
Module III	15%
Descriptors/Topics : Intracellular Signaling I - define growth, growth factor, growth factor receptor, mitogen, receptor, effector, second messenger, action of hormones and other biologically active agents that act via receptors in the nucleus and/or cytoplasm. Intracellular Signaling II - the intracellular signaling cascades triggered by hormone binding to these receptor, G proteins signalling, the action of Ca 2+ and diacylglycerol as second messengers.	
Module IV:	20%
Descriptors/Topics	

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Replication of DNA, Role of DNA polymerases & proteins involved in DNA replication, Compare and contrast eukaryote and prokaryote DNA replication, telomeres, telomerase and altered telomerase function in aging and disease. **Recombination & Repair:** Mutations and types of site mutations: substitution, transition, transversion, insertion, deletion, tautomer, frameshift and nonsense mutation. Repair mechanisms: dimer repair, excision repair, mismatch repair, trans-lesion repair, and recombinational repair.	
Module V:	15%
Descriptors/Topics Transcription **-** RNA transcription and the proteins required for each step, maturation of the RNA transcript derived from a eukaryotic gene, structure of prokaryote and eukaryote promoter and the function of promoter sequences, inhibitors of prokaryote and eukaryote transcription and their mechanisms of action. Concept of operon, inducer, operator and polycistronic transcript, expression of the lac operon and trp operon in *E. coli,* catabolite repression, leader peptide and attenuator site, enhancer and transcription factors, four common DNA-binding motifs found in transcription factors, mRNA stability and alternative splicing in gene expression	
Module VI:	15%
Descriptors/Topics Genetic code and the concept of colinearity of the gene and protein, components required for translation, basic steps involved in initiation, elongation, and termination of protein translation, translational recoding, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation	

Student Learning Outcomes:

- Learn various aspects of protein targeting and transportation of small molecules across the membrane by different means.
- Learn and understand the cell cycle with check points and intracellular signaling mechanisms.
- Learn the mechanism of replication of DNA both in prokaryotes and eukaryotes and repair mechanisms processed by the cell.
- Learn in detail about the mechanism of transcription and post-transcriptional processes in prokaryotes and eukaryotes.
- Learn and understand the mechanism translation, gene expression regulation in prokaryotes and eukaryotes as well as gene silencing.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

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Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Molecular Cell Biology by Bruce Albert
- Molecular Biology by Lodish Darnell and Baltimore
- Molecular Biology of the gene by Watson et al 4th ed.

References:

- Genes VIII by Benjamin Lewis
- Genetics by Ursula Goodenough
- Cytogenetics by l Garl P. Swanson, Mertz & Young
- Biochemistry by Stryer
- Genome by T.A. Brown, John Willey and Sons Inc.

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Course structure: Recombinant DNA Technology-- MTB 202

Course Title: Recombinant DNA Technology **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 202**

Course Objectives:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)	
Module II	20%

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Descriptors/Topics : Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps	
Module III:	20%
Descriptors/Topics : Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis	
Module IV:	20%
Descriptors/Topics In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology	
Module V	20%
Descriptors/Topics DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation	
Module VI	
Descriptors/Topics High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

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- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Genes to Clone by Winnaker

References:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- “Milestones in Biotechnology: Classic Papers on Genetic Engineering” by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.
- “Gene Expression Technology” by D.V. Goeddel in Methods in Methods in Enzymology, Academic
- Press Inc.
- “DNA Cloning: A Practical Approach” by D.M. Glover and B.D. Hames, IRL Press.

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Course structure: Bioprocess Technology- MTB 203

Course Title: Bioprocess Technology **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 203**

Course Objectives:

The present course aims to aware about the requirements for large-scale cultivation of microbes for production of industrially important products with purification and characterization of these bioproducts using different techniquesPre-requisites:

The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Ultracentrifugation	20%
Descriptors/Topics Introduction to Bioprocess Technology, Microbial growth kinetics-batch, continuous, cell recycle & fed- batch.	
Module II: Gel electrophoresis	25%
Descriptors/Topics : Substrates for bioconversion processes and design of media, sterilization; Cell culture techniques; Inoculum development and aseptic transfers. Bioreactors – CSTR, CSTR in series , tower, loops, airlift bubble column & packed bed. Different types of pumps, valves, and line materials, piping convections etc. used in Biochemical Processes	
Module III:	30%
Descriptors/Topics : Process technology for the production of primary metabolites, e.g. Baker's yeast, ethanol, citric acid, amino acids (lysine and glutamic acid). Microbial production of industrial enzymes (glucose isomerase, cellulase, amylase, lipase, protease) and secondary metabolites (penicillins, cephalosporins and streptomycin). Biomass (SCP and mushroom) production from agro-residues. **Ethanol:** production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition , uses, merits and demerits of various technologies for its production. **Antibiotics:** Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery , uses of various forms etc. Streptomycin – chemical structure, production, harvest and recovery, use, by-product of streptomycin fermentation etc. **Amino Acid:** Genetic Control of metabolic pathway.	

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Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism. **Glutamic Acid:** Direct Fermentation, contribution of feed back control and regulation of cell permeability barrier for production. **Biomass:** Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses. What are mushroom, different forms of common mushroom production from agro based raw materials and uses.	
Module IV:	25%
Descriptors/Topics Characteristics of bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Develop an understanding of the various aspects of bioprocess technology and their basic principles.
- Develop skills associated with controlling of various parameters of bioprocess monitoring.
- Understand principles underlying design of fermentor, fermentation Process and downstream processing.
- Get knowledge of industrial productions of various primary and secondary metabolites.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press.
- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

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- Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
- Biochemical Engineering – Kinetics, Mass Transport, Reactors and Gene Expression, W.F. Veith, John Wiley and Sons Inc.
- Biochemical Engineering, S. Aiba, A.E. Humphrey and N.F. Millis, University of Tokyo Press.
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Process Engineering in Biotechnology, A.T. Jackson, Prentice Hall.
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering/ Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society.

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Course structure: Genomics and Proteomics - MTB 204

Course Title: Genomics and Proteomics **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 204**

Course Objectives:

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Introduction to Genomics	15%
Descriptors/Topics Anatomy of prokaryotic and eukaryotic genome. Contents of genomes, Repetitive DNA. Bioinformatics for the analysis of sequence data.	
Module II: Transcriptomes	20%
Descriptors/Topics : Genome expression; RNA Contents, genetic mapping, Microsatellite DNA markers, RFLP, DNA sequencing, PCR, Micro array: DNA micro array marker, random primers, computational methods	
Module III:	15%
Descriptors/Topics : Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.	
Module IV: Proteomics	20%
Descriptors/Topics Introduction to proteomics. Protein structure: secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solutes. The activity of proteins. Protein engineering principles.	
Module V	15%
Descriptors/Topics Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modifications. Protein – protein interaction.	
Module VI	15%
Descriptors/Topics Use of computer simulations and knowledge-based methods in the design process. De-novo design; making use of databases of sequence and structure.	

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Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genomes II, T.A. Brown
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- DNA : Structure and Function, Richard R. Sinden
- www.panimaText.com

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Course structure: Pharmaceutical Biotechnology- MTB 205

Course Title: Pharmaceutical Biotechnology **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 205**

Course Objectives:

The main objectives are to cover representative pharmaceutical dosage forms, and general issues of formulation, production, quality requirements, validation and uses and to gain an understanding of the challenges associated with quality pharmaceutical manufacturing

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :	15%
Descriptors/Topics Introduction to Physical Pharmaceutics - Metrology and Calculations,	
Module II:	20%
Descriptors/Topics : Molecular structure, properties and States of Matter, Solutions, Phase Equilibra, Micromeritic and Powder Rheology, Surface and Interfacial Phenomena, Dispersion Systems, Diffusion & Dissolution, Kinetics and drug stability, Viscosity & Rheology	
Module III:	15%
Descriptors/Topics : Polymer Science and Applications, Formulations and Development, Packaging	
Module IV:	15%
Descriptors/Topics Introduction to Industrial Processing, Transport Phenomena (Fluid Flow, Heat Transfer and Mass Transfer)	
Module V:	20%
Descriptors/Topics Particulate Technology (Particle Size, Size reduction, Size Separation, Powder Flow and Compaction), Unit Operations (Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, and Drying)	
Module VI:	15%
Descriptors/Topics Materials of Pharmaceutical Plant Construction, Good Manufacturing Practice (GMP's) Guidelines	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

After successful completion of the course student will be able to:

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* Prepare different strength of solutions and get a thorough knowledge of analytical chemistry.
* Understand physicochemical properties of drug molecules, flow behaviour of fluids and powder.
* Learn the basics of polymer science and different packaging strategies to be used for pharmaceutical compounds.
* Understand the industrial processing of drugs and various transport phenomena.
* Get knowledge of the materials that are used for plant construction and understand Good Manufacturing practices.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bentley's Pharmaceutics by E A Rawlins
- Pharmaceutical Sciences by Remington

References:

- Physical Pharmacy by Alfred Martin.
- Cooper and Gunn's Tutorial Pharmacy

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Course structure: Environmental Biotechnology- MTB 206

Course Title: Environmental Biotechnology **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 206**

Course Objectives:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :	20%
Descriptors/Topics Environmental pollution and its major impacts on human beings, plants, animals and climate, concept of Global warming and climate change, Global Ozone Problem, Eutrophication, Land degradation, Biomagnification.	
Module II:	15%
Descriptors/Topics : Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels	
Module III:	15%
Descriptors/Topics : Biodegradation, Bioremediation and Phytoremediation of major pollutants (PAH, Pesticides etc), Use of microbial technology for mining of metals (Bioleaching) and Concept of Biomineralisation.	
Module IV:	15%
Descriptors/Topics Waste water engineering: physicochemical characteristic of water, waste water treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments	
Module V:	20%
Descriptors/Topics Bioassessment of environmental quality: Biosensors and biomarkers, Principles of ecotoxicity. Agriculture Sustainability and Clean agricultural practices: Biofertilizers, Biopesticides and vermi composting	
Module VI:	15%
Descriptors/Topics Environmental impact assessment and Environmental audit, Related case studies from India.	

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Student Learning Outcomes:
Having successfully completed this course, students will be able to:

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications” by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

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Course structure: Biosensors- MTB 207

Course Title: Biosensors **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 207**

Course Objectives:

On completion of the module students should Be able to Appreciate the basic configuration and distinction among biosensor systems, To gain an understanding of general biosensor principles and terms, To be able to design, model, simulate, fabricate, and test a biosensor, To gain an overall knowledge of biosensor types, applications, requirements, and capabilities to allow improved interaction with physicians, clinicians, and biomedical engineers, and to enable the student to conduct biomedical engineering research.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :	15%
Descriptors/Topics Introduction to MEMS	
Module II: Biosensors	20%
Descriptors/Topics : Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, SignalTransduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections ofNH^{4+}cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change inlight reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.	
Module III:Biomedical sensors	15%
Descriptors/Topics : Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors andtransducers, who do we need Biomedical sensors and Transducers? Important Design considerations and systemcalibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

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Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Affinity Biosensors: Techniques and Protocol by K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applications by V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors by B.R. Eggins, John Wiley and Sons Inc.

References:

- Sensors and Sensing in Biology and Engineering by F.G. Barth, wt al, Springer Verlag.
- Biosensors by Minh Canh. Tran
- Biosensors: Theory and Applications by Donald G. Buerk
- Enzyme and Microbial Biosensors: : Techniques and Protocols - by Kim R. Rogers, Ashok Mulchandani
- Biosensors in Environmental Monitoring - by Ursula Bilitewski, Anthony P. F. Turner.
- Biosensors: Micro electrochemical Devices - by Marc J. C. Lambrechts
- Biosensors with Fiberoptics - by Donald Lee Wise, Lemuel B. Wingard
- Biosensors and Their Applications - by That Tjien Ngo, Victor Chi-Min Yang
- Thermal Biosensors, Bioactivity, Bioaffinity -by Prakash K. Bhatia
- Novel Approaches in Biosensors and Rapid Diagnostic Assays - by ZviLiron, Avraham Bromberg, Morly Fisher
- Biosensors - by Anthony E. G. Cass.

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Course structure: Agriculture Biotechnology- MTB 209

Course Title: Agriculture Biotechnology **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 209**

Course Objectives:

This course is designed to cover key concepts in the structure and manipulation of DNA and inheritance of genes, traditional plant breeding, current impact of biotechnology on crop production and its commercial applications. Regeneration of plants through in vitro techniques offers a practical strategy for micro propagation.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :	25%
Descriptors/Topics Sterilization; Nutrient medium; Callus & Suspension culture; canning, regulation; Micropropagation, production of virus free plants, anther culture, pollen culture; ovary culture, homozygous lines; meristem culture; somatic hybridization, somaclonal variation, germplasm conservation	
Module II:	25%
Descriptors/Topics : Genetic engineering in plants, direct and indirect method of plant cell transformation, vectors with special reference to Ti plasmids, selectable markers, mechanism of T-DNA transfer to plants, transgenic plants, molecular maps and gene tagging, marker assisted selection.	
Module III:	25%
Descriptors/Topics : Applications of genetic engineering, insect and pest resistance, herbicide resistance, cytoplasmic male sterility in plants, molecular farming.	
Module IV:	25%
Descriptors/Topics : Plant patents, plant variety certificates, safety regulation in transgenic plants.	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

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List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

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Course structure: Bio-Energy Engineering- MTB-211

Course Title: Bio-Energy Engineering **Credit Units: 03**

Course Level: PG Level **Course Code: MTB-211**

Course Objectives:

The goal is to introduce students to biotechnology and tools that enable engineers and process scientists to connect innovations in industrial microorganisms and bioprocess unit operations to the engineering fundamentals, fundamentals of systems biology, and biological tools for design, modeling and evaluation of manufacturing facilities for the production of biofuels, bioproducts and biotherapeutics using a case study approach combined with computer modeling.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :Biomass Sources, Characteristics & Preparation	20%
Descriptors/Topics Biomass Sources and Classification. – Chemical composition and properties of different biomass materials and bio-fuels – Sugar cane molasses and other sources for fermentation ethanol-Sources and processing of oils and fats for liquid fuels- Energy plantations -Preparation of woody biomass: Size reduction, Briquetting of loose biomass, Drying, Storage and Handling of Biomass.	
Module II: Biogas, Technology	20%
Descriptors/Topics : Feedstock for biogas production, Aqueous wastes containing biodegradable organic matter, animal residues-. Microbial and biochemical aspects- Operating parameters for biogas production Kinetics and mechanism - Dry and wet fermentation. Digesters for rural application-High rate digesters for industrial waste water treatment.	
Module III:Bio-Ethanol and Bio-Diesel Technology	20%
Descriptors/Topics : Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.	
Module IV: Pyrolysis and Gasification of Biomass	20%
Descriptors/Topics : Thermo-chemical conversion of ligno-cellulose biomass – Biomass processing for liquid fuel production - Pyrolysis of biomass-Pyrolysis regime, effect of particle size, temperature, and products obtained. **Thermo-chemical gasification principles:** Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidized Bed Gasifiers.	

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Module V: Combustion of Biomass and Cogeneration Systems	20%
Descriptors/Topics : Combustion of Woody Biomass: Theory, Calculations and Design of Equipments. Cogeneration in Biomass Processing Industries. Case Studies: Combustion of Rice Husk, Use of Bagasse for Cogeneration.	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

Text:

- Fuels from Biomass and Wastes by D.L. Klass and G.M. Emert, Ann Arbor Science pub. Inc. Michigan,
- Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes by A. Chakraverthy, Oxford & IBH publishing Co., New Delhi,

References:

- Biogas Systems: Principles and Applications by K.M. Mital, New Age International Publishers (p) Ltd.,
- Biomass Energy Systems, by P. VenkataRamana and S.N. Srinivas, Tata Energy Research Institute, New Delhi, 1996.
- Bio-gas Technology by Khandelwal K.C. and Mahdi, Tata McGraw-Hill pub. Co. Ltd., New Delhi
- Advances in bio-gas Technology by O.P. Chawla, I.C.A.R., New Delhi. 1970.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press

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- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

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Course structure: Cell and Molecular Biology Lab - MTB 220

Course Title: Cell and Molecular Biology Lab **Credit Units: 02**

Course Level: PG Level **Course Code: MTB 220**

Course Objectives:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	50%
Descriptors/Topics 1. Isolation of genomic DNA from prokaryotic and Eukaryotes 2. Isolation of plasmid. 3. Study of apoptosis by TUNEL method 4. Isolation of cell organelles by ultracentrifugation.	
Module II:	50%
Descriptors/Topics : 5. Study of in vitro transcription. 6. Study of DNA repair mechanism 7. Site-directed mutagenesis 8. Isolation of RNA	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advancecell and molecular biology experiments.
- Understanding of biomolecule separation techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

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Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Lab Manual

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Course structure: Recombinant DNA Technology Lab - MTB 221

Course Title: Recombinant DNA Technology Lab **Credit Units: 02**

Course Level: PG Level **Course Code: MTB 221**

Course Objectives:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject

.Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	50%
Descriptors/Topics 1. Preparation and Transformation of competent cells by CaCl2 method. 2. Restriction digestion 3. Legation 4. Southern hybridization	
Module II:	50%
Descriptors/Topics : 5. Western blotting 6. RFLP 7. PCR	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

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- Fundamental practical knowledge of basic and advanceRDT and Molecular biology experiments.
- Understanding of Molecular techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Lab Manual

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Course structure: Bioprocess Technology Lab - MTB 222

Course Title: Bioprocess Technology Lab **Credit Units: 02**

Course Level: PG Level **Course Code: MTB 222**

Course Objectives:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

.Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)

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Module I	25%
Descriptors/Topics Isolation of industrially important micro organisms for microbial processes.	
Module II:	25%
Descriptors/Topics : Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.	
Module III:	25%
Descriptors/Topics : Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)	
Module IV:	25%
Descriptors/Topics : Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advancebioprocess technology techniques and fermentation biology experiments.
- Understanding of fermetion techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Lab Manual

Course Title: Genomics and Proteomics Lab **Credit Units: 01**

Course Level: PG Level **Course Code: MTB 223**

Course Objectives:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

.Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Three dimensional Structures – *In silico*study – large molecular complexes RNA polymerase II, ribosome,unstructured proteins	
Module II:	20%
Descriptors/Topics : DNA sequencing methods, gene finding tools and Genome annotation	
Module III:	20%
Descriptors/Topics : Comparison of two given genomes, Analysis of 2D – IEF data	
Module IV:	20%
Descriptors/Topics : Micro array and Micro array data analysis, Inference of protein function from structure	
Module V:	20%
Descriptors/Topics : Two-hybrid methods	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advanceGenomics and Proteomics experiments.
- Understanding of in-silico techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	

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Text & References:

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Advanced Communication-II

COURSE CURRICULUM

PG: Semester II

Course Title: Advanced Communication-II

Credit Units: 1

Course Code: BCP 241

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective:

The course is designed to make the students ready for placement.

Prerequisites: NIL

Course Contents / Syllabus:			
	Module I Job Correspondence	**20% Weightage**	
	• Job Applications • Resume & Profile Writing for Social Media • Follow Up Letter		
	Module II Dynamics of Group Discussion	**30% Weightage**	
	• Methodology • Guidelines		
	Module III Speaking for Employment	**50% Weightage**	
	• Types of Interview (Technical & HR Rounds) • Fundamentals of Facing Interviews • Question Answer on Various Dimensions • Non-Verbal Communication Component • Interview Etiquettes		
	Pedagogy for Course Delivery • Workshop		

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- Presentation
- Group Discussion
- Lectures

Student Learning Outcomes:

The student will be able to write an impressive resume and face the interview confidently.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100` %	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	10%	15%	5%	70%

Text: ***Bovee, L Courtland, Mukesh chaturvedi, and John U Thill, Business Communication Today, Pearson***

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Comfort , Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994

Reference: ***Guffey, Ellen Mary, Business Communication, Thomson (South Western)***

Stay Hungry, Stay Foolish: Rashmi Bansal

Business Maharajas: Gita Piramal

How to Make Friends in Digital Age: Dale Carnegie

Business Communication / Making Connections in a Digital World, Raymond V. Lesikar, Marie E Flattey, Kathryn Rentz, Neerja Pande, Mc Graw Hill, 2009

Additional Reading: Newspapers and Journals

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BEHAVIORAL SCIENCE-II

Course Code: BSP-243 **Credit unit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.
- Enhancing personal effectiveness and performance through effective interpersonal communication
- Enhancing their conflict management and negotiation skills.

Course Contents:

Module I: Conflict Management (2 Hour)

- Meaning and nature of conflicts
- Types of Conflict
- Styles and Techniques of conflict management
- Conflict management and interpersonal communication

Module II: Behavioral & Interpersonal Communication (2 Hours)

- Importance of Interpersonal Communication
- Rapport Building – NLP, Communication mode
- Steps to improve interpersonal communication
- Meaning and Nature of Behavioural Communication
- Relevance of Behavioural Communication

Module III: Relationship Management for Personal and professional Development (2 Hours)

- Importance of relationships
- Maintaining healthy relationships
- Communication Styles
- Types of Interpersonal Relationships

Module IV: Stress Management (2 Hours)

- Understanding of Stress & GAS Model
- Symptoms of Stress

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- Individual and Organizational consequences with special focus on health
- Healthy and Unhealthy strategies for stress management
- Social support for stress management and well being
- Stress free, Successful and Happy Life

Module V: Conflict Resolution & Management (2 Hours)

- Conflict Resolution Strategies

- Ways of Managing Conflict (Healthy & Unhealthy)

- Impact of Conflict Resolution & Management

Student learning outcomes

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme.

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course.

Suggested Readings:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassel.
- Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
- Harvard Business School, Effective Communication: United States of America.
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

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Course structure: Immunology and Immunotechnology- MTB 301

Course Title: Immunology and Immunotechnology **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 301**

Course Objectives:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease

Processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics Phylogeny of Immune System, Types of immunity clonal nature of immune response. Organization and structure of lymphoid organs. Antibody structure and function. Major histocompatibilty: Complex BCR and TCR, generation of antibody diversity, Complement system	
Module IICells of the immune system	20%
Descriptors/Topics : Hematopoiesis and differentiation, antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance.	
Module III:	15%
Descriptors/Topics : Cell mediated toxicity, Hypersensitivity, Autoimmunity, Vaccines:General considerations, ideotype network hypothesis	
Module IV:	20%
Descriptors/Topics Tumor immunology, Transplantation immunology, Immunotheropy.	
Module V:	15%
Descriptors/Topics Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter, (FACS)Hybridoma technology and its application	

Student Learning Outcomes:

- Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens and how they interact specifically with antibodies.

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- Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions.
- Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity.
- Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Immunology by J. Kubey Fence Creek Publishing (Blackwell).
- Immunology by Ivan Riott

References:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.

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Course structure: Enzymology and Enzyme Technology - MTB 302

Course Title: Enzymology and Enzyme Technology **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 302**

Course Objectives:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I Enzymes	15%
Descriptors/Topics General characteristics of enzymes, Mechanism of action of few enzymes: lysozyme, ribozymes, chymotrypsin and alcohol dehydrogenase.	
Module IIEnzyme Kinetics	20%
Descriptors/Topics : Single substrate steady state kinetics; Multisubstrate systems, Enzyme Inhibitors as therapeutic agents, active site, Isozyme and multienzyme complex.	
Module III: Applications of enzymes	15%
Descriptors/Topics : Clinical and Industrial, Enzyme Immobilization and its applications.	
Module IV:Enzyme Reactors	20%
Descriptors/Topics Reactors for batch/continuous enzymatic processing, Choice of reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.	
Module V:Bio-process Design	15%
Descriptors/Topics Physical parameters, reactor operational stability; Immobilized cells.	
Module VI:Challenges and future trends	15%
Descriptors/Topics Catalytic antibodies, Thermostable enzymes with special references to amylases, lipases and proteases.	

Student Learning Outcomes:

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- Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems by I.H. Segel, Wiley-Interscience
- Enzyme Technology by M.F. Chaplin and C. Bucke, Cambridge University Press.

References:

- Biotechnological Innovations in Chemical Synthesis by R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis by R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry by Trevor Palmer

Industrial Enzymes & their applications by H. Uhlig, John Wiley and Sons Inc.

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Course structure: Drug Design and Development- MTB 303

Course Title: Drug Design and Development **Credit Units: 04**

Course Level: PG Level **Course Code: MTB 303**

Course Objectives:

The aim of the course is to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I : : Drug targets classification	20%
Descriptors/Topics DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G proteincoupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).	
Module II	20%
Descriptors/Topics : Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.	
Module III:	20%
Descriptors/Topics : Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.	
Module IV:	20%
Descriptors/Topics Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.	
Module V:	20%
Descriptors/Topics	

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Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.	

Student Learning Outcomes:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.
- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research by J.A. Glasel and M.P.Deutscher, Academic Press
- Principles of Drug Action" by W.B. Pratt and P. Taylor, Churchill Livingston.

References:

- Principles of Medicinal Chemistry" by W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins.
- Side Effects and Drug Desig by E.J. Lien, Marcel Dekker
- The Anticancer Drugs by W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.

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Course structure: Bioprocess Plant Design- MTB 304

Course Title: Bioprocess Plant Design **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 304**

Course Objectives:

The aim of the course is to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :	15%
Descriptors/Topics Introduction; general design information; Mass and energy balance.	
Module II Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment.	20%
Descriptors/Topics :	
Module III:	15%
Descriptors/Topics : Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment.	
Module IV:	15%
Descriptors/Topics Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries.	
Module V:	20%
Descriptors/Topics Design of facilities for cleaning of process equipment used in biochemical industries.	
Module VI:	15%
Descriptors/Topics Utilities of biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.	

Student Learning Outcomes:

- Understand the general design information about a bioprocess plant.

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- Know the concept of energy and mass balance is well known to students.
- Understand the basic flow sheeting and design of a basic batch and continuous type of fermentor.
- Understand about vessels used for the biotechnological applications.
- Understand the selection and specifications of equipments and cleaning used in a bioprocess plant is well known to students.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Applied Process Design for Chemical and Petrochemical Plants by E.E. Ludwig, Butterworth-Heinemann.
- Chemical Engineering by R.K. Sinnott, J.M. Coulson and J.F. Richardson, Butterworth-Heinemann.

References:

- Chemical Engineers Handbook by R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling by F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers by M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design by E. Bausbacher and R. Hunt, Prentice Hall PTR.

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Course structure: Pollution Prevention Fundamentals- MTB 305

Course Title: Pollution Prevention Fundamentals **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 305**

Course Objectives:

To develop an understanding of the methods and impacts of waste minimization including waste pollution prevention and recycling, obtain an overview of relevant environmental laws and regulations governing waste management, understand the phenomena and environmental impact of green-house gases and alternative energy sources to reduce the effect of global warming.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :Pollution Prevention in Industries	20%
Descriptors/Topics Environment friendly chemical processes-Properties and fates of environmental contaminants- Regulations for clean environment and implications for industries – Improved Manufacturing Operations.	
Module II:Life Cycle Assessment and Environmental Audit.	20%
Descriptors/Topics : Life cycle assessment and pollution prevention economics-Hazard and risk Analysis - Pollution prevention planning - Design for the environment.	
Module III:Conservation of Materials and Energy	20%
Descriptors/Topics : Water energy and reagent conservation – Residuals management – Economic Recovery and Recycling of Wastes - Case studies.	
Module IV:Total Quality Environment Management and Ems 14000	20%
Descriptors/Topics Municipal pollution prevention programmes –Environment Management System-14000- Systematic, Structured and Documented Response to Environmental Issues- Auditable and Time Targeted Environmental Improvement Programs.	
Module V:Hierarchy of Environment Management Practices	20%
Descriptors/Topics Waste-specific pollution prevention: waste pre - generation focus on minimization / recycling, Waste-specific pollution control treatment: pre – generation focus on disposal/ recycling- Waste-specific Post-release-to environment focus: recycling/ remediation	

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Student Learning Outcomes:

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pollution Prevention: Fundamentals and Practice by Bishop P., McGraw-Hill International Edition, McGraw-Hill book Co, Singapore
- Green Chemistry: Theory and Practice by P.T. Anastas and J.C. Warner,, Oxford University Press. N.Y.

References:

- Chemical Technology for better Environment by T.K. Roy, (Editor), Allied publishers Ltd, Chennai
- Pollution Prevention through Process Integration: Systematic Design Tools by El Halwagy, M.M, Academic Press, N.Y.

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Course structure: Drug Delivery Systems- MTB 306

Course Title: Drug Delivery Systems **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 306**

Course Objectives:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :: Basic concepts of Drug Delivery	20%
Descriptors/Topics Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Drug delivery considerations for the new biotherapeutics.	
Module II:Advanced Drug Delivery and Targeting	20%
Descriptors/Topics : Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Variousroutes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basicprinciples).	
Module III:Drug administration	20%
Descriptors/Topics : Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.	
Module IV:Delivery of Genetic material	20%
Descriptors/Topics Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.	
Module V:New generation technologies in Drug delivery and targeting	20%

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Descriptors/Topics Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.	

Student Learning Outcomes:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

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- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

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Course structure: IPR, Biosafety and Bioethics- MTB 307

Course Title: IPR, Biosafety and Bioethics **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 307**

Course Objectives:

The objectives of the course are to explain the fundamental principles of IPR issues and examine information policy issues from different perspectives. Students will study and assess policy groups, intellectual property rights, access to information and research policy issues that usually include plant, animal and microbial genetic engineering products

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Objectives of Intellectual Property Rights, origin and evolution of IPR, tangible and intangible property; concept and classification of intellectual property: Copyrights and related rights, Patent, Industrial Design, Trademarks and Geographical indications, Rights of traditional Knowledge and Protection of Plant varieties	
Module II:IPR	20%
Descriptors/Topics : National and international perspective,TRIPS and WIPO	
Module III:Patent	20%
Descriptors/Topics : Basic criterion for patentability, patentable subjects, patentable inventions, patent acquisition, infringement of patent, discovery Vs invention, product patenting Vs process patenting, special issue in biotechnology patent, Patenting laws in Indian and international perspective, Case study: Basmati case, Neem controversy, Turmeric Case	
Module IV:Biosafety	20%
Descriptors/Topics Definition and requirement; biosafety in relation to human health, environment, transgenic research and applications, biosafety laws, guidelines and conventions, biosafety regulation: principles and practices in microbial and biomedical labs, guidelines for research involving DNA molecule ; Regulation bodies at National and International level	

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Module V:	20%
Descriptors/Topics Legal and socioeco'nomic impact of the products and techniques in Biotechnology, Bioethics in plant, animal and microbial genetic engineering, Ethical issues in healthcare, Biopiracy and ethical conflicts	

Student Learning Outcomes:

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- *Coyles information highway handbook;* A Practical File on the New Information Order, American Library Association, 2000.
- *American Indian Cultural & Research Journal (UCLA)*

References:

- Refer to Periodicals, Industry directories, Articles and report in journals on the regulatory issues, "Biotechnology" series by Rehm& Reed.

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Course structure: Advanced Food Technology- MTB 308

Course Title: Advanced Food Technology **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 308**

Course Objectives:

The purpose of the Food Technology major is to produce professionals with a wide range of pertinent knowledge and skills in food chemistry, food microbiology and safety, quantitative skills, engineering and processing, marketing and consumer research

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Processing and preservation technologies used in the food industry: heating, drying and baking, irradiation (infrared, microwave and radio frequency), concentration, freezing, chemical preservation, chilling, fermentation, a combination of those technologies	
Module II:	20%
Descriptors/Topics : Micro-organisms and their metabolites for food, feed and fuel, development and application of food enzymes: fungal amylases, alpha-amylase, pectinase, amyloglucosidase and catalase. Technology for improvement of the quality of fruit juice through enzymatic treatment, Food spoilage and food poisoning micro-organisms	
Module III:	20%
Descriptors/Topics : Pre- and post-harvest technologies for extension of storage life and better handling and transportation of fresh fruits and vegetables, to sustain freshness and reduce spoilage	
Module IV:	20%
Descriptors/Topics Development of environment-friendly packaging materials based on product characteristics and performance properties of packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminium containers, and retortable pouches based on heat penetration studies and sterilization value	
Module V:	20%
Descriptors/Topics Food Safety in food service Establishment and other food areas	

Student Learning Outcomes:

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Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Food Technology by Fraziar
- Food Microbiology, 2nd edition by Adams and Moss.

References:

- Evaluation Of Certain Food Additives And Contaminants, (WHO Technical Report Series 901) World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland
- International Journal of Food Science & Technology, Blackwell synergy publication
- Bioterrorism and Food Safety by Rasco and Bledsoe.

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Course structure: Industrial Safety and Management - MTB 309

Course Title: Industrial Safety and Management **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 309**

Course Objectives:

Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :Hazards	20%
Descriptors/Topics Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards	
Module II:Psychology and Hygiene	20%
Descriptors/Topics : Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.	
Module III:Occupational diseases and control	20%
Descriptors/Topics : Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.	
Module IV:Management	20%
Descriptors/Topics Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.	
Module V:Laws	20%
Descriptors/Topics Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.	

Student Learning Outcomes:

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Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Safety and Accident Prevention in Chemical Operation 2nd Edn., H.H. Fawcett & W.S .Wood Wiley Interscience,

References:

- Industrial Safety and Laws by Indian School of Labour Education, Madras.

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Course structure: Advanced Animal and Plant Cell Technology – MTB-310

Course Title: Advanced Animal and Plant Cell Technology **Credit Units: 03**

Course Level: PG Level **Course Code: MTB 310**

Course Objectives:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I :Advanced Animal Cell Technology	20%
Descriptors/Topics Brief history of animal cell and organ culture, Cultivation of animal cell *en masse* in bioreactor, methods for scale-up, immobilized cell culture, insect cell culture, somatic cell culture, organ culture, and embryo culture.	
Module II:Advanced Animal Cell Technology	15%
Descriptors/Topics : Valuable products from cell culture, Production of recombinant tissue-plasminogen-activator, blood factor VIII, erythropoietin, insulin, somatostatin, somatotropin.	
Module III:Advanced Animal Cell Technology	15%
Descriptors/Topics : Hybridoma technology, Monoclonal antibodies- production and application, Stem cell technology, custom made animals and tissue engineering	
Module IV:Advanced Plant Cell Technology	15%
Descriptors/Topics Brief introduction to various tissue culture techniques, **Cell Cultures, regeneration and preservation:** Plant regeneration through meristem, callus (somatic embryogenesis) and anthers. Protoplast culture and somatic hybridization. Production, preservation and use of somatic embryos. Artificial Seeds and Cybrids.	
Module V:Advanced Plant Cell Technology	20%
Descriptors/Topics Induction & utilization of somatic variants; Secondary metabolite production through cell cultures. Principles and the technology,	

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pharmaceutical, secondary metabolites & beverage production; Commercialization of tissue culture technology (Micropropagation). Plant cell reactors. Immobilized plant cell reactors	
Module VI:Advanced Plant Cell Technology	15%
Descriptors/Topics Engineering of Chloroplast and mitochondrial genomes and their applications, Biotransformation by plant cells.	

Student Learning Outcomes:

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panim Publication

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Course structure: Immunology and Immunotechnology Lab- MTB 320

Course Title: Immunology and Immunotechnology Lab **Credit Units: 02**

Course Level: PG Level **Course Code: MTB 320**

Course Objectives:

The objectives of the course is to understand the principles of immune function and immunization and to provide advanced training in modern cellular and molecular immunology, with emphasis on the interface between the basic and clinical aspects of the subject.

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Blood film preparation and identification of cells, Identification of blood group, Isolation of serum.	
Module II:	20%
Descriptors/Topics : Lymphoid organs and their microscopic organization.	
Module III :	20%
Descriptors/Topics : WIDAL Test, Radial Immuno Diffusion Test, Ouchterlony Double diffusion Test, ELISA:- DOT, SANDWICH	
Module IV :	20%
Descriptors/Topics : Purification of IgG through affinity chromatography	
Module V :	20%
Descriptors/Topics : Immunohistochemistry	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advanceimmunology and immunotechnologyexperiments.
- Understanding of immunological responses techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

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IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

Lab Manual

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MADHYA PRADESH
Established vide Government of Madhya Pradesh Act No. 27 of 2010

Course structure: Enzymology and Enzyme Technology Lab- MTB 321

Course Title: Enzymology and Enzyme Technology Lab **Credit Units: 01**

Course Level: PG Level **Course Code: MTB 321**

Course Objectives:

To integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic overview of enzyme activity and regulation in cells

Pre-requisites: The students must possess fair understanding of ....

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics Isolation of Enzymes from plant and microbial sources.	
Module II:	15%
Descriptors/Topics : Enzyme assay; activity and specific activity – determination of amylase, acid phosphatase, cellulase, protease.	
Module III :	20%
Descriptors/Topics : Production of enzyme on industrial scale using solid and liquid-state fermentation.	
Module IV :	15%
Descriptors/Topics : Purification of enzyme by ammonium sulphate fractionation, ion-exchange, gel permeation chromatography.	
Module V :	20%
Descriptors/Topics : Enzyme Kinetics: Determination of Michaelis-Menten constant (Km) and Maximum Velocity (Vmax), Temperature optima and pH optima of an enzyme.	
Module VI:	15%
Descriptors/Topics :	

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Enzyme immobilization and its effect on enzyme activity	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advanceEnzymology and Enzymetechnology experiments.
- Understanding of enzyme production techniques

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

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Maharajpura, Gwalior 474005

SUMMER PROJECT

Course Code: MTB 360 Credit Units: 12

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

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1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 **Abstract** and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

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Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

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3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

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The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

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➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

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This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

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PROJECT

Course Code: MTB 460 Credit Units: 30

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

The report should be hard bound and for color coding scheme refer NTCC guidelines.

It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

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Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:

(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

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Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.

In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- ## Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.

(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may

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Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

The list should use exactly the same captions as they appear in the text.List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.

The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

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Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.

Incase the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time
- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the c
and to explain new understanding of the problem after taking the results into consideration. It shoul

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implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or pl[illegible]e further work on the subject, mention that.

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Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

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[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Assessment Scheme:

Continuous Evaluation: 40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation: 60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

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Program Educational Objectives (PEO)
Bachelor of Science (B. Sc.(H)) Biotechnology
Academic Year – 2023-24

B.Sc.(H) Biotechnology

PEO-1: To inculcate the scientific approach to develop deep insight through flexible, research-oriented program to meet the present and futuristic demand of academia and industry.

PEO-2: To develop professional and innovative approach and its impact on human health, agriculture, and environment for sustainable development.

PEO-3: To develop individual and team building ability for providing opportunities for students to manage and work on multidisciplinary projects through interaction with their peers.

PEO-4: To apply the acquired biotechnological and technical skills to inculcate leadership qualities for innovative entrepreneurship.

PEO-5: To acquire leadership qualities, and scientific aptitude for life-long learning.

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AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES

B.Sc. (H) Biotechnology (Six Semesters)

PROGRAM OUTCOMES OF B.Sc. BIOTECHNOLOGY

On completion of the course, students are able to understand about:

PO1. Knowledge: Biotechnology deals with developing knowledge of biological sciences and effective implementation of engineering technologies that manipulate living organisms and biological systems to produce products for advance healthcare, medicine, agriculture, food, Pharmaceuticals and environment control etc.

PO2. General Scope: In general course structure emphasized on distribution, morphology and physiology of microorganisms, in addition to development of skills, working under several aseptic procedures, isolation and identification. This course also includes sophomore level material covering immunology, virology, microbiology, epidemiology and recombinant DNA technology.

PO3. Students understand: Basic Structure and metabolism of Biomolecules, along with instrumentation of several techniques involved in course structure, Atomic theory, Valiancy, Atomic weight.

PO4: Environment and sustainability: Development of fundamental concepts of Ecosystem, energy flow and role of biodiversity in maintaining sustainability.

PO5. Coverage: Courses contain topics covering of several commercial aspects of protecting commercial interests of the applied research, such as intellectual property (IPR) and patents, commercializing technology, promoting entrepreneurship, with lectures and case studies from specific domain business leaders and academic experts.

PO6. Lifelong learning: Ability to engage in life-long learning in the context of technological change.

PO7. Independent thinking: Inculcation of ability to think independently for problem solving.

PO8. Team bonding: Ability to work in a team towards achieving a common goal and solving broad societal and national issues.

PO9. Ethics: Understanding of professional and ethical responsibility among students to conduct at their workplace.

PO10. Interpretation: Ability to design and conduct experiments in biotechnology and analyze data.

PROGRAMME SPECIFIC OUTCOMES OF B.Sc. BIOTECHNOLOGY

PSO1: Empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology.

PSO2: Students are able to learn the modern molecular biological techniques viz, chromatography, SDS-PAGE, Agarose Gel Electrophoresis, fermentation, downstream processing and PCR. These basic and advanced techniques are very essential for the large-scale production of biotechnology

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derived products at commercial level.

PSO3: Students develop knowledge and skillsets need for the production of various primary and secondary commercially relevant products. Like Antibiotics, Vitamins, Hormones, enzymes, proteins and manufacturing industrially important secondary metabolites through tools of bioprocess technology.

PSO4: Recognize the importance of IPR, TRIPS, GATT, PATENT, Bioethics, Entrepreneurship, communication and management skills so as to prepare the next generation of Indian Industrialist.

PSO5: Graduates will be able to justify health safety and legal issues and understand the biotechnological principles behind.

PSO6: Students will be able to demonstrate their ability to apply biotechnological research strategies to provide potential solution for global environmental issues like climate change, Acid rain, ozone depletion, industrial waste treatment and bioremediation etc.

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Amity University Madhya Pradesh
PO Mapping of B.Sc.(H) Biotechnology syllabus with the SDGs

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	PO-1	Knowledge: Biotechnology deals with developing knowledge of biological sciences and effective implementation of engineering technologies that manipulate living organisms and biological systems to produce products for advance healthcare, medicine, agriculture, food, Pharmaceuticals and environment control etc.	SDG 4 Quality Education
2	PO-2	General Scope: In general course structure emphasized on distribution, morphology and physiology of microorganisms, in addition to development of skills, working under several aseptic procedures, isolation and identification. This course also includes sophomore level material covering immunology, virology, microbiology, epidemiology and recombinant DNA technology.	SDG 9 Industry, Innovation, and Infrastructure
3	PO-3	Students understand: Basic Structure and metabolism of Biomolecules, along with instrumentation of several techniques involved in course structure, Atomic theory, Valiancy, Atomic weight.	SDG 4 Quality Education
4	PO-4	Environment and sustainability: Development of fundamental concepts of Ecosystem, energy flow and role of biodiversity in maintaining sustainability.	SDG 13 Climate Action
5	PO-5	PO5. Coverage: Courses contain topics covering of several commercial aspects of protecting commercial interests of the applied research, such as intellectual property (IPR) and patents, commercializing technology, promoting entrepreneurship, with lectures and case studies from specific domain business leaders and academic experts.	SDG 8 Decent work and economic growth
6	PO-6	PO6. Lifelong learning: Ability to engage in life-long learning in the context of technological change.	SDG 3 Good Health and Well Being
7	PO-7	PO7. Independent thinking: Inculcation of ability to think independently for problem solving.	SDG 17: Partnerships for the Goals
8	PO-8	PO8. Team bonding: Ability to work in a team towards achieving a common goal and solving broad societal and national issues.	SDG 17: Partnerships for the Goals
9	PO-9	PO9. Ethics: Understanding of professional and ethical responsibility among students to conduct at their workplace.	SDG 17 Partnerships for the Goals
10	PO-10	PO10. Interpretation: Ability to design and conduct experiments in biotechnology and analyze data.	SDG 9: Industry, Innovation, and Infrastructure

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Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	V	BSB 503	Genomics & Proteomics	National Mission for BioScience for human Health
2.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	V	BSB 504	Recombinant DNA Technology	National Mission for BioScience for human Health
3.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	I	EVS-142	ENVIRONMENTAL STUDIES-I	National Mission for Green India
4.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	II	EVS-242	ENVIRONMENTAL STUDIES-I	National Mission for Green India
5.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	I	BCU 141	Communication Skill – I	National Mission for Natural Language Translation
6.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	II	BCU 241	Communication Skill – II	National Mission for Natural Language Translation
7.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	III	BCU341	Communication Skill – III	National Mission for Natural Language Translation
8.	Amity Institute of Biotechnology	B.Sc.(H) Biotechnology	IV	BCU 441	Communication Skill – IV	National Mission for Natural Language Translation

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PROGRAMME STRUCTURE: B.Sc. Biotechnology-3YDC/ B.Sc. Biotechnology (Honours with Research) -4YDC

FIRST SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 101	Cell Biology	Discipline Specific Course (Core 1)	3	-	-	3
BSB 102	Maths & Biostatistics	Inter/ Multi-Disciplinary Course	3	-	-	3
BSB 103/ BSB 104	Plant Sciences – I/ Animal Sciences-I	Discipline Specific (Elective)	3	-	-	3
BSB 105	Chemistry – I	Discipline Specific (Minor 1)	2	-	-	2
	Minor Track (CBCS)	Minor 2	2	-	-	2
BSB 120	Biotechnology Lab - I	Discipline Specific Course (Core 1) Lab	-	-	2	1
BSB 121	Chemistry Lab – I	Discipline Specific (Minor 1) Lab	-	-	2	1
BSB 122/ BSB 123	Plant Sciences Lab - I / Animal Sciences Lab-I	Discipline Specific (Elective) Lab	-	-	2	1
BCU 141	Communication Skill – I	Ability Enhancement Course (AEC)	2	-	-	2
EVS 142	Environmental Studies - I	Value Added Course (VAC)	2	-	-	2
FLU 144 FLU 145 FLU 146 FLU 147 FLU 148	Foreign Language - I French - I German Spanish Japanese Chinese	Skill Enhancement Course (SEC)	2	-	-	2
	TOTAL					**22**

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SECOND SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 201	Bioanalytical Techniques	Discipline Specific Course (core 1)	3	-	-	3
BSB 202	Introductory Biochemistry & Biophysics	Inter/ Multi-Disciplinary Course	3	-	-	3
BSB 203/ BSB 204	Plant Sciences – II/ Animal Sciences-II	Discipline Specific (Elective)	3	-	-	3
BSB 205	Chemistry – II	Discipline Specific (Minor 1)	2	-	-	2
	Minor Track (CBCS)	Minor 2	2	-	-	2
BSB220	Biotechnology Lab – II	Discipline Specific Course (Core 1) Lab	-	-	2	1
BSB 221	Chemistry Lab – II	Discipline Specific (Minor 1) Lab	-	-	2	1
BSB 222/ BSB 223	Plant Sciences Lab - II / Animal Sciences Lab-II	Discipline Specific (Elective) Lab	-	-	2	1
BCU 241	Communication Skill – II	Ability Enhancement Course (AEC)	2	-	-	2
EVS 242	Environmental Studies - II	Value Added Course (VAC)	2	-	-	2
FLU 244 FLU 245 FLU 246 FLU 247 FLU 248	Foreign Language - II French - II German Spanish Japanese Chinese	Skill Enhancement Course (SEC)	2	-	-	2
BSB-260	*Bio-Instrumentation	Vocational training				4*
	TOTAL					**22**

- ***Vocational training for Certificate in bio-Instrumentation (04 Credit) as NTCC.**

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THIRD SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 301	Genetics	Discipline Specific Course (core 1)	3	-	-	3
BSB 302	Microbiology	Discipline Specific Course (core 2)	3	-	-	3
BSB 303/ BSB 304	Anatomy & Plant Physiology/ Animal Physiology-I	Discipline Specific (Elective)	3	-	-	3
BSB 305	Chemistry – III	Discipline Specific (Minor 1)	2	-	-	2
	Minor Track (CBCS)	Minor 2	2	-	-	2
BSB 320	Biotechnology Lab – III	Discipline Specific Course (Core 1) Lab	-	-	2	1
BSB321	Chemistry Lab – III	Discipline Specific (Minor 1) Lab	-	-	2	1
BSB322/ BSB323	Anatomy & Plant Physiology Lab/ Animal Physiology Lab-I	Discipline Specific (Elective) Lab	-	-	2	1
BCU 341	Communication Skill – III	Ability Enhancement Course (AEC)	2	-	-	2
BSU343	Behavioural Science – III	Value Added Course (VAC)	2	-	-	2
FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language – III French - III German Spanish Japanese Chinese	Skill Enhancement Course (SEC)	2	-	-	2
	TOTAL					**22**

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FOURTH SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 401	Molecular Cell Biology	Discipline Specific Course (core 1)	3	-	-	3
BSB 402	Bioinformatics	Inter/ Multi-Disciplinary Course	3	-	-	3
BSB 403/ BSB 404	Plant Breeding, Embryology, Pathology & Economic Botany/ Animal Physiology-II	Discipline Specific (Elective)	3	-	-	3
BSB 405	Chemistry – IV	Discipline Specific (Minor 1)	3	-	-	3
	Minor Track (CBCS)	Minor 2	2	-	-	2
BSB 420	Biotechnology Lab - IV	Discipline Specific Course (Core 1) Lab	-	-	2	1
BSB 421/ BSB 422	Plant Breeding, Embryology, Pathology & Economic Botany Lab/ Animal Physiology Lab-II	Discipline Specific (Elective) Lab	-	-	2	1
BSB 450	Term Paper (Review Article)	AEC	-	-	-	2
BSU-440	Behavioural Science – IV	VAC	2	-	-	2
FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language – IV French - IV German Spanish Japanese Chinese	Skill Enhancement Course (SEC)	3	-	-	3
BSB 460	*Clinical Biochemistry	*Vocational Training				4*
	TOTAL					

- ***Vocational training for diploma in clinical biochemistry (4 credit) as NTC**

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FIFTH SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 501	Plant Biotechnology	Discipline Specific Course (core 1)	3	-	-	3
BSB 502	Animal Biotechnology	Discipline Specific Course (core 2)	3	-	-	3
BSB 503	Biochemistry and Metabolic Regulation	Discipline Specific Course (core 3)	3	-	-	3
BSB 504	Recombinant DNA Technology	Discipline Specific Course (core 4)	3	-	-	3
BSB-505	Enzyme Technology	Inter/ Multi-Disciplinary Course	2	-	-	2
	Minor Track (CBCS)	Minor 2	3	-	-	3
BSB-521	Plant Biotechnology Lab	Discipline Specific Course (core 1) Lab	-	-	2	1
BSB-522	Animal Biotechnology lab	Discipline Specific Course (core 2) Lab	-	-	2	1
BSB-523	Biochemistry and Metabolic Regulation Lab	Discipline Specific Course (core 3) Lab	-	-	2	1
BSB-524	Recombinant DNA Technology Lab	Discipline Specific Course (core 4) Lab	-	-	2	1
	TOTAL					**21**

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SIXTH SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 601	Environmental Biotechnology	Discipline Specific Course (core 1)	3	-	-	3
BSB 602	Industrial Biology	Discipline Specific Course (core 2)	3	-	-	3
BSB 603	Immunology & Immunotechnology	Discipline Specific Course (core 3)	3	-	-	3
	Minor Track (CBCS)	Minor 2 (Project)	-	-	-	1
BSB 620	Environmental Biotechnology Lab	Discipline Specific Course (core 1) Lab	-	-	2	1
BSB 621	Industrial Biology lab	Discipline Specific Course (core 2) Lab	-	-	2	1
BSB 623	Immunology and Immunotechnology lab	Discipline Specific Course (core 3) Lab	-	-	2	1
BSB 660*	Project (6-8 Week)	Field Project/ Summer Internship Project	-	-	-	6
	TOTAL					**19**

***Summer Internship Program of 6-8 Weeks duration to be conducted during 6th Semester in conjunction with Institute/Industry. This is Non-Teaching Credit Course (NTCC).**

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SEVENTH SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 701	Advanced Microbial Technology	Discipline Specific Course (core 1)	3	1	-	4
BSB 702	Advanced Cell Biology and Genetics	Discipline Specific Course (core 2)	3	1	-	4
BSB 703	Advanced Biophysics & Bioanalytical Techniques	Discipline Specific Course (core 3)	3	1	-	4
BSB 704	Advanced Biostatistics for Biologist	Discipline Specific Course (core 4)	3	1	-	4
BSB 720	Advanced Microbial Technology Lab	Discipline Specific Course (core 1) Lab	-	-	2	1
BSB 721	Advanced Cell Biology and Genetics Lab	Discipline Specific Course (core 2) Lab	-	-	2	1
BSB 722	Advanced Biophysics & Bioanalytical Techniques lab	Discipline Specific Course (core 3) Lab	-	-	2	1
	TOTAL					**19**

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EIGHT SEMESTER

Course Code	Course Title	Broad Category of Courses	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit
BSB 801	Advanced Genomics and Proteomics	Discipline Specific Course (core 1)	3	-	-	3
BSB 802	Drug Delivery System	Discipline Specific Course (core 2)	3	-	-	3
BCH 621	Management Accounting and Cost Control	Inter/ Multi-Disciplinary Course 1	1	-	-	1
BCH 622	Project Management	Inter/ Multi-Disciplinary Course 2	1	-	-	1
BCH 623	Principle of management and Entrepreneurship Development	SEC	1	-	-	1
BSB 860*	Project (10-12 Week)	Dissertation	-	-	-	15
	TOTAL					**24**

***Summer Internship Program of 10-12 Weeks duration to be conducted during 8th Semester in conjunction with Institute/Industry. This is Non-Teaching Credit Course (NTCC).**

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Course structure: Cell Biology - Course Code-BSB 101

Course Title: Cell Biology Credit Units: 03

Course Level: UG Level Course Code: BSB 101

Course Objectives:
• Enable students to understand the cell as a unit of living systems, its various organelles, their structure, function and metabolic processes
• Help students to practice a conceptual frame work for dealing with the evolving understanding of cell.
• Enable students to strengthen the cellular structure of cell organelle and their functions.

Pre-requisites: The students must possess fair understanding of prokaryotic and eukaryotic cell structure and function.
Course Contents/Syllabus:

	Weightage (%)
Module I : **Cell as a basic unit of living systems**	20 %
Descriptors/Topics The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.	
Module II **Ultrastructure of the cell membrane and cell organelles**	20 %
Descriptors/Topics Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).	
Module III Chromosomes	20 %
Descriptors/Topics Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.	
Module IV: Cell division and cell cycle	15 %
Descriptors/Topics: Cell cycle, interphase, mitosis and meiosis	
Module V: Cell – Cell interaction	15 %
Descriptors/Topics: Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis)	
Module VI: Cell differentiation	10%
Descriptors/Topics: Mechanism of cell differention (e.g., RBC); difference between normal and cancer cells	

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Student Learning Outcomes:

- Understand the concepts theories given by scientists for the origin of cell along with different types of prokaryotic and eukaryotic cells
- Analyze various cellular structure of cell organelle and their functions.
- Identify, implement and evolve verbal and written skills of subject along with interdisciplinary approach
- Evaluate the Difference between chromosomal structures in different stages of a cell cycle.
- Enable students to understand the cell differentiation, malignancy and cell death.

Pedagogy for Course Delivery: Students are encouraged to engage in active interaction during lecture through discussion and questions.
Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

Text & References:

Text:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology -Sheelar& Bianchi, John Wiley

References:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell – Becker ,Klinshmith& Harden, Pearson

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Course structure: Maths & Biostatistics- Course Code: BSB 102

Course Title: Maths & Biostatistics — Credit Units: 03

Course Level: UG — Course Code: BSB 102

Course Objectives:
The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents/Syllabus:

	Weightage (%)
Module I **BRIDGE COURSE**	25%
Descriptors/Topics: Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root	
Module II	25%
Descriptors/Topics Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions (e^x, x^n, sin x, cos x, log x), Maxima and Minima, Partial Differentiation, Integration of some basic functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series	
Module III **BIOSTATISTICS**	25 %
Descriptors/Topics: Measure of central tendency and measure of dispersion Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution Simple problems involving Binomial, Poisson and Normal variables,	
Module IV	25%
Descriptors/Topics: Correlation and regression, Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods.	

Student Learning Outcomes:

- Understand the concepts of maths and central tendency and measure of dispersion.
- Analyze various methods of sampling.

Pedagogy for Course Delivery: Students are encouraged to engage in active interaction during lecture through discussion and questions.
Power point presentation and class room lecture.

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List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	10	5	70

Text & References:

Text:

- Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
- Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:

- Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
- Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
- Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
- Statistics of Extremes, E.J. Gumbel, Columbia University Press

Dwivedi

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Course structure: Plant Sciences - I- Course Code: BSB 103

Course Title: **Plant Sciences – I** Credit Units: 03
Course Level: UG Course Code: BSB 103

Course Objectives:

• Enable students to understand the classification, morphology, reproduction in plants.

• Enable students to strengthen economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Pre-requisites: The students must possess fair understanding of plants classification, morphology, reproduction and economic importance.

Course Contents/Syllabus:

	Weightage (%)
Module I **Algae**	25%
Descriptors/Topics : History of Botany and Indian Contribution, Morphological Characteristics of lower plants. Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:*Chlamydomonas*,,*Chara*, *Sargassum*, *Polysiphonia*, *Nostoc*.	
Module II **Fungi**	25%
Descriptors/Topics: Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:,*Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance	
Module III **Bryophytes**	25%
Descriptors/Topics Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia*, *Anthoceros* (Development of Sporophyte only).	
Module IV **Pteridophytes**	25%
Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella*, *Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.	

Student Learning Outcomes:

• Understand the concepts of algal plants morphology, anatomical features, evolution pathways & mode of reproduction.

Dwivedi
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- Analyze various role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans.
- Identify, implement and evolve the occurrence, distribution, structure, phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza
- Evaluate the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes
- Enable students to classification, morphology, reproduction and economic importance plants.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

Text & References:

Text:

- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Dwivedi

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Course structure: Animal Sciences - I- Course Code: BSB 104

Course Title: **Animal Sciences – I** Credit Units: 03
Course Level: UG Course Code: BSB 104

Course Objectives:

• Enable students to understand the characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

• Enable students to strengthen economic importance of various characteristics and variations of invertebrates.

Pre-requisites: The students must possess fair understanding of invertebrate classification, morphology, reproduction and economic importance.

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics : Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy. -Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).	
Module II	20%
Descriptors/Topics: -Protozoa: Type study of Plasmodium. -Porifera: Type of Sycon.	
Module III	20%
Descriptors/Topics: -Coelnterata: Type study of *Ovelia.* -Helminthes: Type Study of *Liverfluke.*	
Module IV	20%
Higher Invertebrates -Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,* -Arthropoda: Type Study of *Prawn*	
Module V	20%
Mollusca: Type Study of *Pila* Echinodermata: External features of Star fish and Echinoderm larvae, Hemichordata: General Characteristics and relationship with nonchordates and chordates, External morphology (Balanoglossus), structure and significance of Tornaria Larva	

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Student Learning Outcomes:

- Learn about characteristics and variations of invertebrates.
- Develop scientific outlook for research and innovation.

- Get knowledge of typical invertebrates and their economic importance.
- Develop conservative outlook for animals.
- Generate written and verbal communication skills over the subject.
- Enable students to classification, morphology, reproduction and economic importance animal.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

Text & References:

Text:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

Dwivedi

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Course structure: Chemistry- I   Course Code: BSB 105

Course Title: **Chemistry– I**   Credit Units: **02**
Course Level: UG   Course Code: BSB 105

Hours: 30

Course Objectives:
The objective of this course is to educate the students about basic analytical chemistry, so that they can prepare solutions of different concentrations. In addition to this, the students will also learn to determine the rate of reaction using chemical kinetics in this course. The last objective of this course is associated with fundamentals of organic chemistry including structure and electron delocalization effects.

Course Contents:

Module I: Basic Analytical Chemistry: (8 Hours)
Introduction to analytical chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Calculations used in Analytical Chemistry Some Important units of measurements:
SI Units, distinction between mass and weight, mole, milli mole and Numerical Problems.
Solution and their concentrations: Concept of Molarity, molality and normality. Expressing the concentration in parts per million (ppm), parts per billion (ppb), Numerical problems.
Chemical Stoichiometry: Empirical and molecular formulas, Stoichiometric calculations, Numerical problems.

Module II: Dilute Solutions and Colligative Properties (8 Hours)
Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.
Module III: Chemical Kinetics: (8 Hours)
Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Dwivedi

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Module IV: Fundamentals of Organic Chemistry: (6 Hours)
Structure, shape and reactivity of organic molecules: Physical effects, electronic displacements: Inductive effect, electromeric effect, resonance and hyperconjugation. Cleavage of bonds: homolysis
and heterolysis. Reactive intermediates: carbocations, carbanions and free radicals. Nucleophiles and electrophiles

Learning Outcomes:
After successful completion of the course students will have the knowledge and skill to understand the very basic concepts of analytical chemistry and calculations. Understand the very basic of solution preparation and rate of reactions. In addition, students will understand the fundamentals of organic chemistry including structure and electron delocalization effects.

Examination Scheme:

Components	**CT**	**A**	**HA/S/V/Q**	**EE**
Weightage (%)	15	5	10	70

CT: Class Test, A: Attendance, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination

Text & References:

Text:
•Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry - Volume I. (2000). India: S. Chand Limited. ISBN 9788121902632
•Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry - Volume II. (2000). India: S. Chand Limited. ISBN 9788121917872
•Puri, Sharma & Pathania, Principles of Physical Chemistry. (2008). India: VISHAL PUBLISHING Company. ISBN 9788188646654
•Morrison & Boyd. Organic Chemistry (2016) Pearson New Delhi. ISBN 8177581694
•Bahl, A., Bahl, B. S. (1997). A textbook of organic chemistry: (for B.Sc. students). India: Chand. ISBN 9788121902595

References:
•J.D. Lee. Concise Inorganic Chemistry, , Black Well Sciences. ISBN 9788126515547.
•Keeler, J., De Paula, J., Atkins, P. W. (2018). Atkins' Physical Chemistry. United Kingdom: Oxford University Press. ISBN 9780198814740.
•Snyder, S. A., Solomons, T. W. G., Fryhle, C. B. (n.d.). Organic Chemistry 12e. United Kingdom: John Wiley & Sons, Limited. ISBN 9781119572985.
•Vogel's Quantitative Chemical Analysis. (2009). India: Pearson Education. ISBN 9788131723258
•Snyder, S. A., Solomons, T. W. G., Fryhle, C. B. (n.d.). Organic Chemistry 12e. United Kingdom: John Wiley & Sons, Limited. ISBN 9781119572985.

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Course structure: BIOTECHNOLOGY LAB – I- BSB 120

Course Title: Biotechnology lab–I (based on cell biology and biostatistics) Credit Units: 01

Course Level: UG Course Code: **BSB 120**
Course Objectives: NA
Course Contents/Syllabus:

	Weightage (%)
Module I **Cell Biology**	50%
Descriptors/Topics: Cytological preparations to study plant /animal cell structure, Fixation, dehydration and staining, Onion root tip and pollen squash preparation. Study of different stages of Mitosis and Meiosis. Embedding and sectioning.	
Module II **Biostatistics**	50%
Descriptors/Topics Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)	

Student Learning Outcomes:
- Understand the concepts of cell biology and biostatistics on the basis of practical.

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable: NA

Lab/ Practical details, if applicable:
Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: CHEMISTRY LAB-I - Course Code: BSB 121

Course Title: **CHEMISTRY LAB – I** Credit Units: 01
Course Level: UG Course Code: BSB 121

Course Objectives:
Through this course, the students will learn the importance of chemical safety and lab safety while performing experiments in laboratory. Calibration of different weights and glass apparatus such as measuring cylinder, burette, pipette, volumetric flasks shall be detailed to the students for systematic initiation of their chemical lab classes.

Course Contents:

Module I
1. Importance of chemical safety and lab safety while performing experiments in laboratory
2. Calibration of different weights and glass apparatus (measuring cylinder, burette, pipette, volumetric flasks).

Module II
Preparation of solutions of different molarity/normality by weighing and dilution.

Module III
Titrimetric Analysis
1. Standardization of NaOH with Oxalic acid.
2. Determination of Normality of given sample of oxalic acid using NaOH as secondary standard.

Module IV
1. Determination of surface tension of liquids.
2. Determination of viscosity of liquids.

Module V
1. Heat of neutralisation of a strong acid and a strong base
2. Solubility curve of KNO3 or benzoic acid.

Module VI
1. Determination Boiling Point of liquids.
2. Determination of Melting Point of solids.
3. Purification of solids by crystallization.
4. Purification of liquids by simple distillation.

Note:

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Students are required to perform at least ten experiments by selecting minimum one experiment from each module.

Instructor may choose to assign value added experiments relevant to theory syllabus.

Course Outcomes:

After completion of this course the students will understand the importance of best practices of chemical safety and lab safety while performing experiments in laboratory. Calibration of different weights and glass apparatus such as measuring cylinder, burette, pipette, volumetric flasks shall be known to the students for systematic initiation of their chemical lab experiments.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CT: Class Test, A: Attendance, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination

Text & References:

1. Laboratory Manual on Engineering Chemistry. S K Bhasin & Sudha Rani; Dhanpat Rai Publishing Company
2. Experiments in Applied Chemistry, Dr. Sunitta Rattan; CATSON Book Publishers.
3. Practical Chemistry, O P Pandey, D N Bajpai, S Giri; S Chand Publishers.
4. Unified Practical Chemistry, MMN Tandon, Shiv Lal Agrawal and Company

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Course structure: Plant Sciences Lab-I Course Code: BSB 122

Course Title: **Plant Sciences Lab - I**. Credit Units: 01
Course Level: UG Course Code: **BSB 122**

Course Objectives:
• Enable students to understand the morphology and anatomy of plant cell through specimen studies.
Pre-requisites: The students must possess fair understanding of algae, fungi, bryophytes and pteridophytes.
Course Contents/Syllabus:

	Weightage (%)
Module I : **Algae**	25 %
Descriptors/Topics: Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)	
Module II: **Fungi**	25 %
Descriptors/Topics: Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)	
Module III : **Bryophytes**	25 %
Descriptors/Topics Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.	
Module IV : **Pteridophytes**	25 %
Descriptors/Topics Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.	

Student Learning Outcomes:
• Understand the concepts of plants.

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable

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Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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MADHYA PRADESH
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Course structure: Animal Sciences Lab-I Course Code: BSB 123

Course Title: **Animal Sciences Lab- I** Credit Units: 01
Course Level: UG Course Code: BSB 123

Course Objectives:
• Enable students to understand the basic concept of animal structure.
• Help students to practice handing of microscopic
• Enable students to strengthen the various cosmopolitan microorganisms and its importance.
Pre-requisites: The students must possess fair understanding of various invertebrates phylum.
Course Contents/Syllabus:

	Weightage (%)
Module	1%-100%
Descriptors/Topics : • Study of museum specimens and slides, related to various phyla of invertebrates • Preparation of slides of amoeba, paramecium. • Dissection of earthworm and digestive system of earth worm, Prawn • Dissection of cockroach and glycerin preparation of mouth parts. • Dissection of Pila. • Use specimens and permanent slides (Mounting). • Examination of pond water for study of different kinds of microscopic non-chordate organisms • Economic importance of any two insects and parasitic adaptation of any one parasite	

Student Learning Outcomes:
• Understand the various invertebrates
• Analyse various microorganism
• Identify, implement and evolve of various system of invertebrtaes.

Pedagogy for Course Delivery: Dissections and Demonstrations of animal by brown papering, Through charts and model easy to understand the complete model.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	10	5	70

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Course structure: Communication Skills-I Course Code: BCU 141

Course Title: **Animal Sciences Lab- I** Credit Units: 02

Course Level: UG Course Code: **BCU 141**

Annexure **'AAB-CD-01a'**

UG- I

Course Title: Communication Skills-I

Credit Units: 2

Course Code: BCU 141

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar	

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	❖ Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	
	Assessment/ Examination Scheme:	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	60%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	20%	15%	5%	60%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha , Business Communication, Galgotia Publishing Company.***

Additional Reading: Newspapers and Journals

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Course structure: ENVIRONMENTAL STUDIES-I Course Code: EVS 142

Course Title: **ENVIRONMENTAL STUDIES-I** Credit Units: 02
Course Level: UG Course Code: **EVS 142**

Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents / Syllabus:		
1.	**Module I The multidisciplinary nature of environmental studies (6 Hrs)**	**25% Weightage**
	• Definition, scope and importance • Need for public awareness	
2.	**Module II Natural Resources (8 Hrs)**	**25% Weightage**
	• Renewable and non-renewable resources: • Natural resources and associated problems • Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. • Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. • Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. • Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. • Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. • Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.	
3.	**Module III Ecosystems (3 Hrs)**	**25% Weightage**
	• Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession • Food chains, food webs and ecological pyramids	

Dwivedi

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Amity University Madhya Pradesh
Maharajpura, Gwalior 474005

	• Introduction, types, characteristic features, structure and function of the following ecosystem: • Forest ecosystem • Grassland ecosystem • Desert ecosystem • Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)	
4.	**Module IV : Biodiversity and its conservation (3 Hrs)**	**25% Weightage**
	Introduction – Definition: genetic, species and ecosystem diversity Biogeographical classification of India Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels India as a mega-diversity nation, Hot-spots of biodiversity Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p

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- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.

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Course structure: Français - ICourse Code: FLU144

Course Title: **Français - I** Credit Units: 02
Course Level: UG Course Code:
FLU144

French syllabus – Programme d'études pour le français
All U.G. Programmes – Foreign Language
Franç
ais - I

Course Objective:

To familiarize the students with French language, its phonetics and its accents.
To enable students

- to greet someone in French, to present and describe oneself and people
- to enter in contact, and begin a conversation, to ask and tell about date
- to talk about the physical aspect and character of the person
- to talk about day to day life tasks like enquiring about time, interest and preference

Course Contents:

Unité 1, 2, 3–pg16-61

Unité 1: Bonjour, ça va ? Salut ! Je m'appelle Agnès

Actes de Parole :- Entrer en contact : Saluer, demander et dire comment ça va – Les pays et les nationalités – les animaux domestiques - Se présenter et présenter quelqu'un - Demander et dire la date - les jours de la semaine –les nombres de 0 à 69 - les mois de l'année – la famille (1) - La France physique et politique.

Unité 2: Qui-est-ce ? Dans mon sac, j'ai….

Actes de Parole :- Demander et répondre poliment – les professions – Quelques objets – La fiche d'identité - Demander et des informations personnelles.

Unité 3: Il est comment ? – Allô ?

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Actes de Parole :- Décrire l'aspect physique et le caractère – les nombres à partir de 70 - Parler au téléphone – Les pays des vacances.

Grammaire :

1. Les pronoms personnels sujets – Les verbes *être* et *avoir* – Les articles indéfinis et définis – La formation du féminin (1) – la formation du pluriel (1) – Les adjectifs possessifs.
2. La formation du féminin (2) – La phrase interrogative: Qu'est-ce que ? / Qu'est-ce que c'est / Qui est-ce ? - La phrase négative (1) – C'est / Il est (1) – Les verbes du premier groupe – Les verbes *aller* et *venir.*
3. La formation du féminin (3) – les articles contractés – les pronoms personnels toniques – Il y a – Les adverbes interrogatifs – les nombres – Les prépositions de lieu - Les verbes du deuxième groupe – le verbe *faire*.

Examination Scheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-	VIVA-	ATTENDAN	**TOTAL**	**END**	
Weightage	15	20	5	**40**	**60**	**100**

Text &References:

Le livre à suivre:

- Marie-Noelle Cocton. GÉNÉRATION A1 (Livre d'élèves) Didier, 2016.
- Marie-Noelle Cocton. GÉNÉRATION A1 (Cahier d'exercices) Didier, 2016.

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Course structure: Bioanalytical Techniques- Course Code: BSB 201

Course Title: **BIOANALYTICAL TECHNIQUES** Credit Units: 03
Course Level: UG Course Code: BSB 201

Course Objectives: The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.
Pre-requisites: The students must possess fair understanding of working of instruments.
Course Contents/Syllabus:

	Weightage (%)
Module I: Instruments, basic principles and usage	25 %
Descriptors/Topics pH meter, Light Microscopy, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism	
Module II: Chromatography techniques	25 %
Descriptors/Topics Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography	
Module III: Electrophoresis	25 %
Descriptors/Topics Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.	
Module IV: Radioisotope tracer techniques and autoradiography	25 %
Descriptors/Topics	

Student Learning Outcomes:
After successful completion of the course student will be able to:

- Understand the principle and instrumentation of Colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, etc.
- Understand principle instrumentation of chromatographic techniques and their types.
- Principle and applications of electrophoresis I.e., PAGE, Immunoelectrophoresis etc.
- Understand radioisotope tracer techniques and application.
- Develop broad knowledge base, deep theoretical understanding of instruments and practical implementation in the laboratory

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Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
- Bioinstrumentation, Webster

References:

- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Principles and Practice of Bioanalysis, Richard F. Venn
- Microscopic Techniques in Biotechnology, Michael Hoppert
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

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Course structure: Introductory Biochemistry and Biophysics- Course Code:BSB 202

Course Title: **Introductory Biochemistry and Biophysics**. Credit Units: 03
Course Level: UG Course Code: **BSB 202**

Course Objectives: Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.
Pre-requisites: The students must possess fair understanding of Basics in Biochemistry and Biophysics
Course Contents/Syllabus:

	Weightage (%)
Module I: Classification of biomolecules, Nature of Biological materials	20 %
Descriptors/Topics carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate	
Module II: Perspectives of biological macromolecules	20 %
Descriptors/Topics : Types of chemical bonds, Water structure and buffer, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.	
Module III: Bio-energetic	20 %
Descriptors/Topics Laws of thermodynamics (1^{st}& 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.	
Module IV: Energetic of a living body	20 %
Descriptors/Topics Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.	
Module V: Electrical properties of biological compartments	20 %
Descriptors/Topics Electricity as a potential signal**,** Neurotrasmitters,Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.	

Student Learning Outcomes:
After successful completion of the course student will be able to:

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• Get familiarize with structures and functions of biomolecules like Carbohydrates, Fats and Nucleic Acids.
• Understand the role of covalent and non-covalent bonds, inter-and intramolecular interactions and their contribution to the native conformation of biomolecules.

• Know the molecular transport within the cell and across membranes and get familiar with the different laws of Physics that are valid in biological systems.
• *Calculate energy changes in biological pathways, understand mechanism of light and sound reception.
• *Understand how electricity can act as potent signal as well the role of neurotransmitters.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Outline of Biochemistry, Conn &Stumph
- Fundamentals of Biochemistry, J.L. Jain
- Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
- Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:

- Textbook of Biochemistry, Lehninger
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Instant notes in Biochemistry, Hames & Hooper
- Anatomy and Physiology – Tortora & Grabowski
- Biochemistry -Voet&Voit

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Course structure: Plant Sciences – II Course Code: BSB 203

Course Title: **PLANT SCIENCES - II** Credit Units: **03**
Course Level: UG Course Code: BSB 203

Course Objectives:
The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.
Pre-requisites: The students must possess fair understanding of gymnosperm and angiosperms.
Course Contents/Syllabus:

	Weightage (%)
GYMNOSPERMS	
Module I	25 %
Descriptors/Topics General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*	
Module II	25 %
Descriptors/Topics Systematic position, occurrence, morphology and development of reproductive structures of the following taxa-*Cycas, Pinus, Ephedra,* Economic importance of *Cycas, Pinus* and *Ephedra.*	
ANGIOSPERMS	
Module III	25 %
Descriptors/Topics Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature, Morphological Characteristics of Angiosperms.	
Module IV	25 %
Descriptors/Topics Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.	

Student Learning Outcomes:

1. The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm.
2. The course content will help the students to trace the evolutionary history, diversi gymnosperms & develop an understanding of fossils, fossilization & geological tin and its significance in the evolution of angiosperms.

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3. The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms.
4. Know the economic importance of the angiosperm plants.

5. Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Pedagogy for Course Delivery:

- **Students are encouraged to engage in active interaction during lecture through discussion and questions.**
- **Power point presentation and class room lecture.**

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

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Course structure: Animal Sciences-II Course Code: BSB 204

Course Title: **ANIMAL SCIENCES-II** Credit Units: 03
Course Level: UG Course Code: **BSB 204**

Course Objectives:
This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.
Pre-requisites: The students must possess fair understanding of vertebrates.

Course Contents/Syllabus:

	Weightage (%)
Module I	25 %
Descriptors/Topics Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)	
Module II	25 %
Descriptors/Topics • Urochordata: Type Study of *Herdmania* (Including development) • Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus* • *Petromyzon*: External Features • Comparison between *Petromyzon* and *Myxine*	
Module III	25 %
Descriptors/Topics Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals) • Integumentary system • Skeletal System: Girdles only • Digestive system	
Module IV	25 %
Descriptors/Topics Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals) • Respiratory System • Circulatory System: Heart and Aortic Arches only • Nervous System; Brain only	

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• Urinogenital System	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge about Chordates.
- Learn about comparative account of vertebrates.
- Learn about anatomical & physiological variability among vertebrates.
- Generates interdisciplinary and collaborative approach.
- Develops ethical and conservative outlook for animals.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

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Course structure: CHEMISTRY-II   Course Code: BSB 205

Course Title: **CHEMISTRY - II**   Credit Units: **02**
Course Level: UG   Course Code: BSB 205

Course Objective:
After completion of the course, the students will acquire knowledge about basic stereochemistry, structure, bonding mechanism & molar mass. They will get knowledge about chemical equilibrium and its applications. Students will have knowledge of ionic equilibrium and its applications. Students will have knowledge of different chromatographic methods, their principle, and its applications.

Course Contents:

Module I: Stereochemistry of Organic compounds: (8 Hours)
Concept of isomerism. Geometrical isomerism: Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Optical isomerism: Elements of symmetry, molecular chirality, enantiomers & their properties, stereogenic centre, optical activity of enantiomers. Concept of chirality (up to two carbon atoms): chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro isomers, meso isomer, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Conformations and Conformational analysis: Conformations of ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations.

Module II: Chemical and Ionic Equilibrium: (8 Hours)
Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Le-Chatelier's principle and its applications.
Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Solubility and solubility product of sparingly soluble salts - applications of solubility product.

Module III: Chromatography: (6 Hours)
Introduction, Principle and Classification. Mechanism of separation: adsorption, partition & ion-exchange. Development of chromatograms: frontal, elution and displacement methods.
Paper Chromatography (ascending, descending and circular), Thin Layer Chromatography (
and Column Chromatography (CC). Gas Chromatography (GC) and High-Pressure Liquid
Chromatography (HPLC), types of column and column selection, applications, limitations

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Module IV: Functional Group Chemistry: (8 Hours)
General methods of preparation, properties, reactions and uses of;
1. Alkanes
2. Alkenes - Geometrical isomerism; Mechanism of electrophilic addition: addition of hydrogen, halogens, water, hydrogen halides (Markownikoff's and peroxide effect); Ozonolysis.
3. Alkynes - Acidic character; Addition of hydrogen, halogens, water and hydrogen halides; Polymerization.
4. Aromatic hydrocarbons: Mechanism of electrophilic substitution, directive influence of functional group in mono-substituted benzene.
5. (a) Alcohols: Identification of primary, secondary and tertiary alcohols. (b) Phenols: Acidic nature, electrophilic substitution reactions: halogenation, nitration and sulphonation, Reimer - Tiemann reaction. (c) Ethers: Structure.
6. Aldehyde and Ketones: Nucleophilic addition to >C=O group, relative reactivities of aldehydes and ketones; Important reactions such as Nucleophilic addition reactions, Grignard reagent; oxidation; reduction (Wolff Kishner and Clemmensen); Aldol condensation, Cannizzaro reaction, Haloform reaction; Chemical tests to distinguish between aldehydes and Ketones.
7. Carboxylic acids: Acidic strength and factors affecting it.

Learning Outcomes:
After successful completion of the course students will have the knowledge and skill to apply the principles of chemical sciences:
- To understand the basic stereochemistry, structure, bonding mechanism & stability, so that application of materials in different field can be understood.
- To understand chemical and ionic equilibrium and its applications.
- To learn and understand principles of chromatography and its applications.
- To understand the functional group chemistry and different synthetic methods related.

Assessment/ Examination Scheme:

Components	CT	Attendance	HA/S/V/Q	EE
Weightage (%)	15	5	10	70

Text & References:
Text:

- Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry - Volume I. (2000). A textbook of Organic Chemistry, Bahl & Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.
- Vogel's Quantitative Chemical Analysis

References:

- Advanced Organic Chemistry, Bahl & Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol. I & II, I. L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol. I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan
- Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd.

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- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India.

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Course structure: Biotechnology Lab-II   Course Code:BSB 220

Course Title: Biotechnology Lab – II   Credit Units: 01
Course Level: UG   Course Code: BSB 220

Course Contents/Syllabus:

	Weightage (%)
Module I: Biochemistry	50 %
Descriptors/Topics Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction and estimation of lipids, Estimation of protein by Bradford method.	
Module II	50 %
Descriptors/Topics Paper chromatography of sugars, Amino Acids, Plant pigments. Use of spectrophotometer.	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Chemistry Lab II   Course Code-BSB 221

Course Title: CHEMISTRY LAB – II Credit Units: 01
Course Level: UG Course Code: BSB 221

Total Hours: 30

Course Objectives:
The course has been designed to introduce the topics of chemical analysis of inorganic and organic salts and mixtures. The students will get better understanding of the theoretical principles included in their parallel theory syllabus. Elementary separation techniques have been included in the lab syllabus to introduce the concept of separation of components from mixtures.

Course Contents:

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following:
Pb^{2+}, Hg^{2+}, Hg_2^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^+, K^{1+}, CO_3^{2-}, S^{2-}, SO_3^{2-}, NO_2^{1-}, CH_3COO^{1-}, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO_3^{1-}, SO_4^{2-}, $C_2O_4^{2-}$, PO_4^{3-}, BO_3^{3-}.

Module II

Elemental analysis of organic compounds (non-instrumental)

Module III
Qualitative identification of functional group of organic compounds – CHO, C=O, -COOH, Ester, Phenol, Amine, amides, Alcohols.

Module IV: Chromatography:
1. Identification by determination of the Rf values of the given organic/ inorganic compounds by paper chromatography
2. Identification by determination of the Rf values of the given organic/ inorganic compounds by thin layer chromatography

Module V
Separation of two component mixture using Column chromatography

Note:
1.Students are required to perform at least ten experiments by selecting minimum one experiment from each module.
2.Instructor may choose to assign value added experiments relevant to theory syllabus.

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Course Outcomes:

The course will enable the students to understand the topics of chemical analysis of inorganic and organic salts and mixtures. The students will get clarity of understanding of the theoretical principles included in their parallel theory syllabus. Elementary separation techniques have been included in the lab syllabus to introduce the concept of separation of components from mixtures.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CT: Class Test, A: Attendance, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination

Text & References:

1. Laboratory Manual on Engineering Chemistry. S K Bhasin & Sudha Rani; Dhanpat Rai Publishing Company
2. Experiments in Applied Chemistry, Dr. Sunitta Rattan; CATSON Book Publishers.
3. Practical Chemistry, O P Pandey, D N Bajpai, S Giri; S Chand Publishers.
4. MMN Tandon; Dhanpat Rai & Sons

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Course structure: Plant Sciences Lab II Course Code:BSB 222

Course Title:**PLANT SCIENCES LAB - II** Credit Units: 01
Course Level: UG Course Code: BSB 222

Course Contents/Syllabus:

	Weightage (%)
Module I: Gymnosperm	50%
Descriptors/Topics Study of the Gymnosperms like *Cycas*, *Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations**.**	
Module II: Angiosperms	50%
Descriptors/Topics: Study of various types of leaves, inflorescence, flowers and fruits. Detailed description and identification of locally available plants of the families as prescribed in theory course.	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Animal Sciences Lab II Course Code:BSB 223

Course Title: ANIMAL SCIENCES LAB - II Credit Units: 01
Course Level: UG Course Code: BSB 223
Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Descriptors/Topics Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear Different types of important edible fishes of India .Study of specimens and slides related to Chordates should be added	
Module II	25%
Descriptors/Topics: Study of *Rana tigrina*, physiological systems through model	
Module III	25%
Descriptors/Topics Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model	
Module IV	25%
Descriptors/Topics Mice: Arterial system and reproductive system.	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:
Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Communication Skills II   Course Code-BCU 241

Course Title: **Communication Skills II** Credit Units: 02
Course Level: UG Course Code: BSB 241

UG: Semester II
Course Title: Communication Skills II
Course Code: BCU 241

Credit Units: 2

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
2	0	0	0	2

Course Objectives:
To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)
Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	

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4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment	
6.	**Pedagogy for Course Delivery:** • Extempore • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	60%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	20%	15%	5%	60%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.***
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin

Reference: ***K.K.Sinha , Business Communication, Galgotia Publishing Company.***
Alan Pease : Body Language

Additional Reading: Newspapers and Journals

Text:

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Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference:

K.K.Sinha , Business Communication, Galgotia Publishing Company.
Alan Pease : Body Language
Additional Reading: Newspapers and Journals

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Course structure: Environmental Studies II Course Code-EVS 242

Course Title: **Environmental Studies II** Credit Units: 02
Course Level: UG Course Code: BSB 241

Total Hours: 30
Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans. Wasteland reclamation, Consumerism and waste products, Environmental Protection Ac (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollutio

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Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.
Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

• Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

• Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)

• Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

• Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p

• De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)

• Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environme Security. Stockholm Env. Institute Oxford Univ. Press. 473p

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- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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Course structure: Français-II **Course Code- FLU244**

Course Title: **Français-II** Credit Units: 02
Course Level: UG Course Code: **FLU244**

French syllabus – Programme d'études pour le français
All U.G. Programmes –Foreign Language

Français-II

Course Code: FLU244 **Credit Units: 02**

Course Objective:

To furnish the linguistic tools

- to express about frequent action, routine and leisure activities
- to talk about food, shopping, enquire about prix, services, mode of payment.
- to ask and give information about outing, excursion.
- to describe about family, dress and accessories.

Course Contents:

Unité 4, 5, 6–pg: 62-109

Unité 4: Les loisirs- la routine

Actes de Parole :- Parler de ses goûts et ses préférences – Décrire sa journée - les loisirs - les matières – les temps et l'heure – la fréquence.

Unité 5: Où faire ses courses ? – Découvrez et dégustez !

Actes de Parole :- Au restaurant : Commander et commenter – Inviter et répondre à une invitation - Les aliments – Les quantités – Les commerces et les commerçants – Demander et dire le prix – Les services – Les moyens de paiement - Le pays des gourmands.

Unité 6: Tout le monde s'amuse – Les ados au quotidien

Actes de Parole : - Décrire une tenue – Ecrire un message amical – Les sorties – Situer dans le temps – la famille (2) - Les vêtements et les accessoires.

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1. Les adjectifs interrogatifs - les nombres ordinaux – l'heure – les pronoms personnels *COD* – les verbes pronominaux – les verbes du premier groupe en *–e_er*, *-é_ et*, *-eler*, *- eter* – le verbe *prendre.*

2. Les articles partitifs – le pronom « *en* » (la quantité) – très ou beaucoup ? – La phrase négative (2) – C'est/ Il est (2) – L'impératif – Il faut- les verbes : *devoir, pouvoir, savoir,vouloir.*

3. Les adjectifs démonstratifs – La formation du féminin (4) - Le pronom indéfini « *on* » - Le futur proche – Le passé composé – Les verbes du premier groupe en « - *yer* » – Les verbes *voir* et *sortir*.

Examination Scheme:

	INTERNAL				EXTERNAL	GRAND
Components	MID-SEM	VIVA-	ATTENDAN	**TOTAL**	**END**	
Weightage	15	20	5	**40**	**60**	**100**

Text & References:

Le livre à suivre:

- Marie-Noelle Cocton. GÉNÉRATION A1 (Livre d'élèves) Didier, 2016.
- Marie-Noelle Cocton. GÉNÉRATION A1 (Cahier d'exercices) Didier, 2016.

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Course structure: BIOINSTRUMENTATION (NTCC) **Course Code: BSB 260**

Course title: Bioinstrumentation (NTCC) **Course Code BSB 260**

Course Level: UG **Credit Units: 04**

- Accuracy and precision of pipettes
- Calibration of pH meter
- Buffer preparation
- Dilution techniques
- Preparation of hypertonic, isotonic and hypotonic solutions
- Centrifugation: Density gradient
- Spectroscopy: Absorption spectra of proteins and Nucleic acids
- Verification of Beer Lambert law
- Determination of concentration of nucleic acids
- Agarose gel electrophoresis
- SDS PAGE
- Paper Chromatograph
- Thin layer chromatography

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Course structure: GENETICS   Course Code: BSB 301

Course Title: GENETICS   Credit Units: 03
Course Level: UG Level   Course Code: BSB 301

Course Objectives:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Course Contents/Syllabus:

	Weightage (%)
Module I :	20 %
Descriptors/Topics Brief history, scope and significance of Genetics. Mendelian law of inheritance.Lethality and interaction of gene.Multiple allele and isoallele.Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.	
Module II	15 %
Descriptors/Topics Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.	
Module III	15 %
Descriptors/Topics Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.	
Module IV:	15 %
Descriptors/Topics: Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome**.**	
Module V:	15 %
Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.	
Module VI:	10%
Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.	
Module VII:	10%

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Descriptors/Topics: Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand the concept of classical genetics including Mendelian laws is easily grasped by students.
- Understand the basic microbial genetics including prokaryotic gene expression and regulation.
- Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept.
- Know various chemical and physical mutagens involved in causing mutation.
- Understand the concept of sex determination and populations genetics.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text & References:

Text:

- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

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Course structure: Microbiology Course Code: BSB 302

Course Title: Microbiology Credit Units: **03**

Course Level: UG Level Course Code: BSB 302

Course Objectives:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module I :	20 %
Descriptors/Topics: Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology - Principles of microbial nutrition, Culture media, Theory and practice of sterilization.	
Module II	20 %
Descriptors/Topics: Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.	
Module III	20 %
Descriptors/Topics Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.	
Module IV:	20 %
Descriptors/Topics: Metabolic Diversity among microorganisms-photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).	
Module V: **Archaea**	20 %
Descriptors/Topics: Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.	

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Student Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the microbiological techniques for the isolation and characterization of microbes.
- Understand the mechanism of different metabolic processes.
- Know the physiology and survival mechanism of extremophilic bacteria.
- Know the concept of virus lytic and lysogenic cycle is quite clear to students.
- Understand the epidemiology and microbial pathogenesis.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

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Course structure: Anatomy & Plant Physiology **Course Code: BSB 303**

Course Title: **ANATOMY & PLANT PHYSIOLOGY** Credit Units: 03
Course Level: UG Level Course Code: **BSB 303**

Course Objectives:

The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Course Contents/Syllabus:

	Weightage (%)
Module I :	25 %
Descriptors/Topics Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviourof cambium in Achyranthes, Boerhaavia, Bignonia and Dracaena. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.	
Module II :	25 %
Descriptors/Topics Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.	
Module III :	25 %
Descriptors/Topics Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.	
Module IV :	25 %
Descriptors/Topics Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C3 and C4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.	

Student Learning Outcomes:

1. The students will be conceptually integrated to plant internal structure & their functions
2. Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants.
3. The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation.
4. The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixati the influence of environmental factors on photosynthesis will be understood by the studen

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5. The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:

- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

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Course structure: Animal Physiology I **Course Code-BSB 304**

Course Title: **ANIMAL PHYSIOLOGY - I** Credit Units: 03

Course Level: UG Level Course Code: **BSB 304**

Course Objectives:

Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module I : Physiology of Respiratory System	20 %
Descriptors/Topics Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.	
Module II : Physiology of Digestive System	20 %
Descriptors/Topics Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food	
Module III : Physiology of Cardiovascular System	20 %
Descriptors/Topics Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation	
Module IV: Physiology of Neuromuscular System	20 %
Descriptors/Topics Contraction and relaxation of muscle, Sarcomere, Cori"s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters	
Module V	20 %
Descriptors/Topics: Physiology of Reproductive System (Male, Female), Gametogenesis, Sperms and Eggs, Gene Bank, Sperm Bank, Superovulation, IVF, ET, ZIFT, ICSI, Placenta Banking	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Gain knowledge about functioning of systems of body.
- Generate path for further research and innovation.

Dwivedi

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- Enhance new collaborative approaches with modern fields of biotechnology

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

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Course structure: CHEMISTRY - III - Course Code-BSB 305 (BSB 306 BOS Approved in chemistry)

Course Title: CHEMISTRY - III **Credit Units: 02**

Course Level: UG Level (30hr) Course Code: **BSB 305**

Course Objectives:

The objective of this course is to educate the students about photochemistry and different photochemical reactions. The students will also learn different inorganic elements present in biomolecules which are responsible for specific bioactivity. In addition to this, the student will also learn the concepts related to electrochemistry and colloidal chemistry. The last objective of this course is associated with reaction mechanism in organic chemistry including structure and electron delocalization effects.

Course Contents/Syllabus:

Module I: Photochemistry (8 Hours)

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthuss–Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).

Module II: Bioinorganic Chemistry (6 Hours)

Bioinorganic Chemistry: Essential and trace elements to Biological processes, metalloporphyrins. Biological role of alkali and alkaline earth metal ions. Nitrogen fixation.

Module III: Electrochemistry and Colloidal State (8 Hours)

Electrochemistry: Specific and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory and its limitations, weak and strong electrolytes. Ostwald's dilution law its uses and limitations, Debye-Huckel-Onsager's equation (elementary treatment). Electrode reactions, Nernst equation, derivation and computation of cell E.M.F. and its measurement, single electrode potential, SHE, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance.

Colloidal State: Definition, classification of colloids. Solids in liquids (sols): properties-kinetic, optical and electrical; stability of colloids, protective action. Hardy-Schulze law, gold number. Liquids in solids (gels): classification, preparation and properties, inhibition, general application of colloids. Liquids in liquids (emulsions): types of emulsions, preparation, emulsifier.

Module IV: Reaction Mechanism (8 Hours)

Classification and determination of reaction mechanisms. Kinetic isotope effects, Aliphanic Nucleophilic substitution reactions: SN1, SN2, SNi mechanisms. Elimination Reactions: beta-eliminations. E1, E2 and E1cB mechanisms. Addition Reactions: Electrophilic and nucleo[illegible] additions to olefins, dienes and acetylenes. Examples such as epoxidation will be discuss[illegible] detail. Markonikoff and anti-Markonikoff additions. Substitution reactions in a[illegible]

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compounds: Electrophilic substitutions such as nitration, sulphonation, halogenation etc., Nucleophilic substitution reactions of activated aromatic nuclei. Molecular rearragements: Rearrangements involving electron deficient carbon, nitrogen and oxygen. Classical and non-classical carbocatons. Importance of cross over experiments in determining migratory preferences and rearrangement reactions.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to understand the very basic concepts of photochemistry and bio-inorganic chemistry. Understand the concepts related to electrochemistry and colloidal state. The last part of this course deals with organic reaction mechanism and help students to learn different types of mechanism responsible for different chemical transformations.

Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

CT: Class Test, A: Attendance, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination

Text & References:

- Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry - Volume I. (2000). India: S. Chand Limited. ISBN 9788121902632
- Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry - Volume II. (2000). India: S. Chand Limited. ISBN 9788121917872
- Puri, Sharma & Pathania, Principles of Physical Chemistry. (2008). India: VISHAL PUBLISHING Company. ISBN 9788188646654
- Morrison & Boyd. Organic Chemistry (2016) Pearson New Delhi. ISBN 8177581694
- Bahl, A., Bahl, B. S. (1997). A textbook of organic chemistry: (for B.Sc. students). India: Chand. ISBN 9788121902595

References:

- J.D. Lee. Concise Inorganic Chemistry, , Black Well Sciences. ISBN 9788126515547.
- Keeler, J., De Paula, J., Atkins, P. W. (2018). Atkins' Physical Chemistry. United Kingdom: Oxford University Press. ISBN 9780198814740.
- Snyder, S. A., Solomons, T. W. G., Fryhle, C. B. (n.d.). Organic Chemistry 12e. United Kingdom: John Wiley & Sons, Limited. ISBN 9781119572985.
- Vogel's Quantitative Chemical Analysis. (2009). India: Pearson Education. ISBN 9788131723258
- Snyder, S. A., Solomons, T. W. G., Fryhle, C. B. (n.d.). Organic Chemistry 12e. Unit Kingdom: John Wiley & Sons, Limited. ISBN 9781119572985.

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Course structure: BIOTECHNOLOGY LAB-III Course Code:BSB 320

Course Title: **BIOTECHNOLOGY LAB – III** Credit Units: 01
Course Level: UG Course Code: BSB 320
Course Contents/Syllabus:

	Weightage (%)
Module I Module I: Genetics	20%
Descriptors/Topics Study of mendalian ratios, Study of bacterial conjugation	
Module II	20%
Descriptors/Topics Study of gene interaction, Study of chromosome structure & size Study of Genetics disorder in human	
Module III	20%
Descriptors/Topics Aseptic techniques: Cleaning of glassware, cotton plugging and sterilization. Preparation of growth media for fungi and bacteria., Staining methods- simple staining, Gram endospore staining, fungal staining, negative staining. Identification of bacteria based on staining, shape and size, Bacterial growth curve and generation time of *E.coli* Identification of pathogenic bacteria from sewage and waste water. isolation and identification of aquatic fungi from local water bodies.	
Module IV	20%
Descriptors/Topics Isolation of microorganisms from air, water and soil samples: dilution, pour plating, spread plate and colony purification. Enumeration of microorganisms: total vs. viable counts.	
Module V Biochemistry	20%
Descriptors/Topics Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity –amylase.	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable
Lab/ Practical details, if applicable:
Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	[illegible]

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Course structure: Chemistry Lab-III Course Code:BSB 321

Course Title: **CHEMISTRY LAB – III** Credit Units: 01
Course Level: UG Course Code: BSB 321

Total Hours: 30

Course Objectives:

The course has been designed to introduce the topics of organic synthesis and electrochemistry-based experiments. The students will get better understanding of the theoretical principles included in their parallel theory syllabus. Several organic synthesis techniques have been included in the lab syllabus to introduce the concept of preparation of organic molecules. In addition, conductometry based experiments are added for better understanding the conductance related applications.

Course Contents:

ORGANIC CHEMISTRY
Module I
I. Synthesis of Organic Compounds
(a) Acetylation of salicylic acid, aniline, glucose, and hydroquinone.
(b) Benzoylation of aniline and phenol.
(c) Aliphatic electrophilic substitution.
(d) Preparation of iodoform from ethanol and acetone.
(e) Aromatic electrophilic substitution:
1. Nitration
a. Preparation of m-dinitrobenzene
b. Preparation of p-nitro acetanilide
2. Halogenation
a. Preparation of p-Bromo acetanilide
b. Preparation of 2,4,6-tribromophenol.
(f) Diazotization/coupling

a. Preparation of methyl orange
b. Preparation of methyl red
(g) Oxidation
• Preparation of benzoic acid from toluene
(h) Reduction
a. Preparation of aniline from nitrobenzene
b. Preparation of aniline from nitrobenzene

PHYSICAL CHEMISTRY
Module II

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(a) To determine the strength of the given substance conductometrically using standard alkali solution.
(b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
(c) To study the saponification of ethyl acetate conductometrically.
(d) To determine the ionisation constant of a weak acid conductometrically.
(e) To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO4$/ $K2Cr2O7$ as titrant and calculate the redox potential of $Fe+++$ system on the hydrogen scale.

Course Outcomes:

The course will enable the students to understand the topics of organic synthesis and conductance applications. The students will get clarity of understanding of the theoretical principles included in their parallel theory syllabus. Elementary organic synthesis techniques and conductance-based experiments have been included in the lab syllabus to introduce the concept of organic synthesis from different substrates.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CT: Class Test, A: Attendance, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination

Text & References:

1. Laboratory Manual on Engineering Chemistry. S K Bhasin & Sudha Rani; Dhanpat Rai Publishing Company
2. Experiments in Applied Chemistry, Dr. Sunitta Rattan; CATSON Book Publishers.
3. Practical Chemistry, O P Pandey, D N Bajpai, S Giri; S Chand Publishers.
4. MMN Tandon; Dhanpat Rai & Sons

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Course structure: Anatomy & Plant Physiology Lab - Course Code:BSB 322

Course Title: **ANATOMY & PLANT PHYSIOLOGY LAB** Credit Units: 01

Course Level: UG Course Code: BSB 321

Course Contents/Syllabus:

	Weightage (%)
Module I Physiology	60%
Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay. Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer. Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.) Experimentation- Separations of photosynthetic pigments by thin layer chromatography. Respiration – Determination of R.Q.	
Module II **: Plant Anatomy**	40%
Anatomy of normal dicot and monocot roots, stems & leaves Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena	

Pedagogy for Course Delivery:

Laboratory instructions
Methodology discussion
Hands on experiments
Data collection

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Animal Physiology LAB-I - Course Code:BSB 323

Course Title: **Animal Physiology LAB – I** Credit Units: 01
Course Level: UG Course Code: BSB 323
Course Contents/Syllabus:

	Weightage (%)
Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.	100%
Determination of RBC count in blood sample	
Determination of Hb % using Sahl's Hemoglobinometer.	
Blood Group Testing (ABO & Rh)	
Determination of TLC & DLC in blood sample.	
Demonstrate amylase activity from saliva and squash preparation of salivary gland chromosome.	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:
Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Communication Skills-III Course Code: BCU 341

Course Title: **Communication Skills-III** Credit Units: 02
Course Level: UG Course Code: **BCU 341**

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

UG: Semester III
Course Title: Communication Skills-III
Credit Units: 2
Course Code: BCU 341
Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary**	**35% Weightage**
	• Spellings • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	
2.	**Module II Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III Business Memos** • Format & Characteristics	**20% Weightage**

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4.	**Module IV Short Stories**	**10% Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	60%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	20%	15%	5%	60%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press*.

Additional Reading: Newspapers and Journals

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Course structure: Behavioural Science -III Course Code: BSU 343

Course Title: **Behavioural Science -III** Credit Units: 02

Course Level: UG Course Code: **BSU 343**

Course structure: Understanding Self for Positive Personal Growth- Course Code: BSU-343

Course Title: Understanding Self for Positive Personal Growth Credit Units: 2

Course Level: UG Level Course Code: BSU-343

Course Objectives:

This course aims at imparting an understanding of:

- Understanding self & process of self-exploration
- Importance of individual differences & personality traits.
- Learning strategies of problem solving
- To inculcate elementary level of understanding of group/team functions
- To develop team spirit and work abilities

Course Contents:

Module I: Self: Core Competency (6 Hours)

- Components of understanding Self
- Self-esteem, Self-identity, Self-concept, Self-confidence, and Self-image,
- Technique of self-awareness; Johari Window
- Stages – self-awareness, self-acceptance and self-realization
- Building positive Attitude

Module II: Individual differences & Personality (6 Hours)

Personality: Definition& Relevance Sensation (BIG5& MBTI)

- Importance of nature & nurture in Personality Development
- Nature of Socialization
- Patriotism and National Pride
- Importance of discipline, hard work, Integrity, and accountability

Module III: Managing Diversity (6 Hours)

- Defining Diversity
- Affirmation Action and Managing Diversity
- Increasing Diversity in Work Force
- Barriers and Challenges in Managing Diversity

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Module IV: Problem Solving **(6 Hours)**

- Nature & types of problem
- Thinking as a tool for Problem Solving
  - Critical Thinking and Creative Thinking: ICEDIP model
- Barriers/ Hindrances to problem solving:
  - Perception, Expression, Emotion, Intellect &Work environment
- Plan of Action

Module V: Group Dynamics and Team Building **(6 Hours)**

- Definition and Characteristics
- Stages of group formation
- Building Effective Teams
- Meaning, Nature, and Functions of leadership
- Leadership styles in organization
- Power to empower

Student learning outcomes

- Student will nurture an understanding of self
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving
  - conflict, and motivating others.

Examination Scheme:

Evaluation Components	**Attendance**	**Journal of Success (JOS)**	**Social Awareness Program (SAP) SAP Report/SAP Presentation**	**End Semester Exam**	**Total**
Weightage (%)	**5**	**15**	**20**	**60**	**100**

Suggested Readings:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985. J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 19
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999.
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996.

Dwivedi

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- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books.

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Course structure: Français -III **Course Code: FLU344**

Course Title: **Français -III** Credit Units: 02

Course Level: UG Course Code: **FLU344**

French syllabus-Programme d'études pour le français

All U.G. Programmes–Foreign Language

Français -III

Course Code: FLU344
Credit Units: 02

Course Objective:

To strengthen the language of the students in both oral and written
To revise the grammar in application and the communication tasks related to topics covered already
To get acquainted with the current social communication skills, oral (dialogue, telephone conversations, etc.) and written and perform simple communication tasks such as

- talking about city life style, various modes of transportations.
- talking about how to indicate the direction and to enquire information's about tourists places.
- describe about an object using colors, shapes, materials and measurements.
- talking about obligation, permission and restriction.

Course Contents:

Unité 1, 2, 3 – pg 14-54,
Unité 1:Vivre la ville et visiter une ville

Actes de Parole:- Indiquer le chemin - Demander des renseignements touristiques - transports - Les lieux de la ville.

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Maharajpura, Gwalior 474005

Unité 2: On vend ou on garde – Ventes d'autrefois, ventes d'aujourd'hui

Actes de Parole:- Permettre - défendre - obliger - Décrire un objet : les couleurs - les formes – les matériaux – les mesures - l'informatique.

Unité 3: Félicitations ! En voyage !

Actes de Parole:- Présenter ses vœux - les fêtes – Faire une réservation- les voyages - l'aéroport et l'avion– la gare et le train - l'hôtel.

Grammaire :

1. La comparaison - Les prépositions avec les noms géographiques – Les pronoms personnels *COI* –
Le pronom *y* (le lieu) – la position des pronoms compléments – Les verbes du premier groupe en – *ger*
et *–cer*, -Les verbes: *ouvrir* et *accueillir.*
2. La formation du pluriels (2) – les adjectifs de couleur – Les adjectifs : *beau, nouveau, vieux* – les pronoms relatifs *qui* et *que* – l'imparfait - Les verbes: *connaître, écrire, mettre* et *vendre*.
3. Les articles: particularités – les pronoms interrogatifs variables: *lequel* – les pronoms démonstratifs – la question avec inversion – les adverbes de manière – Les verbes: *recevoir* et *conduire*.

Examination Scheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-	VIVA-	ATTENDAN	**TOTAL**	**END**	
Weightage	15	20	5	**40**	**60**	**100**

Text &References:

Le livre à suivre:

- Marie-Noelle Cocton. GÉNÉRATION A2 (Livre d'élèves) Didier, 2016.
- Marie-Noelle Cocton. GÉNÉRATION A2 (Cahier d'exercices) Didier, 2016.

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Course structure: Molecular Cell Biology Course Code:BSB 401

Course Title: **MOLECULAR CELL BIOLOGY** Credit Units: 03

Course Level: UG Level Course Code: BSB 401

Course Objectives: The aim is to extend understanding of the molecular mechanisms via which genetic information's are stored, expressed and transmitted among generations.

Course Contents/Syllabus:

	Weightage (%)
Module I: Introduction to Moleculer Biology	20 %
Descriptors/Topics: Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications. Molecular basis of life:DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.	
Module II:Insertion elements, transposons and retrotransposons	20 %
Descriptors/Topics: Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications. Application of genetic engineering Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.	
Module III: Structure of prokaryotic and eukaryotic genes	15 %
Descriptors/Topics: Transcription mechanism in prokaryotes and eukaryotes. Translation :Translation mechanisms in prokaryotes and eukaryotes.	
Module IV: Gene Expression in prokaryotes	15 %
Descriptors/Topics: Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)	
Module V:Eukaryotic geneExpression	15 %
Descriptors/Topics: Overview of gene expression, polyadenylation, cap formation, RNA degradation.	
Module VI: Oncogenes and Tumor Suppressor genes	15 %
Descriptors/Topics: Oncogenes, tumorsuppressor genes in humans, role of genes in cancer development.	

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Student Learning Outcomes:

After successful completion of the course student will be able to:

- Develop deep understanding of DNA/ RNA structure, and mechanism of DNA replication.
- Understand Genetic Codes and Transposable elements
- Understand mechanism of transcription and translation in prokaryotes and eukaryotes.
- Enhance fine molecular understanding of operon gene regulation ion in prokaryotes.
- Understand the mechanism of Oncogenes and Tumor suppressor genes

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson,
- Garland Publishing.

References:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell,
  W. H Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis,
  Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley
  Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

Dwivedi

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Course structure: Bioinformatics Course Code: BSB 402

Course Title: **BIOINFORMATICS** Credit Units: 03
Course Level: UG Level Course Code: **BSB 402**

Course Objectives: The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Course Contents/Syllabus:

	Weightage (%)
Module I: Computers	20 %
Descriptors/Topics General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.	
Module II: Basic Bioinformatics	20 %
Descriptors/Topics Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)	
Module III: Biological Databases	20 %
Descriptors/Topics Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)	
Module IV: Phylogenetic Analysis	20 %
Descriptors/Topics Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.	
Module V: Genome analysis	20 %
Descriptors/Topics Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.	

Dwivedi

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Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the structural organization and characteristics of computers and its parts.
- Describe the concept of use of internet in bioinformatics.
- Explain the concept and organization of biological databases.
- Understand and explain the structure and functions of the phylogenetic analytic tools.
- Interrogate major database sources and be able to integrate this information with clinical data.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Introduction to Bioinformation – T.Attawood

References:

- A book on C by Kelley : Programming in C, Addison-Wesley Publishing
- Introduction to C++ for Engineers and Scientists, Prentice-Hall
- Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
- Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
- Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
- Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
- Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

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Course structure: Plant Breeding, Embryology, Pathology & Economic Botany

Course Code:BSB 403

Course Title: Plant breeding, embryology, pathology & economic botany Credit Units: 03

Course Level: UG Level Course Code: **BSB 403**

Course Objectives:

To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology

Course Contents/Syllabus:

	Weightage (%)
Module I :	25 %
Descriptors/Topics Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to Polygonum type. Fertilisation, Endosperm and embryo onagrad type.	
Module II :	25 %
Descriptors/Topics Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding	
Module III :	25 %
Descriptors/Topics General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi	
Module IV :	25 %
Descriptors/Topics Economic importance with special reference to plants yielding: a) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson), b) Common fibre yielding plants - Cotton, Jute . c) Medicinal Plants – (Papaver somniferum, and Atropabeladona.) d) Common timber yielding plants –Dalbergiasisso, Tectonagrandis	

Student Learning Outcomes:

1. The students will develop modern approach to experimental plant embryology developmental, structural and molecular point of view.

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2. The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation.
3. The students will be able to analyse the historical evolution of plant breeding. Will be able to understand the basic Mendelian genetics, plant reproduction systems and breeding products.
4. The students will develop an understanding of the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them.
5. The students will develop an understanding of the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:

- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

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Course structure: Animal Physiology-II - Course Code: BSB 404

Course Title: ANIMAL PHYSIOLOGY- II Credit Units: 03

Course Level: UG Level Course Code: **BSB 404**

Course Objectives:

Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module 1: Endocrine Physiology: Endocrine glands in mammals	25 %
Descriptors/Topics • General anatomy and physiology Pituitary, • General anatomy and physiology of Thyroid, • General anatomy and physiology Parathyroid, • General anatomy and physiology Pancreatic islets • General anatomy and physiology Adrenal	
Module II: Excretory System	25 %
Descriptors/Topics . • General morphology and characteristics of Mammalian Kidney (Rabbit). • Structure & Function of Tubular reabsorption and Secretion. • Structure & Function of Nephron, Glomerular filtration.	
Module III:Reproductive System	25 %
Descriptors/Topics • Structure & Function of Testes & Ovary of Rabbit. • Spermatogenesis and its hormonal regulation • Oogenesis and its hormonal Regulation • Ovulation and fertilization	
Module IV:Developmental Biology	25 %
Descriptors/Topics . • Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane, Cleavage: types. • Fertilization, Frog Embryology, Tadpole Metamorphosis, Parthenogenesis • Formation of blastula in chick • Fate Map, Morphogenetic Movement & Gastrulation in Chick. • Extra embryonic membranes in chick, Embryology, Fate Map.	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Understands functioning of important systems of body.
- Develops knowledge about endocrinology and developmental biology.

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- Leads to enhance interest in research in advanced biotechnology.
- Exposure with other interdisciplinary subjects of biology.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

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Course structure: CHEMISTRY - IV - Course Code-BSB 405 (BSB 406 as per chemistry BOS)

Course Title: CHEMISTRY - IV Credit Units: 03

Course Level: UG Level (45Hrs) Course Code: **BSB 405**

Course Objectives:

The objective of this course is to educate the students about biomolecules, their structures and chemical properties. The carbohydrate, protein, fats, oils and detergents are thoroughly discussed. Different reagents responsible for specific transformations are also discussed in this course. In addition to this, the student will learn the concepts related to spectroscopic techniques such as UV-Visible, IR and NMR techniques. Using these techniques, students can able to solve the structure of different simple or complicated chemicals in a short duration of time.

Course Contents/Syllabus:

Module I: Biomolecules: **(12 Hours)**

Carbohydrates: Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharide. Erythro and threo diastereomers. Conversion of glucose into mannose. Cyclic structure of D (+)- glucose. Mechanism of mutarotation. Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Amino Acids, Peptides, Proteins and Nucleic Acids: Classification, structure and stereochemistry of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation. Nucleic acids: Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Module II: Fats, Oils, Detergents and Synthetic Dyes: **(8 Hours**

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Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, soaps, synthetic detergents, alkyl and aryl sulphonates.

Dyes: Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.

Module III: Reagents (10 Hours)

Reagents: Introduction, Fenton's Reagent, Gilman'sreagent, Wilkinson's catalyst, Lindlar catalyst, Adams' catalyst**,** Lithium aluminium hydride, Sodium borohydride, Anhydrous aluminium chloride, Dicyclohexylcarbodiimide, N-Bromosuccinimide, Lead tetra acetate, Osmium tetroxide, Perbenzoic acid, Periodic Acid, Raney nickel, selenium dioxide.

Module IV: Spectroscopic Techniques (15 Hours)

Principle and applications of UV-Visible, IR and NMR spectroscopy.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to understand the very basic concepts of different biomolecules. Understand the very basic concepts of different reagents used in organic chemistry. Further, the structure and bonding of compounds can be determined using different spectroscopic techniques by students.

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

CT: Class Test, A: Attendance, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination

Text & References:

Text:

- Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry - Volume I. (2000). India: S. Chand Limited. ISBN 9788121902632
- Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry - Volume II. (2000). India: S. Chand Limited. ISBN 9788121917872
- Puri, Sharma & Pathania, Principles of Physical Chemistry. (2008). India: VISHAL PUBLISHING Company. ISBN 9788188646654
- Morrison & Boyd. Organic Chemistry (2016) Pearson New Delhi. ISBN 817758169

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- Bahl, A., Bahl, B. S. (1997). A textbook of organic chemistry: (for B.Sc. students). India: Chand. ISBN 9788121902595

References:

- J.D. Lee. Concise Inorganic Chemistry, , Black Well Sciences. ISBN 9788126515547.
- Keeler, J., De Paula, J., Atkins, P. W. (2018). Atkins' Physical Chemistry. United Kingdom: Oxford University Press. ISBN 9780198814740.
- Snyder, S. A., Solomons, T. W. G., Fryhle, C. B. (n.d.). Organic Chemistry 12e. United Kingdom: John Wiley & Sons, Limited. ISBN 9781119572985.
- Vogel's Quantitative Chemical Analysis. (2009). India: Pearson Education. ISBN 9788131723258
- Snyder, S. A., Solomons, T. W. G., Fryhle, C. B. (n.d.). Organic Chemistry 12e. United Kingdom: John Wiley & Sons, Limited. ISBN 9781119572985.

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Course structure: Biotechnology Lab IV - Course Code-BSB 420

Course Title: BIOTECHNOLOGY LAB-IV Credit Units: 01

Course Level: UG Course Code: **BSB 420**

Course Contents/Syllabus:

	Weightage (%)
Module I: Computers	25%
Handling of computers and Protein and nucleotide sequence retrieval and analysis using different databases	
Module II: Bioinformatics	25%
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.	
Module III	25%
Isolation of nuclear DNA (genomic & plasmid DNA) and Agarose gel electrophoresis	
Module IV	25%
Descriptors/Topics Blood film preparation &identification of blood cells Enumeration of total WBC, RBC count in blood by hemocytometer, Enumeration of differential Leukocytes in blood sample Study of blood groups Study of ELISA.	

Pedagogy for Course Delivery:

Laboratory instructions

Methodology discussion

Hands on experiments

Data collection

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Plant Breeding, Embryology, Pathology & Economic Botany Lab **Course Code-BSB 421**

Course Title: PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY LAB Credit Units: 01
Course Level: UG Course Code: BSB 421
Course Contents/Syllabus:

	Weightage (%)
Module I: Embryology	40%
Study of permanent slides of the: a) T.S. anther, pollen, germinating pollen b) L.S. ovule types c) Endosperm d) Embryos e) L.S. caryopsis f) Dissection of embryo	
Module II: Plant Pathology	30%
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.	
Module III: Economic Botany	30%
Descriptors/Topics Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:
Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: ANIMAL PHYSIOLOGY LAB - II - Course Code-BSB 422

Course Title: ANIMAL PHYSIOLOGY LAB - II   Credit Units: 01
Course Level: UG   Course Code: BSB 422
Course Contents/Syllabus:

	Weightage (%)
Module I	25%
• Study of permanent slides: Endocrinae system - T.S of Pituitary gland - T.S of Thyroid gland - T.S of Parathyroid gland - T.S of Pancreatic islets - T.S of Adrenal gland	
Module II	25%
• Study of permanent slides: **Excretory System** - T.S of Kidney - T.S of Nephron - Estimation of Blood Urea, Bilirubin and Creatinine.	
Module III	25%
• Descriptors/Topics • Study of permanent slides: **Reproductive System** - T.S of Ovary - T.S of Testes	
Module IV	25%
Descriptors/Topics • Chick Embryology: - Permanent slide of different steps of development of Chick embryo. -Preparation of temporary slide of Chick embryo	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable
Lab/ Practical details, if applicable:
Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	1[illegible]

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TERM PAPER (Review Article)

Course Code: BSB 450 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.

b) Begin by making a list of subject-headings under which you might expect the subject to be listed.

c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.

b) In research studies, notice the methods and procedures, results & conclusions.

c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.

b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose

b) main body of the paper

c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ide

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6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.

b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.

c) Check for proper spelling, phrasing and sentence construction.

d) Check for proper form on footnotes, quotes, and punctuation.

e) Check to see that quotations serve one of the following purposes:

(i) Show evidence of what an author has said.

(ii) Avoid misrepresentation through restatement.

(iii) Save unnecessary writing when ideas have been well expressed by the original author.

f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to

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[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[2] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

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Course structure: **Behavioural Science – IV** **Course Code: BSU443**

Course Code: BSU-443 **Course Credit: 02 ne**

Course structure: Values & Ethics for Personal and Professional Excellence– Course Code: BSU-443

Course Title: Value & Ethics for Personal & Professional Excellence **Credit Units: 2**

Course Level: UG Leve **Course Code: BSU-443**

Course Objectives:

- This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice in personal & professional development.
- To understand & frame strategies of stress management & career development.

Course Contents:

Module I: Nature of Stress **(6 Hours)**

- Nature, Characteristics &Types of stress
- Stages and Models of Stress
  - The physiology of stress
  - Stimulus-oriented approach.
  - Response-oriented approach.
  - The transactional and interactional model.
  - Pressure – environment fit model of stress.

Module II: Causes, symptoms & Consequences of stress **(6 Hours)**

- Personal, Organizational & Environmental causes & symptoms
- Effect on behavior, personality & performance
- Individual and Organizational consequences with special focus on health
- Analyzing choke points in your personal processes by analysis in area of placements, events, seminars, conference, extracurricular activities, projects etc.

Module III: Career Planning **(6 Hours)**

- Importance of Career Planning & Development
- Developing positive attributes at workplace (personal and professional)
- Assessment of Career Development
- Impression Formation for Career Enhancement

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Module IV: Application & Management **(6 Hours)**

- *Strategies for stress management*
  - Healthy and Unhealthy strategies
  - Peer group and social support
- Time Management for Career Planning and Development
- Application of positive emotions in relationships, and organizations
- Well-Being: Secret of happy mind and healthy life
- Managing Stress creatively and productively

Module V: Importance of Values, Morals & Ethics **(6 Hours)**

- Meaning, type and relationship between Values, Morals, and Ethics
- Personal & Professional Values
- Ethical Decision Making
- Prevention of Corruption &Crime
- Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.
- Student will be able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	**5**	**15**	**20**	**60**	**100**

Text & References:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.
- Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon..
- Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA:Allyn and Bacon, Inc.
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers.
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, G (1996); Pfeiffer & Company.

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Course structure: Français -IV   Course Code: FLU444

Course Title: **Français -III**   Credit Units: 03

Course Level: UG   Course Code: **FLU444**

French Syllabus-Programme d'études pour le français

All U.G. Programmes –Foreign Language

Français - IV

Course Code: FLU444   **Credit Units: 03**

<u>Course Objective</u>:

To strengthen the language of the students in both oral and written
To revise the grammar in application and the communication tasks related to topics covered already
To get acquainted with the current social communication skills, oral (dialogue, telephone conversations, etc.) and written and perform simple communication tasks such as

- talking about various types of accommodations.
- talking about various parts of internal and external parts of the body.
- describe about accidents and natural calamities.
- talking about education system in France, formalities to go abroad, weather forecast etc.

<u>Course Contents</u>:

Unité 4, 5, 6 – pg: 58-103.

Unité 4: On fait le ménage ! – A propos de logement

Actes de Parole :- Protester et réagir – Exprimer l'intérêt et l'indifférence – Le logement - la maison – les pièces – Meubles et équipement – les tâches ménagères.

Unité 5: Tous en forme ! – Accidents et catastrophes

Actes de Parole :- Raconter au passé – Exprimer la peur et rassurer – Le corps humain : l'extérieur et l'intérieur – Les maladies et les remèdes - Les accidents – Les catastrophes naturelles.

Unité 6: Faire ses études à l'étranger – Bon voyage ! – la météo

Actes de Parole :- Exprimer son opinion – Parler de la météo - Parler de l'avenir – Le système scolaire – Les formalités pour partir à l'étranger – La météo.

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Grammaire :

1. Le présent progressif – Les pronoms possessifs – La phrase négative (3) – Quelques adjectifs et pronoms indéfinis - Les verbes : *lire, rompre* et *se plaindre.*
2. Le passé composé et l'imparfait – le passé récent – l'expression de la durée – les adjectifs et les pronoms indéfinis : *rien, personne, aucun.* – les verbes : *dire, courir* et *mourir.*
3. Les pronoms démonstratifs neutres – le futur simple – Situer dans le temps – *Moi aussi / non plus – Moi non / si* – les verbes impersonnels - les verbes : *croire, suivre* et *pleuvoir.*

Examination Scheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	20	5	**40**	**60**	

Text & References:

Le livre à suivre:

- Marie-Noelle Cocton. GÉNÉRATION A2 (Livre d'élèves) Didier, 2016.
- Marie-Noelle Cocton. GÉNÉRATION A2 (Cahier d'exercices) Didier, 2016.

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Course Structure: Diploma in Clinical Biochemistry (Skill based) Course code:460

Course Name: Diploma in Clinical Biochemistry **Course Code: BSB 460**
Course Levels: UG **Credit Units: 04**

Course Objective:

Clinical Biochemistry mainly deals with the biochemical aspects that are involved in several clinical conditions. The results of qualitative and quantitative analysis of body fluids assist the clinicians in the diagnosis, treatment, prevention of disease, drug monitoring, forensic investigation, tissue and organ transplantation.

Course contents :

Serum estimation

1. Estimation of blood glucose by Nelson – Somogyi Method
2. Estimation of serum Cholesterol by Zak's Method
3. Estimation of blood Urea by Diacetylmonoxime Method
4. Estimation of Total Protein in serum by Biuret Method
5. Estimation of total protein in serum by Folin-Lowry method
6. Estimation of Uric acid in serum using Phosphotungstic acid reagent
7. Estimation of inorganic phosphate in serum by Fiske-Subbarao Method
8. Estimation of serumBilirubin
9. Estimation of serum creatinine.
10.Clinical Enzymology:
11. Assay of serum alkaline phosphatase
12. Assay of Serum alanine amino transferases (ALT/SGPT)
13. Assay of serum aspartate amino transferases (AST/SGOT)

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Course structure: : PLANT BIOTECHNOLOGY **- BSB 501**

Course Title: PLANT BIOTECHNOLOGY **Credit Units**: 3

Course Level: UG Level **Course Code: BSB 501**

Course Objectives:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through in vitro techniques offers a practical strategy for micro propagation. Pre-requisites: The course helps in developing a detailed understanding of plant biotechnology and applications.

Course Contents/Syllabus:

	Weightage (%)
Module I: Introduction to in vitro methods	25%
Descriptors/Topics Terms and definitions. Beginning of in vitro cultures in our country (ovary and ovule culture, in vitro pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.	
Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications	25%
Descriptors/Topics Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).	
Module III: Introduction to protoplast isolation	25%
Descriptors/Topics Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.	
Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants	25%
Descriptors/Topics Introduction to A tumefaciens. Tumor formation on plants using A.tumefaciens (Monocots vs. Dicots). Practical application of genetic transformation.	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Handle the basic instruments used in plant biotechnology.
- Learn Preparation of stocks for culture media.
- Learn surface sterilization of different explants
- Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab
- Get training of problems related to germination, callus induction and propagation.

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Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topic.

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:
- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

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Course structure: ANIMAL BIOTECHNOLOGY **- BSB 502**

Course Title: ANIMAL BIOTECHNOLOGY **Credit Units:**3
Course Level: UG Level **Course Code:** BSB 502
Course Objectives:
The aim of the course is to provide equal importance to areas like in vitro fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.
Pre-requisites: The course helps in developing a detailed understanding of animal biotechnology and applications.
Course Contents/Syllabus:

	Weightage (%)
Module I	
Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering. Cell-culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures.	20%
Module II	
In-Vitro Fertilization (IVF) and Embryo Transfer Technology (ETT).	15%
Module III	
Somatic cell hybridization, Hybridoma technology and Production of Monoclonal antibodies.	20%
Module IV	
Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer, Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc. Bioethical issues related to animal biotechnology.	20%
Module V	
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin).	15%
Module VI	
Fundamentals of Stem cell based therapy, Regenerative medicines	10%

Student Learning Outcomes:
After successful completion of the course student will be able to:

- Understand theory of animal cell culture, culture media, methods to develop cell line and their maintenance for commercial applications.
- Understand scale up production of monoclonal antibodies and hybridoma technolo

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- Understand the structure and function of variety of hormones and growth factors.
- Understand the technology and concept behind *invitro* fertilization and embryo transfer, and development of superior live stocks.
- Understand the concept of ethical value regarding the use of animal biotechnology.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topic.

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss.

References:

- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
- Cell Culture LabFax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication.

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Course structure: Biochemistry and metabolic regulation-Code-BSB 503

Course Title: **Biochemistry and metabolic regulation** Credit Units: 03

Course Level: UG Level Course Code: BSB 503

Course Objectives:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents/Syllabus:

	Weightage (%)
Module I :	20 %
Descriptors/Topics Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation - mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway	
Module II	20 %
Descriptors/Topics Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.	
Module III	20 %
Descriptors/Topics Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation	
Module IV:	20 %
Descriptors/Topics: Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,	
Module V:	20%
Descriptors/Topics: Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge of biochemical aspects of body.
- Learn about important metabolic pathways and their regulation.

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- Deals with pathways responsible for energy production.
- Study of various enzymatic reactions and their role in body.
- Develops collaborative and research approach.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing.

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Course structure: Recombinant DNA Technology – Course Code: BSB 504

Course Title: RECOMBINANT DNA TECHNOLOGY **Credit Units:**3
Course Level: UG Level **Course Code:** BSB 504

Course Objectives:
A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course. Pre-requisites: The course helps in developing a detailed understanding of recombinants and applications.
Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.	
Module II	20%
Descriptors/Topics Methods of DNA Introduction into living cells.	
Module III	20%
Descriptors/Topics Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.	
Module IV	20%
Descriptors/Topics Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.	
Module V	20%
Descriptors/Topics Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP. PCR: Basic principles and its modification application and uses.	

Student Learning Outcomes:
After successful completion of the course student will be able to:
* Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification.
* Know various methods of introducing DNA into living cells.
* Learn the technique of gene cloning, tools used in it and different vectors used for transf host cells.

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* Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy.
* Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topic.

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene cloning and DNA analysis by T.A. Brown

References:

- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

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Course structure: Enzyme Technology   Course Code: BSB 505

Course Title: ENZYME TECHNOLOGY   **Credit Units:**2
Course Level: UG Level   **Course Code:** BSB 505
Course Objectives:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I: Enzymes	10%
Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.	
Module II: Enzyme Kinetics	25%
Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH and temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.	
Module III: Immobilization of Enzymes	10%
Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects	
Module IV: Enzyme reactors	25%
Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.	
Module V: Bioprocess Design	
Physical parameters, reactor operational stability; Immobilized cells.	10%
Module VI Challenges and future trends	20%
Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and HyperthermophilicArchaea and Bacteria.	

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Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation,
Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text & References:

Text:

- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

***References*:**

- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience

Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

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Course structure: Plant Biotechnology Lab Course Code: BSB 521

Course Title: PLANT BIOTECHNOLOGY LAB **Credit Units:**1
Course Level: UG Level **Course Code:** BSB 521

Course Objectives:

The aim of the course is to provide equal importance to areas like in vitro fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal and plant biotechnology.

Pre-requisites: The course helps in developing a detailed understanding of animal and plant biotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module I	30%
Sterilization of glasswares and equipments. Preparation of cotton plugs and culture media Preparation of stocks for culture media Preparation of culture media	
Module II	30%
Preparation and sterilization of different explants Inoculation of explants on culture media Callus culture	
Module III	30%
Seed Culture on media Embryo culture.	
Module IV	10%
Study of viability of seeds Agrobacterium mediated transformation studies in plants	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Understand theory of plant tissue culture, culture media, methods to develop cell lines. and their maintenance for commercial applications.
- Understand the technology and concept of animal cell culture.
- Understand the concept of ethical value regarding the use of plant biotechnology.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Vi**

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15	10	05	35	15	10	10

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Course structure: Animal Biotechnology Lab Course Code- BSB 522

Course Title: ANIMAL BIOTECHNOLOGY LAB **Credit Units:** 1
Course Level: UG Level **Course Code:** BSB 522

Course Objectives:

The aim of the course is to provide equal importance to areas like in vitro fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal and plant biotechnology.

Pre-requisites: The course helps in developing a detailed understanding of animal and plant biotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Descriptors/Topics Sterilization techniques of glass wares & equipment's. Preparation of stock solutions and buffers for animal cell culture.	
Module II	25%
Descriptors/Topics Preparation of Natural and Artificial Cell culture media. Sterilization of Animal Cell Culture media and storage. Inoculation of specific tissues for callusing	
Module III	25%
Descriptors/Topics Inoculation of primary cells on culture media. Inoculation and maintenance of cell lines	
Module IV	25%
Descriptors/Topics Study of toxicity on cell lines, MTT assay for cell viability.	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Understand theory of animal cell culture, culture media, methods to develop cell lines. and their maintenance for commercial applications.
- Understand scale up production of cell culture.
- Understand the concept of ethical value regarding the use of animal biotechnology.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Vi**

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15	10	05	35	15	10	10

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Course structure: Biochemistry and Metabolic Regulation Lab **Course Code: BSB 523**

Course Title: BIOCHEMISTRY AND METABOLIC REGULATION LAB **Credit Units:** 1
Course Level: UG Level **Course Code:** BSB 523

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Course structure: Recombinant DNA Technology Lab Course code: **BSB 524**

Course Title: RECOMBINANT DNA TECHNOLOGY LAB **Credit Units:**1
Course Level: UG Level **Course Code:** BSB 524

Course Objectives: The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	40%
Descriptors/Topics Genomic DNA isolation from- Plant, Bacteria and animal cells Qualitative and quantitive estimation of genomic DNA -Proposed	
Module II	30%
Descriptors/Topics Genomic DNA isolation, Plasmid Isolation, from bacterial cells and qualitative and quantitative estimation	
Module III	30%
Descriptors/Topics Restriction digestion of Genomic DNA and Plasmid DNA study:	
Module IV	30%
Descriptors/Topics Handeling of PCR, Development of PCR cycling programme, Performance of PCR using random primer, Electrophoresis of Amplified product.	
Module V	30%
Descriptors/Topics Ligation study Study of Southern hybridization	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: Environmental Biotechnology Course Code: BSB 601

Course Title: ENVIRONMENTAL BIOTECHNOLOGY **Credit Units:** 03
Course Level: UG Level **Course Code:** BSB 601

Course Objectives:
The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.
Pre-requisites: The course helps in developing a detailed understanding of Environmental Biotechnology.
Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.	
Module II	20%
Descriptors/Topics Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels	
Module III	20%
Descriptors/Topics Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants Biomineralisation: Use of microbial technology for mining	
Module IV	20%
Descriptors/Topics Treatment of municipal solid and liquid wastes Environmental impact assessment and Environmental audit	
Module V	20%
Descriptors/Topics Bioassessment of Environmental Quality, Biofertilizers and Biopesticides	

Student Learning Outcomes:
After successful completion of the course student will be able to:
- Understand the delicate interrelationship of different components of environment.

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- Understand conventional fuels, their impact and concept of clean fuel technology.
- Learn approaches and concepts behind bioremediation xenobiotic compounds, mechanism of microbial leaching and mining.
- Learn the concept of municipal solid and liquid wastes management and EIA.
- Understand the concept and assessment of environmental quality.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation,
Students are encouraged in active interaction during classroom discussions on topic.

Assessment/ Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:
- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

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Established vide Government of Madhya Pradesh Act No. 27 of 2010

Course structure: Industrial Biology **-Course Code: BSB 602**

Course Title: INDUSTRIAL BIOLOGY **Credit Units:**03

Course Level: UG Level **Course Code:** BSB 602

Course Objectives:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Pre-requisites: The course helps in developing a detailed understanding of Industrial applications of Biotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Introduction to industrially important microbes, Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation.	
Module II	20%
Descriptors/Topics Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.	
Module III	20%
Descriptors/Topics Microbial fermentative products, Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, food products from microbes (Dairy &SCP etc)	
Module IV	20%
Descriptors/Topics Production of fermented dairy products	
Module V	20%
Descriptors/Topics Immobilized enzymes systems, production and applications.	

Student Learning Outcomes:

Upon completion of the course, students will be able to:

- Develop an understanding of the various aspects of Bioprocess Technology.
- Develop skills associated with screening of Industrially Important Strains and media formulation for industry.
- Understand principles underlying design of fermentor, fermentation process and downstream processing
- Develop an understanding of the various aspects of dairy Technology.
- Understand principles underlying immobilization and their application.

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Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topic.

Assessment/ Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Industrial Microbiology – Cassida

References:
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot&Duhn.

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Course structure: Immunology & Immunotechnology Course Code-BSB 603

Course Title: **IMMUNOLOGY & IMMUNOTECHNOLOGY** Credit Units: 03
Course Level: UG Level Course Code: BSB 603
Course Objectives:
Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents/Syllabus:

	Weightage (%)
Module I :	
Historical perspective of immune system and immunity; Innate and specific immunity. Humoral immunity, Cell-mediated immunity and Clonal selection theory. The organs: Primary and secondary lymphoid organ. Hematopoiesis and regulation. Cells of the immune system: Granulated and Agranulated cells.	20 %
Module II:	
Histocompatibility: structure of MHC class I, II & III Antigens & their mode of antigen presentation MHC restriction. Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes. Genetic basis of antibody diversity. Antibodies in targeting therapeutic agents. Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application	20 %
Module III :	
Measurement of antigen – antibody interaction: Affinity, Avidity, cross reactivity, Agglutination, Precipitation Immunodiffusion, Immuno-electrophoresis, ELISA, RIE, Western blotting, Fluorescent antibody techniques	20 %
Module IV :	
Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination. Autoimmunity and autoimmune diseases: Hashimoto's thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma Hypersensitivity- type I, II, III, and IV hypersensitivity Tissue and organ transplantation	20 %
Module V :	
Immunoinformatics: Immunomics B cell and T cell databases. Webservers and tools for prediction of B-cell epitopes, T-cell epitopes, allergy and *in-silico* vaccine designing. Introduction of immunophysics techniques and applications.	20%

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Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the phylogeny of immune system, types of immunity, immune response.
- Describe the concept of clonal selection theory, humoral and cell mediated immunity.
- Understand and explain the structure and functions of the organs and cells of the immune system.
- Understand the mechanism of antigen-antibody interaction.
- Describe the structure of antibodies, their types and functions in immunity.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

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Course structure: Environmental Biotechnology Lab Course Code: BSB 620

Course Title: ENVIRONMENTAL BIOTECHNOLOGY LAB **Credit Units:**1
Course Level: UG Level **Course Code:** BSB 620
Course Objectives:
The aim of the course is to provide equal importance to areas like in vitro fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal and plant biotechnology.
Pre-requisites: The course helps in developing a detailed understanding of various techniques available for large scale cultivation of microorganisms.
Course Contents/Syllabus:

	Weightage (%)
Module I-ENVIRONMENTAL BIOTECHNOLOGY	50%
Descriptors/Topics Symptomological studies of the impacts of conventional fuel Comparative and statistical analysis of the pigments content due to air pollution. Phytochemical analysis	
Module II-ENVIRONMENTAL BIOTECHNOLOGY	50%
Descriptors/Topics Comparative and statistical analysis of the sugar content as an impact of air pollution Proline content study in environmental stress in plants. Antioxidant enzyme study. NR activity estimation and its statistical analysis under pollution stress conditions.	

Student Learning Outcomes:
After successful completion of the course student will be able to:
- Understand effect of pollution on plant pigments.
- Understand effect of pollution on plant sugar level and other

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation
Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Industrial Biology Lab Course Code: BSB 621

Course Title: INDUSTRIAL BIOLOGY LAB **Credit Units:** 1
Course Level: UG Level **Course Code:** BSB 621
Course Objectives:

Course Objectives:
The aim of the course is to provide equal importance to areas like in vitro fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal and plant biotechnology.
Pre-requisites: The course helps in developing a detailed understanding ofvarious techniques available for large scale cultivation of microorganisms.
Course Contents/Syllabus:

	Weightage (%)
Module I- INDUSTRIAL BIOLOGY	25%
Descriptors/Topics Fermentation Process	
Module II- INDUSTRIAL BIOLOGY	25%
Descriptors/Topics Production of alcoholic fermentation.	
Module III- INDUSTRIAL BIOLOGY	50%
Descriptors/Topics Downstream processing of alcoholic fermentation.	

Student Learning Outcomes:
After successful completion of the course student will be able to:
- Understand microbial culture development, process of production ethanol.
- Understand scale up production of ethanol and downstream processing.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation
Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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Course structure: Immunology and Immunotechnolog Lab Course Code: BSB 623

Course Title: IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB Credit Units: 1
Course Level: UG Level Course Code: BSB 623

Course Objectives:
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	40%
Descriptors/Topics Blood film preparation and identification of cells. Identification of blood group, Isolation of serum, Lymphoid organs and their microscopic organization	
Module II	30%
Descriptors/Topics , WIDAL Test, Radial Immuno Diffusion Test, Ouchterlony Double diffusion Test	
Module III	30%
Descriptors/Topics DOT, SANDWICH, Purification of lgG through affinity chromatography,Immunohistochemistry .	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:
Text:
- ***Practical Biochemistry, Sawhney and Singh***

References:
Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

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PROJECT(6-8 Week)

Course Code: BSB 660 **Credit Units:06**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

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This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

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Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding
First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report
After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font
For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

➢ Title or Cover Page
The title page should contain the following information: Project Title; Student's Name; Course; Year; Super
Name.

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- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Dwivedi

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Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions
Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

Dwivedi

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Course structure: Advanced Microbial Technology Course Code: BSB 701

Course Title: Advanced Microbial technology **Credit Units: 04**
Course Level: UG Level **Course Code: BSB 701**
Course Objectives:
To acquaint the students to understand thebasic concept of microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I:Introduction to microbiology	30%
Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,	
Module II: Control of Microorganisms	20%
Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.	
Module III: Microbial Genetics	30%
Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation.Microbial regulation of gene expression: the trp and lac operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.	
Module IV: **Medical Microbiology**	20%
Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Recognize and explain the significant role that microbes play in the world around

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- Explain the similarities and differences of microbes as compared to higher forms of life.
- Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences.
- Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage.
- Explain the basic principles of immunology relating to host resistance.
- Evaluate the physical and chemical methods of microbial control.
- Recognize microbial diseases and their control.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation,
Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings.

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Course structure: Advanced Cell Biology And Genetics Course Code: BSB 702

Course Title: **Advanced Cell Biology and Genetics** Credit Units: 04
Course Level: UG Level Course Code: BSB 702

Course Objectives:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporate elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I:	30%
Mendelian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over. Extra-chromosomal inheritance: Mitochondrial and chloroplast genetic code Chromosomal aberration and polyploidy Concept of gene – classical and modern, psendo allelism, position effect, intragenic crossing over & complementation (cistron, recon &nutron) Benzer's work on r II locus in T2 bacteriophage. Population genetics- Hardy Weinberg selection , k and r selection	
Module II: Cell organelles	20%
Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.	
Module III:	10%
Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.	
Module IV:	20%
Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase,Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP	

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kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.	
Module V: Cancer Biology	10%
Types of cancer; development of cancer, cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.	
Module VI: Cell Cycle	10%
Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Analyse hereditary data and apply fundamental knowledge in genetic calculations and chromosomal aberrations.
- Understand various cellular organelles, its structure, function, phenomenon of protein sorting and targeting and also the transport across these organelles.
- Understand molecular mechanisms of how and why cells move?
- Understand the molecular structure and function of various receptors and mechanism of cell signalling.
- Understand different molecular mechanisms that bring about cell death or factors that lead to cancer.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation,
Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.

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AMITY UNIVERSITY

MADHYA PRADESH

Established vide Government of Madhya Pradesh Act No. 27 of 2010

Course structure: Advanced Biophysics and Bioanalytical techniques Course Code:-BSB 703

Course Title: Advanced Biophysics and Bioanalytical techniques **Credit Units: 04**
Course Level: UG Level **Course Code: BSB 703**

Course Objectives:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Pre-requisites: The students must possess fair understanding of ……………………………..

Learning Outcomes

After successful completion of the course student will be able to:

- Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential.
- Learn about the radiation biophysics and its uses such as tracer techniques etc.
- Learn about various spectroscopic techniques and X –ray crystallography.
- Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein.
- Learn different chromatography and centrifugation techniques for separation of bio-molecules.

Course Contents/Syllabus:

	Weightage (%)
Module I:Membrane Biophysics	20%
Genesis of membrane potential in nerve & membrane, Nerst& Goldman equation, Patch Clamp and Voltage –Clamp techniques for measuring membrane potential.	
Module II: Radiation Biophysics	20%
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.	
Module III: Non-Radioactive tracer Technology	15%
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.	
Module IV: Spectroscopy and X –ray crystallography	15%
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.	
Module V: Electrophoresis	15%
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.	

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Module VI: Chromatography and Centrifugation	15%
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential.
- Learn about the radiation biophysics and its uses such as tracer techniques etc.
- Learn about various spectroscopic techniques and X –ray crystallography.
- Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein.
- Learn different chromatography and centrifugation techniques for separation of bio-molecules.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation,
Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:
Text:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.

***References*:**

- Bioinstrumentation, Webster.
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

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Course structure: Advanced Biostatistics For Biologists Course Code: BSB 704

Course Title: Advanced Biostatistics for Biologists Credit Units: 04

Course Level: UG Level Course Code: BSB 704

Course Objectives:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.
Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I *Descriptive statistics*	25%
Descriptors/Topics Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)	
Module II:	25%
Descriptors/Topics : Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.	
Module III:	25%
Descriptors/Topics : Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)	
Module IV:	25%
Descriptors/Topics Applications of statistical methods using statistical software	

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Fundamental knowledge of basic statistical Techniques.
- Various Statistical Tools used in data presentation and interpretation
- Probability and various distributions.
- Formulation and testing of hypothesis
- Correlation & Regression analysis.
- Analysis of variance(ANOVA)
- Applications of various statistical methods using statistical softwares like SPSS, SA

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Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. VisweswaraRao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

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Course Structure: Advanced Microbial Technology Lab, Course Code: BSB 720

Course Title: **Advanced Microbial Technology Lab** **Credit Units: 01**

Course Level: UG Level **Course Code: BSB** 720

Course Objectives:

The objective of the present course is to elaborate the concept of advanced technology of microbiology and microbiological procedures for the identification of microbes. Apart from that the understanding of biochemical and molecular characterization of microbes are also enhanced.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I:	30%
Aseptic techniques: preparation of culture media for cultivation of specific microorganism. Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi	
Module II:	15%
Biochemical test - Indole test. methyl red test. vogesproskaeur lest. citrate utilization. starchhydroysis, protease. catalase test and oxidase test.	
Module III:	30%
Isolation of special microbes from environment by isolation and enrichment techniques Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD Soil microbiology: Isolation of rhizospheremicroflora (actinomycetes, azotobacter, bacteria and fungi)	
Module IV:	15%
Antibiotic sensitivity test by disc diffusion assay	
Module V:	10%
Biochemical and molecular characterization of micro organisms Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Isolate bacterial and fungal cultures on soild and liquid media.
- The biochemical testing related to bacterial and fungal biochemical properties.
- Biochemical and molecular characterization of microbes for their identification.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: Advanced Cell Biology and Genetics Lab- Course Code: BSB 721

Course Title: **Advanced Cell Biology and Genetics lab** **Credit Units: 01**

Course Level: UG Level **Course Code: BSB 721**

Course Objectives:

The objective of the present course is to elaborate the concept of cell fractionation and separation along with chloroplast study. This also includes the mitochondrial isolation and to understand the concept of apoptosis. Objectives also include the elaboration of different stages of cell cycle.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I:	15%
Cell fractionation and separation of cell organelles byultra-centrifugation.	
Module II:	15%
Isolation of chloroplast from spinach and study of electron transport chain.	
Module III:	20%
Isolation of mitochondria and study of electron transport chain.	
Module IV:	50%
Study of apoptosis by TUNEL method. Site directed mutagenesis Mutation detection and analysis Mitosis Meiosis	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Isolate chloroplast and mitochondria from cells.
- Understand the concept of separation and centrifugation of cell organelles.
- Mitosis and meiosis stages during cell division.

Pedagogy for Course Delivery: Demonstration, on-site training and hands on experiments and interpretation

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

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Course structure: Advanced Biophysics & Bioanalytical Techniques lab - BSB 722

Course Title: Advanced Biophysics & Bioanalytical Techniques lab **Credit Units: 01**
Course Level: UG Level **Course Code: BSB 722**
Course Objectives:

To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Ultracentrifugation	16%
Descriptors/Topics Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.	
Module II: Gel electrophoresis	16%
Descriptors/Topics: Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.	
Module III:	16%
Descriptors/Topics: TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.	
Module IV:	20%
Descriptors/Topics UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.	
Module V	16%
Descriptors/Topics Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.	
Module VI	16%
Descriptors/Topics Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.	

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Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Understand centrifugation machine and their techniques for the separation of biomolecules.
- Know about electrophoresis and their different types and their application.
- Know about chromatography techniques and their different types and their application
- Know different types of spectroscopes and microscopes and their application analysis of different molecules.
- Learn about the radioactivity and their measurement using scintillation counters.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles & Techniques" by Keith Wilson and John Walker.
- Biophysical Chemistry by David Friefelder.

References:

- "Microscopic Techniques in Biotechnology" by Michael Hoppert
- "Principles & Practice of Bioanalysis" by Richard F. Venn
- "Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes" by J.F.
- Van Impe, Kluwer Academic
- "Crystal Structure Analysis" by J.P. Glusker and K.N. Trueblood, Oxford University Press
- "Crystallography made Crystal Clear" by G. Rhodes, Academic Press
- "NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry" by H. Gunter, John
  Wiley and Sons Ltd.

- "Principles of Physical Biochemistry" by K.E. Van Holde, Prentice Hall.

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EIGHT SEMESTER

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Established vide Government of Madhya Pradesh Act No. 27 of 2010

Course structure: Genomic and Proteomics- Course Code : BSB 801

Course Title: Advanced Genomic and Proteomics **Credit Units: 03**
Course Level: UG Level **Course Code: BSB 801**
Course structure: GENOMICS AND PROTEOMICS

Course Title: Advanced genomics and proteomics Credit Units: 04
Course Level: PG Level Course Code: MSB204

Course Objectives:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

PART-1: GENOMICS	Weightage (%)
Module I	20%
Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genomes.	
Module II	15%
Transcriptomics and metatranscriptomics: Introduction, method and uses.genetic mapping.	
Module III	15%
Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy	
Module IV	10%
Micro array: DNA micro array marker, computational methods.	
PART-II: PROTEOMICS	
Module V	
Introduction to proteomics Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.	20%
Module VI	
Post translationalprotein modification	10%
Module VII	
Protein-Protein interaction some example	10%

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

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- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Pedagogy for Course Delivery: Class room lecture and PowerPoint presentation, Students are encouraged in active interaction during classroom discussions on topics.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:
- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

References:
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown

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Course structure: Drug Delivery System- Course Code: BSB 802

Course Title: Drug Delivery System **Credit Units: 03**
Course Level: UG Level **Course Code: BSB 802**

Course Objectives:

The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents/Syllabus:

	Weightage (%)
Module I :: Basic concepts of Drug Delivery	25%
Descriptors/Topics Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics	
Module II: Advanced Drug Delivery and Targeting	25%
Descriptors/Topics : Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)	
Module III :Drug administration	25%
Descriptors/Topics : Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery	
Module IV: Delivery of Genetic material	15%
Descriptors/Topics Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy	
Module V: New generation technologies in Drug delivery and targeting	25%
Descriptors/Topics Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.	

Student Learning Outcomes:

After successful completion of the course student will be able to:

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- Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

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Course structure: Management Accounting and Cost Control – Course Code: BCH 621

Course Title: MANAGEMENT ACCOUNTING AND COST CONTROL

Credit Units: 01

Course Level: UG Level Course Code: BCH621

Course Objectives:

- Enable students to understand the concepts of financial, cost and management accounting,
- The course aims to help students to develop skills for preparation and analysis of financial statements to enhance management planning and control, cost classification, allocation and how the costing techniques are useful in the process of managerial decision-making.

Pre-requisites: NA

Course Contents/Syllabus:

	Weightage (%)
Module I	**25%**
Descriptors/Topics Relevance of management accounting, Difference between management, financial and cost accounting, Basics concepts of accounting, financial statements	
Module II:	**25%**
Descriptors/Topics Cost accounting fundamentals, cost behaviour / classification, cost volume profit analysis, cost allocation, overhead application	
Module III	**25%**
Descriptors/Topics Variable and Absorption costing, Job-Costing and Process-Costing Systems,	
Module IV	2
Descriptors/Topics Tools for planning and control, Master budget, Flexible Budgets and Variance analysis	**25%**

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Student Learning Outcomes:

- Understand the concepts cost and management accounting
- Analyze and provide recommendations to improve the operations of organisations through the application of cost and management accounting techniques;
- Evaluate the costs and benefits of different conventional and contemporary costing systems
- Enable students to demonstrate mastery of costing systems, cost management systems, budgeting systems.

Pedagogy for Course Delivery: The course will use a mix of numerical problems, case studies, workshops and hands-on exercises. Participants are encouraged to engage in active interaction through classroom participation

Lab/ Practical details, if applicable: N/A Assessment/

Examination Scheme:

Components	**Mid term**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**End term**
Weightage (%)	15	5	10	70

Text Reading:

1. Cost Accounting, C.Horngreen, Prenctice Hall
2. Cost and Managerial Accounting, J.O. Cherrington, E.D. Hubbard and D.H. Luthy, WCB Publications.

References:

- Management Accounting, C. Horngreen, Prenctice Hall

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Course structure: Project Management - Course Code: BCH 622

Project Management: BCH 622

Course Title: Project Management **Credit Units: 1**

Course Level: UG Level Course Code: BCH 622
Course Objectives:

- Enable students to understand the concepts of project management to prepare students for an exciting career in today's competitive era.
- The course aims at making an understanding of the tools and the framework necessary to build a cohesive workflow plan that will help develop industry-standard process.
- Students will also learn project management skills specifically to all design and redesign projects, from the simplest to the most complex

Pre-requisites: The students must possess fair understanding of basic management concepts and also have adequate knowledge of financial management.

Course Contents/Syllabus:

	Weightage (%)
Module I Introduction	**15%**
Descriptors/Topics Conceiving a project, Strategic Management and Project Selection, Work Breakdown Structure	
Module II Project Training	**30%**
Descriptors/Topics Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Project in Contemporary Organizations.	
Module III Project initiation	**20%**
Descriptors/Topics Project implementation– Scheduling, Resource Allocation, Monitoring and Information, Project Control	
Module IV Managing Risk	

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Descriptors/Topics Risk Management Process: Risk Identification, Risk Assessment. Risk Response Development: Risk Response Control	**20%**
Module V Project Termination	**15%**
Descriptors/Topics Project Auditing and Termination	

Student Learning Outcomes:

- Understand the concepts of Project Management.
- Analyze the various skills required for Project Management.
- Identify, implement and evolve skills need in project management.
- Enable students to become future project Managers.

Pedagogy for Course Delivery: The course will use a mix of case studies, workshops and hands-on exercises. Participants are encouraged to engage in active interaction through classroom participation.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Project Management: A Managerial Approach, J.P. Meredith and S.J. Mantel, John Wiley and Sons Inc.

References:

- Project Management: The Managerial Process, Clifford F. Gray and Erik W. Larson

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AMITY UNIVERSITY
MADHYA PRADESH
Established vide Government of Madhya Pradesh Act No. 27 of 2010

Course structure: Principles of Management and Entrepreneurship Development Course Code: BCH 623

Course Title: Principles of Management and Entrepreneurship Development

Credit Units: 1

Course Level: UG Level Course Code: BCH 623

Course Objectives:

- Enable students to understand the Management functions and Entrepreneurship so as to prepare students for an exciting career in today's competitive era.
- Help students to practice and apply the knowledge to cope up with the changing environment because of the advent of technology and other influences.
- Enable students to develop and strengthen the required entrepreneurship skills from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Pre-requisites: The students must possess fair understanding of entrepreneurship and also have adequate knowledge of Organization Behavior

Course Contents/Syllabus:

	Weightage (%)
Module I	**30%**
Descriptors/Topics Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.	
Module II	**20%**
Descriptors/Topics Formal and informal organization, Performance appraisal, Training and development.	
Module III	
Descriptors/Topics Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.	**20%**

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Module IV	
Descriptors/Topics Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.	**30%**

Student Learning Outcomes:

- Understand the concepts of Management functions and Entrepreneurship development.
- Analyze various skills required for Entrepreneurial Development.
- Identify, implement and evolve managerial and entrepreneur skills.
- Evaluate the learning outcomes.
- Enable students to become future leaders and entrepreneurs.

Pedagogy for Course Delivery: The course will use a mix of case studies, workshops and hands-on exercises. Participants are encouraged to engage in active interaction through classroom participation.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

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MAJOR PROJECT(10-12 Week)

Course Code: BSB 860 **Credit Units: 15**

Course Objective:

The students are expected to utilize their scheduled periods by undertaking the project that would be completed during the semester

Every student shall undertake a major Project. The major Project shall be undertaken in some biotechnology industry or laboratory of repute. Each student shall be assigned to a faculty who shall continuously monitor the progress of the Project in the concerned laboratory or industry. The faculty, in consultation with the concerned scientist of the industry/laboratory, shall decide the topic of the project. At the conclusion of the project the student shall submit a seminar and a dissertation. The dissertation shall be evaluated by the internal faculty/examiner. The student then shall have to appear for the viva voce axamination.

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

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Maharajpura, Gwalior 474005

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

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Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

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Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**
- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

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Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ **Summary**

➢ **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

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(Sub- Sections: Times New Roman, 14 Pts., Italics)

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BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	100
Viva Voce:	100
Total:	**200**

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Program Educational Objectives (PEO)
Bachelor of Technology (B. Tech.) Biotechnology
Academic Year – 2023-24

B.Tech. Biotechnology

PEO1: To enable the students in applying the gained knowledge of biotechnology to pursue higher studies and careers in industries and research institutions.

PEO2: To prepare the students to exhibit innovative thinking ability towards different aspects of biotechnology.

PEO3: To inculcate the ability in planning and executing the experiments in state-of-the-art biotechnology laboratories.

PEO4: To develop professional attitude and ethics with effective communication and scientific writing skills, teamwork, multidisciplinary approach and apply their technical expertise to mitigate societal and technical challenges.

PEO5: To engage in lifelong learning with knowledge of contemporary and futuristic issues related to biotechnology using advanced techniques.

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AMITY INSTITUTE OF BIOTECHNOLOGY

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

B.Tech. Biotechnology (Eight Semesters)

PROGRAMME OUTCOMES OF B.TECH. BIOTECHNOLOGY

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practices.

PO9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective [illegible]d design documentation, make effective presentations, and give and receive clear instructions.

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PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES OF B. TECH. BIOTECHNOLOGY

PSO1: Impart a high-quality husbandry education in biotechnology and discipline students to meet future challenges.

PSO2: Understand the nature and basic concepts of cell biology, Biochemistry, Molecular biology and bioinformatics.

PSO3: Analyze the complex problems of agriculture and address issues through use of modern tools and techniques of biotechnology.

PSO4: Perform experimental procedures as per established laboratory standards in the areas of Biochemistry, Molecular biology, Plant tissue culture, Genetic Engineering, Molecular Ecology, Molecular marker technology and Bioinformatics.

PSO5: Understand the applications of biotechnology in all spheres and develop crops with improved productivity thereby increasing farmers' income, better human health and decreased environmental pollution.

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<u>PO Mapping of B.Tech. Biotechnology syllabus with the SDGs</u>

Sr No	Program Outcome [PO]	Program Outcome	Mapping with SDGs.
1	**PO-1**	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems	SDG 4 Quality Education
2	**PO-2**	Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	SDG 3 Good Health and Well being
3	**PO-3**	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	SDG 4 Quality Education
4	**PO-4**	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	SDG 2 Zero Hunger
5	**PO5**	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	SDG 3 Good Health and Well Being
6	**PO6**	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.	SDG 2 Zero Hunger
7	**PO7**	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	SDG 17 Partnerships for the Goals
8	**PO8**	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.	SDG 17 Partnerships for the Goals
9	**PO9**	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	SDG 17 Partnerships for the Goals
10	**PO10**	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	SDG 10 Reduce Inequalities
11	**PO11**	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	SDG 9: Industry, Innovation, and Infrastruct

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12	**PO12**	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	SDG 9: Industry, Innovation, and Infrastructure

Courses Mapped with various National Missions

Sr. No.	Name of School	Program Name	Semester	Course Code	Course Name	National Mission
1.	Amity Institute of Biotechnology	B.Tech. Biotechnology	I	EVS-142	ENVIRONMENTAL STUDIES-I	National Biodiversity Mission
2.	Amity Institute of Biotechnology	B.Tech. Biotechnology	I	EVS-242	ENVIRONMENTAL STUDIES-I	National Biodiversity Mission
3.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VIII	BTB802	Drug Delivery Systems	National Biopharma Mission
4.	Amity Institute of Biotechnology	B.Tech. Biotechnology	IV	BTB-402	Genetics	National Mission for BioScience for human Health
5.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VI	BTB 601	RECOMBINANT DNA TECHNOLOGY	National Mission for BioScience for human Health
6.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VIII	BTB-801	GENOMICS AND PROTEOMICS	National Mission for BioScience for human Health
7.	Amity Institute of Biotechnology	B.Tech. Biotechnology	VII	BTB-708	ENVIRONMENTAL BIOTECHNOLOGY	National Mission for Waste to Wealth

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PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
BTB 101	Applied Mathematics - I	3	1	-	4	
CHE 101	Applied Chemistry	3	1	-	4	
CSE 104	Programming for Problem Solving	2	1	-	3	
BTB 105	Life Sciences-I	2	1	-	3	
CHE 121	Applied Chemistry Lab	-	-	2	1	
CSE 124	Programming for Problem Solving Lab	-	-	4	2	
BTB 123	Engineering Graphics Lab	-	-	2	1	
BCU 141	Communication Skill - I	1	-	-	1	
EVS 142	Environmental Studies - I	2	-	-	2	
BSU 143	Behavioural Science - I	1	-	-	1	
 FLU 144 FLU 145 FLU 146 FLU 147 FLU 148	Foreign Language - I French - I German Spanish Japanese Chinese	2	-	-	2	
	TOTAL				**24**	

SECOND SEMESTER

BTB 201	Applied Mathematics – II	3	1	-	4	
PHY 101	Applied Physics – I	3	1	-	4	
CSE 204	Object Oriented Programming Using C++	2	1	-	3	
ECE 101	Basic Electrical Engineering	3	-	-	3	
BTB 206	Life Science-II	3	-	-	3	
PHY 121	Applied Physics Lab – I	-	-	2	1	
CSE 224	Object Oriented Programming Using C++ Lab	-	-	2	1	
ECE 121	Basic Electrical Engineering Lab	-	-	2	1	
BCU 241	Communication Skill – II	1	-	-	1	
EVS 242	Environmental Studies – II	2			2	
BSU 243	Behavioural Science – II	1	-	-	1	
 FLU 244 FLU 245 FLU 246 FLU 247 FLU 248	Foreign Language – II French - II German Spanish Japanese Chinese	2	-	-	2	
	TOTAL				**26**	

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TERM PAPER DURING SUMMER BREAK

THIRD SEMESTER

BTB301	Cell Biology	3	-	-	3	
BTB302	Biochemistry – I	3	-	-	3	
BTB303	Microbiology	3	1	-	4	
BTB304	Molecular Biology	3	1	-	4	
CSE 202	Data StructuresThrough C++	3	-	-	3	
BTB320	Cell Biology Lab	-	-	2	1	
BTB321	Biochemistry Lab – I	-	-	2	1	
BTB322	Microbiology Lab	-	-	2	1	
BTB323	Molecular Biology Lab	-	-	2	1	
CSE 222	Data Structures Through C++ Lab	-	-	2	1	
BCU341	Communication Skill – III	1	-	-	1	
BSU 343	Behavioural Science – III	1	-	-	1	
FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language – III French - III German Spanish Japanese Chinese	2	-	-	2	
BTB330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**28**	

FOURTH SEMESTER

BTB401	Biochemistry – II	3	1	-	4	
BTB402	Genetics	3	1	-	4	
BTB403	Methods & Instrumentation in Biotechnology	3	-	-	3	
BTB404	Chemical Biology	2	1	-	3	
CSE 403	Java Programming	3	-	-	3	
BTB420	Biochemistry Lab – II	-	-	2	1	
BTB421	Genetics Lab	-	-	2	1	
BTB422	Methods & Instrumentation in Biotechnology Lab	-	-	2	1	
CSE 423	Java Programming Lab	-	-	4	2	
BCU441	Communication Skill – IV	1	-	-	1	
BSU 443	Behavioural Science – IV	1	-	-	1	
FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language – IV French - IV German Spanish Japanese Chinese	2	-	-	2	
	TOTAL				**26**	

SUMMER PROJECT I – (6 - 8 WEEKS)

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FIFTH SEMESTER

BTB501	Plant Biotechnology	3	-	-	3	
BTB502	Animal Biotechnology	3	-	-	3	
BTB503	Structural Biology	3	-	-	3	
BTB504	Chemical Engineering Principles	3	-	-	3	
BTB505	Basic Bioanalytical Techniques	3	-	-	3	
CSE510	Advanced Programmimg through Python	3	-	-	3	
BTB520	Plant Biotechnology Lab	-	-	2	1	
BTB521	Animal Biotechnology Lab	-	-	2	1	
BTB522	Structural Biology Lab	-	-	2	1	
CSE530	Advanced Programmimg through Python Lab	-	-	2	1	
BCU 541	Communication Skill – V	1	-	-	1	
BSU 543	Behavioural Science – V	1	-	-	1	
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language – V French - V German Spanish Japanese Chinese	2	-	-	2	
BTB560	Summer Project – I (Evaluation)	-	-	-	5	
	TOTAL				**31**	

SIXTH SEMESTER

BTB601	Recombinant DNA Technology	3	-	-	3	
BTB602	Enzymology & Enzyme Technology	3	-	-	3	
BTB603	Immunology & Immunotechnology	3	1	-	4	
BTB604	Computational Biology	3	-	-	3	
BTB605	Fundamentals of Biochemical Engineering	3	-	-	3	
BTB620	Recombinant DNA Technology Lab	-	-	2	1	
BTB621	Enzymology & Enzyme Technology Lab	-	-	2	1	
BTB622	Immunology & Immunotechnolgy Lab	-	-	2	1	
BTB623	Computational Biology Lab	-	-	2	1	
BCU 641	Communication Skill - VI	1	-	-	1	
BSU 643	Behavioural Science - VI	1	-	-	1	
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	2	-	-	2	
	TOTAL				**24**	

SUMMER PROJECT - II – (6 - 8 WEEKS)

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SEVENTH SEMESTER

BTB701	Bioprocess Technology	3	-	-	3	
BTB702	Downstream Processing	3	-	-	3	
BTB703	Statistics for Biology	3	-	-	3	
	Elective (Anyone of the following 8)	3	-	-	3	
BTB704	. Biosensors					
BTB705	• Thermodynamics of Biological Systems					
BTB706	• Pharmaceutical Chemistry & Drug Design					
BTB707	• Current Topics in Biotechnology					
BTB708	• Environmental Biotechnology					
BTB709	• Bioprocess Plant Design					
BTB710	• Artificial Neural Networks					
CSE 710	Relational Database Management System	3	-	-	3	
BTB720	Bioprocess Technology Lab	-	-	2	1	
BTB721	Downstream Processing Lab	-	-	2	1	
CSE 730	Relational Database Management System Lab	-	-	2	1	
BTB760	Summer Project - II (Evaluation)	-	-	-	6	
	TOTAL				**24**	

EIGHTH SEMESTER

BTB801	Genomic & Proteomics	3	1	-	4	
BTB802	Drug Delivery Systems	3	-	-	3	
BCH 621	Management, Accounting & Cost Control	1	-	-	1	
BCH 622	Project Management	1	-	-	1	
BCH 623	Principles of Management & Entrepreneurship Development	1	-	-	1	
CSE 804	ASP.NET	3	-	-	3	
BTB820	Genomic & Proteomics Lab	-	-	2	1	
CSE 824	ASP.NET Lab	-	-	2	1	
BTB860	Major Project (10-12 Weeks)	-	-	-	16	
	TOTAL				**31**	

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Course structure: APPLIED MATHEMATICS – I - BTB 101

Course Title: APPLIED MATHEMATICS – I ` **Credit Units: 04**
Course Level: UG Level Course **Code: BTB 101**

Course Objective:

- Enable students to acquire the knowledge of Mathematics for a better understanding of almost all the Engineering and Science subjects.
- Help students to understand the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Pre-requisites: The students must possess fair understanding of basic concepts of mathematics such as factorization, logarithms, exponentials, etc.

Course Contents/Syllabus:

	Weightage (%)
Module I: Differential Calculus	**40%**
Descriptors/Topics: Derivative of a function, Derivatives at a point, Fundamental rules for differentiation: Product Rule, Quotient Rule and Chain Rule, Differentiation of Implicit Functions, Parametric forms and Logarithmic Differentiation, Successive differentiation, Leibnitz's theorem (without proof), Mean value theorem, Taylor's and Maclaurin's Theorem, Asymptote & Curvature, Partial Differentiation, Euler's Theorem, Maxima and Minima	
Module II: Integral Calculus	**30%**
Descriptors/Topics: Fundamental Integral Formulae, Methods of Integration: Integration by Substitution, By Parts, Partial Fractions, Definite Integral and its Properties, Reduction Formulae, Application to length, Area and Volume.	
Module III: Ordinary Differential Equations	**30%**
Descriptors/Topics: Definition of Order and Degree of differential equation, Formation of ODEs, Solution of Differential Equation of 1st Order and 1st Degree: Variable Separation, Homogeneous Differential Equations, Linear Differential Equations, Exact Differential Equations, General Linear ODE of Second Order, Solution of Homogeneous Equation, Solution of Simple Simultaneous ODE	

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Student Learning Outcomes:

- Understand the concepts the concepts of basic calculus related to engineering applications.
- Eligible to identify the problems to apply the integration methods for computing area and other related concepts.
- Can apply the modeling of differential equations in engineering systems having rate of change

Pedagogy for Course Delivery: The course will use lectures and practices on numerical and applications to engineering problems. Participants are encouraged to engage in active interaction through classroom participation.

Lab/ Practical details, if applicable: N/A Assessment/Examination Scheme:

Components	**MidTerm**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**EE**
Weightage (%)	15	10	5	70

Text Readings:

- Differential Calculus by Shanti Narain
- Integral Calculus by Shanti Narain

References:

- Differential Equation by A.R.Forsyth
- Higher Engineering Mathematics by H.K. Dass

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Course structure: APPLIED CHEMISTRY – CHE 101

Course Title: APPLIED CHEMISTRY **Credit Units: 4**

Course Level: UG Level **Course Code: CHE 101**

Course Objectives:

The course aims to train the students in basic and applied principles of Chemistry. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply the knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields. The makeup of substances is always a key factor, which must be known. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents/Syllabus:

Module I: Chemical Bonding (10 Hours)

Fajan's rule; Hybridization. Valence bond and Molecular orbital theory for diatomic molecule (H_2, N_2 & O_2); Bond order & magnetic characters of these molecules.

Module II: Thermodynamics & Chemical Equilibrium (Use of free energy in chemical equilibria) (12 Hours)

Le Chatelier's Principle; Equilibrium constant from Thermodynamic Constants; pH and pOH, Buffer Solution, Buffer Action

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Corrosion: Prevention and corrosion control.

Module III: Stereochemistry (8 Hours)

Symmetry and chirality, Isomerism; diastereomers, enantiomers, optical activity, absolute configurations of one chiral carbons and conformational analysis of ethane.

Module IV: Polymers (8 Hours)

Introduction; Polymerization; Addition and Condensation Polymerization. Thermosetting and Thermoplastic Polymers. Molecular Weight of Polymer; Rubber, Plastic and Fiber; Preparation, Properties and uses of PMMA, Polyester, Epoxy Resins and Bakelite, Silicone Polymers.

Module V: Water Chemistry (12 Hours)

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Introduction and specifications of water, Hardness and its determination (EDTA method only), Alkalinity, Caustic embrittlement, Boiler feed water, boiler problems; scale, sludge, Carbonate & phosphate conditioning, colloidal conditioning & calgon treatment, Water softening processes; Lime – soda process, Ion exchange method. Water for domestic use.

Module VI: Instrumental Methods of analysis (10 Hours)

Introduction; Principles of spectroscopy; Laws of absorbance,
IR: Principle, Instrumentation and Application
UV: Principle, Instrumentation and Application
NMR: Principle, Instrumentation and Application

Course Outcomes:

After successful completion of the course students will have the knowledge and skill to:

- Apply the principles of chemical sciences to understand the very basic bonding mechanism, thermodynamic requisites and energetic consideration of reactions. Application of engineering materials in different situations such as boiler corrosion, polymer science etc.

Assessment/ Examination Scheme:

Components	**A**	**Mid Term**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

1. Keeler, J., De Paula, J., Atkins, P. W. (2018). Atkins' Physical Chemistry. United Kingdom: Oxford University Press. ISBN 9780198814740
2. Rattan, S. Engineering Chemistry, Arihant Publication. ISBN: 8190691910
3. Plane, R. A., Sienko, M. J. (1979). Chemistry: Principles and Applications. Japan: McGraw-Hill. ISBN 9780070573215
4. Mohan, J. (2004). Organic Spectroscopy: Principles and Applications. United Kingdom: Alpha Science. ISBN 9780849339523
5. Jain, P.; Jain. Engineering Chemistry. (2020). India: Dhanpat Rai Publishing Company (P) Limited. ISBN 978-9352165728
6. Vollhardt, P., Schore, N., Vollhardt, K. P. C. (2018). Organic Chemistry: Structure and Function. United Kingdom: Macmillan Learning. ISBN 9781319187712

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PROGRAMMING FOR PROBLEM SOLVING

Course Code: CSE 104 **Credit Units: 03**

Total Hours: 30

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Module 1: Introduction to Programming (3 hours)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Module 2: Programming Essential (8 hours)

Arithmetic expressions and precedence, Conditional Branching and Loop, Writing and evaluation of conditionals and consequent branching , Iteration and loops.

Module 3: Arrays (4 hours)

Arrays (1-D, 2-D), Character arrays and Strings.

Module 4: Basic Algorithms (3 hours)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 5: Function (3 hours)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Module 6: Recursion (3 hours)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module 7: Structure (2 hours)

Structures, Defining structures and Array of Structures.

Module8: Pointers (2 hours)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

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Module 9: File handling(2 hours)

Basics of file Handling.

Course Outcomes:

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical error
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, EE: End Semester Examination;

Text & References:

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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Course structure: Life Sciences-I - Course Code BTB-105

Course Title: Life Sciences-I **Credit Units: 3**

Course Level: UG Level **Course Code: BTB-105**

Course Objectives:

Enable students to understand the characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata and classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Invertebrates	25%
Descriptors/Topics Salient features and outline classification of various phyla of invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).	
Module II Vertebrates	20%
Descriptors/Topics Salient features and outline classification of Phylum Chordataupto order with suitable examples (According to Parker and Haswell latest edition)	
Module III Lower Plants	25%
Descriptors/Topics Systematic: Recent trends in classification of Algae, Fungi, Bryophyte and Pteridophytes. General account: Characteristic features; mode of reproduction and life cycles in Algae; Fungi including Lichens and Mycorrhiza; Bryophyte and Pteridophytes. Economic Importance: Industrial applications; Ecological significance; Importance in agriculture.	
Module IV Higher Plants	30%
Descriptors/Topics Systematics: Elementary knowledge of ICBN: Principles; Rank of taxa, Retention and rejection of names; Type method; Principle of priority; Effective and valid publication; Author Citation. Broad outline of Bentham & Hooker, D.D Pant's classification General account: General characteristic features, Distribution, mode of reproduction and generalised life cycles of Gymnosperms and Angiosperms. Economic Importance: Industrial and ecological importance of Gymnosperms and Angiosperms	

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Student Learning Outcomes:

- Learn about basics of animal and plant kingdom.
- Learn about taxonomy and variability among different groups.
- Enhance collaborative and research outlook.
- Develops awareness for career options in biological sciences.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	10	5	70

Text & References:

- Fundamentals of Environmental Chemistry, G.S.Sodhi, Narosa Publishers.
- Introduction to Environmental Pollution, B.K Sharma, H.Kaur, Goel Publishers.
- Biochemistry Styrier.
  - *Cell Biology, C B Pawar.*
- Biochemistry, Lalinger.
- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.
- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.

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Course structure: APPLIED CHEMISTRY LAB – CHE 121

Course Title: APPLIED CHEMISTRY LAB **Credit Units: 1**

Course Level: UG Level **Course Code: CHE 121**

Course Objectives:

Principles of chemistry relevant to the study of science and engineering have clarity of understanding through experiments. Learning process and learning outcomes get enhanced through experiments relevant to and commensurate with theoretical knowledge. The lab course is designed to teach the students the basics and advanced chemical principles through experiments.
Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields; the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic application of principles.

Course Contents/Syllabus:

List of experiments: [Any 10]

1. Chemical analysis of water for determination of hardness. (2 Hrs)
2. Chemical analysis of water for determination of Alkalinity. (2 Hrs)
3. Chemical analysis of water for determination of residual Chlorine. (2 Hrs)
4. Synthesis of urea - formaldehyde resin. (2 Hrs)
5. Determination of dissolved oxygen in water. (2 Hrs)
6. Determination of surface tension of a given liquid. (2 Hrs)
7. Plant pigments separation by paper chromatography. (2 Hrs)
8. Conductometric titration. (2 Hrs)
9. Determination of water modules of crystallization in Mohr's salt. (2 Hrs)
10. Application of distribution law in the determination of equilibrium constant. (2 Hrs)
11. Determination of amount of Oxalic acid and Sulphuric acid in one litre of solution. (2 Hrs)
12. pH metric titration. (2 Hrs)

Student Learning Outcomes:

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The students will learn to measure molecular/system properties such as:

- Surface tension.
- Viscosity.
- Conductance of solutions.
- Redox potentials.
- Dissolved oxygen, Chloride content of water etc.

Assessment/ Examination Scheme:

Components	**A**	**Mid Term**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

1. Pandey O.P. & et Al. Practical Chemistry (2010), S. Chand New Delhi. ISBN:978-8121908122.
2. Das, Subash Chandra. Advanced practical chemistry, 3/e rev. / Kolkata Quality Printing 2003
3. Vogel's Quantitative Chemical Analysis. (2009). India: Pearson Education. ISBN 9788131723258
4. S K Bhasin & Sudha Rani. Laboratory Manual on Engineering Chemistry.(2019); Dhanpat Rai Publishing Company. ISBN: 978-8187433132
5. Experiments in Applied Chemistry, Dr. Sunitta Rattan; CATSON Book Publishers.

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PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: CSE 124 **Credit Units: 02**

Total Hours :40

Course Objective:

The purpose of this course is to introduce to students to the field of programming using C language. These students will be able to enhance their analysing and problem solving skills and use the same forwriting programs in C.

List of experiments/demonstrations:

Tutorial 1: Problem solving using computers:**(2 hours)**

Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:**(2 hours)**

Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:**(4 hours)**

Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:**(4 hours)**

Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting**: (4 hours)**

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings**: (4 hours)**

Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value: **(4 hours)**

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):(4 hours)
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls:**(4 hours)**

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation: **(4 hours)**

Lab 11: Pointers and structures

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Tutorial 12: File handling:**(4 hours)**

Lab 12: File operations

Course Outcomes:

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

Examination Scheme:

IA			**EE**			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –Internal Assessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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Course structure: ENGINEERING GRAPHICS LAB- BTB 123

Course Title: Engineering Graphics Lab **Credit Units: 01**

Course level: UG Level **Credit Code: BTB 123**

Course Objective:

This course will provide students concepts on the drawings of different curves like straight line, parabola, ellipse etc. After completion of this course, students will be able to draw different figures manually and will be capable of using various instruments involved in drawings.

Course Contents:

Module I: General (Weightage:15%)

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications.

Module II: Projections of Point and Lines (Weightage:20%)

Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Module III: Planes other than the Reference Planes (Weightage:20%)

Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Module IV: Projections of Plane Figures (Weightage:15%)

Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

Module V: Projection of Solids (Weightage:15%)

Simple cases when solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

Module VI: Development of Surface (Weightage:15%)

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Development of simple objects with and without sectioning. Isometric Projection

Examination Scheme:

Components	Mid Term/Internal Viva	Attendance	Assignment/ Project/Seminar/Quiz	End term/External Viva
Weightage (%)	15	5	10	70

Text & References:

- M.B. Shah & B.C. Rana, Engineering Drawing, Pearson Education, 2007
- PS Gill, Engineering Drawing, Kataria Publication
- ND Bhatt, Engineering Drawing, Charotar publications
- N Sidheshwar, Engineering Drawing, Tata McGraw Hill
- CL Tanta, Mechanical Drawing, “Dhanpat Rai”

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COURSE CURRICULUM

Annexure **'AAB-CD-01a'**

UG- I
Course Title: Communication Skills-I
Credit Units: 1
Course Code: BCU 141

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	

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<table>
<tr><td>5.</td><td>Student Learning Outcomes:
The students should be able to :
• Identify Common Errors and Rectify Them
• Develop and Expand Writing Skills Through Controlled and Guided Activities
• To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.</td><td></td></tr>
<tr><td>6.</td><td>Pedagogy for Course Delivery:
Workshop
Group Discussions
Presentations
Lectures
Extempore</td><td></td></tr>
<tr><td></td><td>Assessment/ Examination Scheme:
<table>
<tr><th>Theory L/T (%)</th><th>Lab/Practical/Studio (%)</th><th>End Term Examination</th></tr>
<tr><td>100%</td><td>NA</td><td>70%</td></tr>
</table>
Theory Assessment (L&T):
<table>
<tr><th>Components (Drop down)</th><td>CIE</td><td>Mid Sem</td><td>Attendance</td><th>End Term Examination</th></tr>
<tr><th>Weightage (%)</th><td>10%</td><td>15%</td><td>5%</td><td>70%</td></tr>
</table></td><td></td></tr>
</table>

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha , Business Communication, Galgotia Publishing Company.***

Additional Reading: Newspapers and Journals

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ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**

Total Hours: 20

Course Objectives:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

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Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.

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- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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MADHYA PRADESH

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Behavioural Science - I

Course Code: BSU-143 **Course Credit: 01**

Course Objective:

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This course aims at imparting an understanding of:

· Understanding self & process of self exploration

· Learning strategies for development of a healthy self esteem

· Importance of attitudes and its effective on personality

· Building Emotional Competency

Course Contents:

Module I: Self: Core Competency (2 Hours)

· Understanding of Self

· Components of Self – Self identity

· Self concept

· Self confidence

· Self image

Module II: Techniques of Self Awareness (2 Hours)

· Exploration through Johari Window

· Mapping the key characteristics of self

· Framing a charter for self

· Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness (2 Hours)

· Meaning

· Importance

· Components of self esteem

· High and low self esteem

· Measuring your self esteem

Module IV: Building Positive Attitude (2 Hours)

· Meaning and nature of attitude

· Components and Types of attitude

· Importance and relevance of attitude

Module V: Building Emotional Competence (2 Hours)

· Emotional Intelligence – Meaning, components, Importance and Relevance

· Positive and negative emotions

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· Healthy and Unhealthy expression of emotions

Student learning outcomes

· Student will Develop accurate sense of self

· Student will nurture a deep understanding of personal motivation

· Student will develop thorough understanding of personal and professional responsibility

· Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

· Organizational Behaviour, Davis, K.

· Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers

· Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books

· Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour

· Dressler, David and Cans, Donald: The Study of Human Interaction

· Lapiere, Richard. T – Social Change

· Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison –

Welsley, US.

· Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.

· LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi

· J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer &

Company

· Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

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Français-I

Course Code: FLU144 **Credit Units: 02**

Course Objective:

Tofamiliarize students with the French language, with its phonetic system and its accents.

Toenable students

- togreet someone inFrench
- topresent anddescribe oneselfandpeople
- toenterincontact,andbegina conversation
- totalkaboutone’sfamily,tastes andpreferences

Course Contents:

Dossiers1,2–pg5-24Dossier1:Toi,moi,nousActesdeCommunication:

S’adresserpolimentàquelqu’un,entrerencontact,seprésenter,présenterquelqu’un,saluer,poserdesquestions

simplespourconnaître quelqu’un,épeleret compter

Dossier2:EnfamilleActesdeCommunication:

Parler de sa famille, Décrire quelqu’un, exprimer ses goûts, écrire et comprendre un message court, inviter

quelqu’un,exprimerla possession,la négation

Grammaire :

1. articles indéfinis,articlesdéfinis, masculinetfémininindesnomset desadjectifs,pluriel desnomset desadjectifs

2. pronomssujetsettoniques,on,c’est/il est+ profession,

3.masculinet fémininindesadjectifsdenationalité

4. verbes-être,avoir,aller,‘er’groupe

5. l’interrogation–l’intonation,est-ce que,quiest-ce ? Qu’est-ce que? L’inversion; où,comment,quand; quel

6. la négation

7. adjectifspossessifs

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Examination Scheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

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APPLIED MATHEMATICS – II

Course Code: BTB 201 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from athematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Linear Algebra

Definition of a Matrix, Operations on Matrices Determinants, Elementary Operations, Reduction of a Matrix to Row Echelon Form, Rank of a Matrix, Consistency of Linear Simultaneous Equations, Gauss Elimination and Gauss Jordan –Method, Eigen values and Eigen Vectors of Matrix, Caley-Hamilton theorem, Diagonalization of a matrix.

Module II: Complex Number

Definition of Complex Number, Equality, Conjugate and Modulus of a Complex Number, Polar form of a Complex Number, De-Moivre's Theorem, Roots of a Complex Number, Exponential and Circular function of a Complex Number, Hyperbolic Functions and their inverses.

Module III: Vector Calculus

Scalar and vector field, Gradient, Divergence and Curl, Directional Derivative, Evaluation of a Line Integral, Green's theorem in plain (without proof), Stoke's theorem (without proof) and Gauss Divergence theorem (without proof)

Module IV: Probability and Statistics

Frequency Distribution, Arithmetic Mean, Median, Partition Values, Mode, Variance and Standard Deviation, Curve Fitting, Principle of least squares, Linear regression.

Introduction to Probability, Addition and Multiplication theorem of Probability, Random variables and Probability Distribution,Expected values, Binomial distribution, Poisson distribution and Normal.

Distribution and their Applications.

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Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Higher Engineering Mathematics by H.K. Dass

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APPLIED PHYSICS - I

Course Code: PHY-101 **Credit Units: 04**

Credit hours: 40hrs.

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering

Course Contents:

Module I: Electromagnetics (10hrs)

Scalar and vector fields, gradient of a scalar field, physical significance of gradient, equipotential surface. Line, surface and volume integrals, Divergence and curl of vector field and mathematical analysis physical significance, Electric flux, Gauss' law, Proof and Applications, Gauss divergence and Stokes theorems.

Differential form of Gauss' Law, Amperes' Law, Displacement current, Faradays Law, Maxwell equations in free space & isotropic media (Integral form & differential form), EM wave propagation in free space, Poynting vector.

Module II: Special Theory of Relativity (10hrs)

Michelson-Morley experiment, Importance of negative result, Inertial & non-inertial frames of reference, Einstein's postulates of Special theory of Relativity, Space-time coordinate system, Relativistic Space Time transformation (Lorentz transformation equation), Transformation of velocity, Addition of velocities, Length contraction and Time dilation, Mass-energy equivalence (Einstein's energy mass relation) & Derivation of Variation of mass with velocity,

Module III: Wave Mechanics (10hrs)

Wave particle duality, De-Broglie matter waves, phase and group velocity, Heisenberg uncertainty principle, wave function and its physical interpretation, Operators, expectation values. Time dependent & time independent Schrödinger wave equation for free & bound states, square well potential (rigid wall), Step potential.

Module IV : Semiconductor and Electronic Materials (10hrs)
Band Theory of Solids, Semi-conductors: Intrinsic and Extrinsic, Carreir concentration, Direct and indirect band- gaps, Types of Electronic materials, p-n Junction Diode,Diode Equat Breakdown in p-n Junction Diode: Avalanche and Zener, Zener Diode and its applic photoconductivity and photovoltaics.
Superconductivity, Meissner Effect, Type I and Type II Superconductors

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Course Outcomes:

After successful completion of the course students will have the knowledge and skill to:

- Apply vector calculus to static electric-magnetic fields in different engineering situations.
- Analyze andApply Maxwell's equation to diverse engineering problems.
- Relate semiconductor material properties to semiconductor devices.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Physics of waves, W. C. Elmore & M. A. Heald
- Introduction to Electrodynamics, D. J. Griffith
- Engineering Physics, Satya Prakash
- Concept of Modern Physics, A. Beiser
- Solid State Physics, S. O. P.

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OBJECT ORIENTED PROGRAMMING USING C++

Course Code: CSE 204 **Credit Units: 03**

Total Hours: 30

Course Objective:

The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Module I: Introduction (6 hours)

Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts:Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module 2: Classes and Objects (7 hours)

Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module 3: Inheritance (6 hours)

Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hierarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module 4: Polymorphism (6 hours)

Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module 5: Strings, Files and Exception Handling (5 hours)

Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators.

Examination Scheme:

Components	A	CT	S/V/Q/HA	EE
Weightage (%)	5	15	10	70

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CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Course Outcomes:

At the end of this course, students will demonstrate ability to:

- To apply concepts of classes and objects in real world scenarios.
- Understand object-oriented programming features in C++,
- Apply these features to program design and implementation,
- Understand object-oriented concepts and how they are supported by C++,
- Gain some practical experience of C++.

Text & References:

Text:

• A.R.Venugopal, Rajkumar, T. Ravishanker “Mastering C++”, TMH, 1997

• R. Lafore, “Object Oriented Programming using C++”, BPB Publications, 2004.

• “Object Oriented Programming with C++” By E. Balagurusamy.

• Schildt Herbert, “C++: The Complete Reference”, Wiley DreamTech, 2005.

References:

• Parasons, “Object Oriented Programming with C++”, BPB Publication, 1999.

• Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication, 2002.

• Yashwant Kanethkar, “Object Oriented Programming using C++”, BPB, 2004

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Basic Electrical Engineering

Course Code: ECE - 101 **Credit Units: 03**

Course Objective:

The objective of the course is to provide a brief knowledge of Electrical Engineering to students of all disciplines. This Course includes some theorems related to electrical, some law's related to flow of current, voltages, basic knowledge of Transformer, basic knowledge of electromagnetism, basic knowledge of electrical network.

Module 1:

DC Circuits (7 hours) Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's and Norton's Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2:

AC Circuits (7 hours) Representation of sinusoidal waveforms, peak and R.M.S. values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Module 3:

Transformers (6 hours) Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4:

Electrical Machines (6 hours) Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5:

Power Converters (4 hours) DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Course Outcomes:

- To understand and analyze basic electric and magnetic circuits.

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- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations.

Examination Scheme:

Components A CT S/V/Q/HA EE Weightage (%) 5 15 10 70 CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering” , Tata McGraw Hill, 2010.
- D. C. Kulshreshtha, “ Basic Electrical Engineering”, McGraw Hill, 2009.
- L. S. Bobrow, “ Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
- E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
- V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course structure: Life Sciences-II- Course Code BTB-206

Course Title: Life Sciences-II Credit Units: 3
Course Level: UG Level Course Code: BTB-206

Course Objectives:

•Enable students to provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals.

•Helpful to understand the variations from one class to another. Moreover paper will provide knowledge of various physiological activities of higher plants which will help them to understand the various profiles of modern biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Anatomy & Physiology of Rabbit	25%
Descriptors/Topics • Integumentary system • Skeletal System: Girdles only • Digestive system • Respiratory System	
Module II Anatomy & Physiology of Rabbit	25%
Descriptors/Topics • Circulatory System: Heart and Aortic Arches only • Nervous System; Brain only • Endocrine System • Urinogenital System	
Module IIIPlant Physiology-I	25%
Descriptors/Topics Plant-water Relations: Importance of water to plant life; physical properties of water; Imbibition, Diffusion, Osmosis and Plasmolysis; absorption and transport of water; transpiration-types, physiology of stomata, factors affecting transpiration, importance of transpiration. Transport of Organic Substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation; Plant Hormones.	
Module IV Plant Physiology-II	25%
Descriptors/Topics Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration. Respiration: Seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening.	

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Student Learning Outcomes:

•Develops knowledge of animal and plant physiological aspects.
•Deals with functioning of systems in both animals and plants.
•Acts as useful tool for further research and innovation.
•Develops collaborative and innovative approach.
•Creates verbal and written communication skills in subject.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
  Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
  Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing Hours.

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APPLIED PHYSICS LAB - I

Course Code: PHY121 **Credit Units: 01**

Credit Hours:20hrs.

Course Objective

To provide detailed introduction to the principal class of semiconductor and electronics components

Time allocated for experiments No.1-10 is 2 hours each.

List of Experiments:

1. To determine the forbidden band gap energy of a semiconductor.
2. To determine the frequency of AC mains using sonometer.
3. To determine the value of specific charge (ratio of e/m) of an electron by Thomson method.
4. To study the common base characteristics of a PNP junction transistor, by drawing input characteristic curves and output characteristic curves.
5. To study the common emitter characteristics of a NPN junction transistor, by drawing input characteristic curves and output characteristic curves.
6. To study a series /parallel resonant LCR circuit, its resonate frequency and quality factor
7. To study the voltage regulation characteristics of a zener diode.
8. To study the characteristics of a solar cell.
9. To draw V – I characteristics of a photocell and to verify the inverse square law of radiation.
10. To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.

Course Outcomes: After completion of course student will develop: Practical understanding andapplications of fundamental concept of classical and modern Physics.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**EE**
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

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OBJECT ORIENTED PROGRAMMING USING C++ LAB

Course Code: CSE 224 **Credit Units: 01**
Total Hours: 20

Course Objective:

To perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members.
SOFTWARE REQUIRED: TURBO C++

Lab assignment will be based on the following: (20 Hours)

1. [Classes and Objects] Write a program that uses a class where the member functions are defined inside a class. **(1Hours)**
2. [Classes and Objects] Write a program that uses a class where the member functions are defined outside a class. **(1Hours)**
3. [Classes and Objects] Write a Program to Demonstrate Inline functions. **(1Hours)**
4. [Classes and Objects] Write a Program to Demonstrate Friend function, classes and this pointer. **(1Hours)**
5. [Constructors and Destructors] Write a program to demonstrate the use of zero argument and parameterized
constructors. **(2Hours)**
6. [Operator Overloading] Write a program to demonstrate the overloading of increment and decrement
operators. **(2Hours)**
7. [Inheritance] Write a program to demonstrate the single inheritance. **(1Hours)**
8. [Inheritance] Write a program to demonstrate the multiple inheritance. **(1Hours)**
9. [Inheritance] Write a Program to demonstrate use of protected members, public & private protected classes, multilevel inheritance etc. **(1Hours)**
10. [Polymorphism] Write a program to demonstrate the runtime polymorphism. **(1Hours)**
11. [Exception Handling] Write a program to demonstrate the exception handling. **(2Hours)**
12. [Templates and Generic Programming] Write a program to demonstrate the use of function template. **(2Hours)**
13. [Templates and Generic Programming] Write a program to demonstrate the use of class template. **(2Hours)**
14. [File Handling] Write a Program to Show how file management is done in C++. **(2Hours)**

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Examination Scheme:

IA			**EE**			
A	**PR**	**Practical Based Test**	**Major Experim ent**	**Minor Experim ent**	**Practical Record**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Course Outcome:

At the end of this course, students will demonstrate ability to:

- knowledge of the structure and model of the C++ programming language, (knowledge)
- evaluate user requirements for software functionality required to decide whether the C++ programming language can meet user requirements (analysis)
- design the object-oriented programs for real world problems.

Text & References:

Text:

• A.R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997
• R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.
• "Object Oriented Programming with C++" By E. Balagurusamy.
• Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.

References:

• Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
• Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.
• Yashwant Kanethkar, "Object Oriented Programming using C++", BPB, 2004.

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BASIC ELECTRICAL ENGINEERING LAB

Course Code: ECE 121 Credit Units: 01

List of experiments/demonstrations:

1.Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

2.To verify KVL & KCL in the given network.

3.To verify Superposition Theorem.

4.To verify Maximum Power Transfer Theorem.

5.Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

6.Torque Speed Characteristic of separately excited dc motor.

7.To determine and verify RTh, VTh, RN, IN in a given network.

8.To perform open circuit & short circuit test on a single-phase transformer.

9.To study transient response of a given RLC Circuit

10. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT Switchgear.

Laboratory Outcomes:

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

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Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

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COMMUNICATION SKILL-II

<u>COURSE URRICULUM</u>

UG: Semester II
Course Title: Communication Skills II
Course Code: BCU 241

Credit Units: 1

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	
4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography,* Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	

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5. Student Learning Outcomes:

The students should be able to :

- Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment

6. Pedagogy for Course Delivery:

- Extempore
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	50%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	30%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.***
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin

Reference: ***K.K.Sinha , Business Communication, Galgotia Publishing Company.***
Alan Pease : Body Language

Additional Reading: Newspapers and Journals

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ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**

Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studiesz

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Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)

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- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and

Standards, Vol I and II, Enviro Media (R)

- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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Behavioral Science - II

Course Code: BSU-243 **Course Credit: 01**

Total Hours: 10

Course Objective:

This course aims at enabling students towards:

·Understand the importance of individual differences

· Better understanding of self in relation to society and nation

· Facilitation for a meaningful existence and adjustment in society

· Inculcating patriotism and national pride

Course Contents:

Module I: Individual differences & Personality **(2 Hours)**

· Personality: Definition& Relevance

· Importance of nature & nurture in Personality Development

· Importance and Recognition of Individual differences in Personality

· Accepting and Managing Individual differences

· Intuition, Judgment, Perception & Sensation (MBTI)

· BIG5 Factors

Module II: Managing Diversity **(2 Hours)**

· Defining Diversity

· Affirmation Action and Managing Diversity

· Increasing Diversity in Work Force **(2 Hours)**

· Barriers and Challenges in Managing Diversity

Module III: Socialization

· Nature of Socialization

· Social Interaction

· Interaction of Socialization Process Contributions to Society and Nation

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Module IV: Patriotism and National Pride **(2 Hours)**

· Sense of pride and patriotism·
Importance of discipline and hard work · Integrity and accountability

Module V: Human Rights, Values and Ethics **(2 Hours)**

Meaning and Importance of human rights

· Human rights awareness

· Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

§Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions

§Student will be able to understand and respect individual difference, so to enhance the relationship §Learn social responsibility and develop a sense of citizenship

§Student will be able to identify and understand the impact of culture on one's leadership style

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

·Davis, K. Organizational Behaviour,

·Bates, A. P. and Julian, J.: Sociology - Understanding SocialBehaviour

·Dressler, David and Cans, Donald: The Study of Human Interaction

.·Lapiere, Richard. T – Social Change

·Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.

·Rose, G.: Oxford Textbook of Public Health,
Vol.4, 1985. Robbins O.B.Stephen;.
Organizational Behaviou

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Français-II

Course Code: FLU244 **Credit units: 02**

Course Objective:

Tofurnishthelinguistictools

- totalkaboutdailyactivitiesand sports,toexpressnecessities
- totalkaboutactivitiesinrecent future,
- tohave conversationsandperform daytodaylife taskslike enquiringabouttime,take anappointment
- toenquire aboutproductsandplace orders ina shop/ restaurant.

Course Contents:

Dossiers3,4–pg25-44 Dossier3:Quelle journée! ActesdeCommunication:

Parlerdesesactivitésquotidiennes,sesituerdansletemps,demanderl'heureetladate,parlerdessports etdes

loisirs,exprimerla fréquence

Dossier4:Vousdésirez?ActeeCommunication:

Exprimerlaquantité,demanderetdonnerleprix,exprimerlanécessité,lavolontéetlacapacité,compar eret

exprimersespréférences, s'exprimer au futur proche, prendrerendez-vous, s'exprimer aurestaurant/dansles magasins

Grammaire :

1. l'expressiondutemps
2. lesarticlescontractés,lesquantités indéterminéeset déterminées
3. lesadverbesde fréquences
4. verbes-faire,prendre,venir,pouvoir,vouloir,lesverbespronominaux
5. lacomparaisondel'adjectif
6. la négation(suite)
7. lefutureproche

Examination Scheme:

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	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.<u>A proposA1Livre del'élève</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.<u>A proposA1Cahierd'exercices</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.<u>Réussirle DELFA1.</u>Paris: Didier,2010.

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Course structure: Cell Biology- Course Code BTB-301

Course Title: Cell Biology | Credit Units: 3
Course Level: UG Level | Course Code: BTB-301

Course Objectives:

Cell biology plays a central role to connect the different fields of biotechnology which is highly interdisciplinary. It incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The object of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics •The cell theory, pre cellular evolution, prokaryotic and eukaryotic cells.	
Module II Anatomy & Physiology of Rabbit	15%
Descriptors/Topics •Cell cycle - molecular events, cell division, mitosis and meiosis	
Module III	15%
Descriptors/Topics Cellular organelles - structure and function of cell wall, plasma membrane nucleus, Mitochondria, Chloroplast, Nucleus,lysosomes, peroxisomes, golgi bodies, and transport across membranes.	
Module IV	15%
Descriptors/Topics Cell locomotion- cytoskeleton, structure and function of cilia and flagella	
Module V	15%
Descriptors/Topics Cellular signaling –general mechanism of signaling and structures of the various types of receptors.	
Module VI	15%
Descriptors/Topics Types of cancer, etiology of cancer, metastasis, cytological role of p53 and p21 genes in cancer development.	
Module VII	10%
Descriptors/Topics Apoptosis	

Student Learning Outcomes:

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- Understand and explain the cell theory origin of life, and evolution.
- Understand the cell cycle, regulatation and checkpoints' in the cell-cycle.
- Understand structure of cell membranes, transport of solutes across cell membranes.
- Learn structure and function of the cell cytoskeleton, cilia and flagella.
- Understand mechanism of signaling and receptors involved in signaling process.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmilian
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.

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Course structure: Biochemistry-I- Course Code BTB-302

Course Title: Biochemistry-I Credit Units: 3
Course Level: UG Level Course Code: BTB-302

Course Objectives:

Enable students to understand of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics • Introduction aims and scope Chemical foundations of Biology -Properties of water, acids, bases and buffers, covalent bonds, Non-covalent interactions in biological systems.	
Module II	20%
Descriptors/Topics Introduction to biomolecules - Carbohydrates -Sugars; Polysaccharides Lipids -classification, structure and function. Lipids and biological membranes, Lipid linked proteins and lipoproteins, Atherosclerosis.	
Module III	20%
Descriptors/Topics Metabolism and bioenergetics -First and second law, free energy and chemical equilibrium, Organic reaction mechanisms, Design of metabolism-concept of free energy, ATP-ADP cycle. Cellular energy transactions -role of mitochondria and chloroplast	
Module IV	20%
Descriptors/Topics Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondrion and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway	
Module V	20%
Descriptors/Topics Lipid metabolism -Lipid digestion, absorption and transport, fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism. Cholesterol and Arachidonic Acid metabolism, Phospholipids, Sphingolipids and Glycolipids.	

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Student Learning Outcomes:

- Understand and explain the cell theory origin of life, and evolution.
- Understand the cell cycle, regulatation and checkpoints' in the cell-cycle.
- Understand structure of cell membranes, transport of solutes across cell membranes.
- Learn structure and function of the cell cytoskeleton, cilia and flagella.
- Understand mechanism of signaling and receptors involved in signaling process.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.

Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

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Course structure: Microbiology- Course Code BTB-303

Course Title: Microbiology Credit Units: 4
Course Level: UG Level Course Code: BTB-303

Course Objectives:

•The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	
Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization	15%
Module II	
Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, Fed batch culture, continuous culture, culture collection and maintenance of cultures.	15%
Module III	
Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.	10%
Module IV	
Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).	15%
Module V	
Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophilesViruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.	15%
Module VI	
Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.	15%

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Module VII	
Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics - penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.	15%

Student Learning Outcomes:

- Understand the microbiological techniques for the isolation and characterization of microbes.
- Understand the mechanism of different metabolic processes.
- Know the physiology and survival mechanism of extremophilic bacteria.
- Know the concept of virus lytic and lysogenic cycle is quite clear to students.
- Understand the epidemiology and microbial pathogenesis.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC.Brown Publisher.

Dwivedi

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Course structure: Molecular Biology- Course Code BTB-304

Course Title: Molecular Biology Credit Units: 4
Course Level: UG Level Course Code: BTB-304

Course Objectives:

•The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I DNA Replication and repair	15%
Descriptors/Topics Nucleic Acid Structure and Functions, Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA replication, DNA repair Mechanism.	
Module II Transcription	15%
Descriptors/Topics Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements.	
Module IIIModifications in RNA	15%
Descriptors/Topics 5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.	
Module IV Translation	20%
Descriptors/Topics Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation, co-and post-translational modifications of proteins.	
Module V Regulation of Gene Expression in prokaryotic and eukaryotic systems	15%
Descriptors/Topics Lac operon, Araoperan, regulation in Eukaryotes, Epigenetics	
Module VIAntisense and Ribozyme technology	20%
Descriptors/Topics Molecular mechanism of antisense molecules, inhibition of spilicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of Ribozyme; Hammerhead, hairpin and other ribozymes, strategies for designing ribozymes, applications of antisense and ribozyme technologies	

Student Learning Outcomes:

- Learn about the mechanism of replication of DNA in prokaryotes and eukaryotes.
- Learn and compare the mechanism of transcription in prokaryotes and eukaryotes.
- Learn the various post-transcriptional processes in cell.
- Learn about the mechanism of protein synthesis in prokaryotes and eukaryotes.
- Understand about gene expression regulation and various mechanisms of gene silencing

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Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell. B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing
- Gene VIII, Benjamin Lewin 2005, Oxford University Press

References:

- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.

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Course structure: DATA STRUCTURES THROUGH C++ (CSE 202)

Course Title: DATA STRUCTURES THROUGH C++ **Credit Units: 3**

Course Level: UG Level **Course Code: CSE 202**

Course Objectives:

To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures. To understand the notations used to analyze the Performance of algorithms. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations. To choose an appropriate data structure for a specified application. To understand and analyze various searching and sorting algorithms. To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

Pre-requisites: Understand basics of C & C++ language Concepts thoroughly.

Course Contents/Syllabus:

	Weightage (%)
Module I Introduction to C++	**20%**
Descriptors/Topics 1 C++ Programming Concepts: Review of C, input and output in C++, functions in C++- value parameters, reference parameters, Parameter passing, function overloading, function templates, Exceptions-throwing an exception and handling an exception, arrays, pointers, new and delete operators, class and object, access specifiers , friend functions, constructors and destructor, Operator overloading, class templates, Inheritance and Polymorphism. 2 Basic Concepts - Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Complexity Analysis Examples, Introduction to Linear and Non Linear data structures.	
Module II Introduction to DS	**20%**
Descriptors/Topics 1. Representation of single, two dimensional arrays, sparse matrices-array and linked representations.	

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2. Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion. 3. Stack ADT, definition, array and linked implementations, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition, array and linked Implementations, Circular queues-Insertion and deletion operations.	
Module III TREES	**20%**
1. Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees, Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap. 2. Minimum Spanning Tree: Prim's and Kruskal's Algorithm, Shortest Path Algorithms.	
Module IV SEARCHING & SORTING	**20%**
Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods. Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort, Comparison of Sorting methods.	
Module V GRAPHS	**20%**
1. Graphs–Definitions, Terminology, Applications and more definitions, Properties, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis, 2. Search Trees-Binary Search Tree ADT, Definition, Operations-Searching, Insertion and Deletion, Balanced search trees-AVL Trees-Definition and Examples only, B-Trees- Definition and Examples only, Red-Black Trees-Definitions and Examples only, Comparison of Search Trees.	

Student Learning Outcomes:

Ability to choose appropriate data structures to represent data items in real world problems.

Ability to analyze the time and space complexities of algorithms.

Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.

Able to analyze and implement various kinds of searching and sorting techniques.

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Pedagogy for Course Delivery: The learning/teaching/working methods involved include lectures, open and closed labs, team work, design project, peer reviewing, an experimental project, and writing a scientific article. We give our arguments for applying these methods,

What is their role from the pedagogical point of view, and discuss the experiences **Assessment/ Examination Scheme:**

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

Note: A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text & References Reading:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd.
- Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference:

- Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
- Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

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Course structure: Cell Biology Lab- Course Code BTB-320

Course Title: Cell Biology Lab   Credit Units: 1
Course Level: UG Level   Course Code: BTB-320

Course Objectives:

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics • Microscopy: Light microscopy, Bright field, Phase contrast &Gram's staining.	
Module II	20%
Descriptors/Topics • Study of chromoplasts, chloroplast in plant cell.	
Module III	20%
Descriptors/Topics Mitosis and Meiosis	
Module IV	20%
Descriptors/Topics Study of permanent slides of types of cancer	
Module V	20%
Descriptors/Topics Study of apoptosis	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: Biochemistry Lab-I- Course Code BTB-321

Course Title: Biochemistry Lab-I Credit Units: 1
Course Level: UG Level Course Code: BTB-321

Course Objectives: The course aims on understanding of the different assays for the presence of different biomolecules such as, carbohydrates, lipids etc. Students will also have understanding of presence of common adulterants in some samples.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Colorimetric determination of pK.	
Module II	40%
Colour reactions of sugars. (Molischs test, iodine test, Saliwanoff test, Fehlings test, Benedicts test, Bials test). Quantitative test for Carbohydrate & Protein. Colour based tests for the identification of common adulterants	
Module III	40%
Cholesterol estimation Estimation of free fatty acids Estimation of iodine number.	

Student Learning Outcomes:
Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation
List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: Microbiology Lab- Course Code BTB-322

Course Title: MicrobiologyLab Credit Units: 1
Course Level: UG Level Course Code: BTB-322

Course Objectives:

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	10%
Descriptors/Topics 1. Preparation of solid and liquid media.	
Module II	10%
Descriptors/Topics Isolation and maintenance of organisms by plating, streaking and serial dilution.	
Module III	10%
Descriptors/Topics Preparation of slant cultures.	
Module IV	10%
Descriptors/Topics Growth curve measurement of bacterial population by turbidometry.	
Module V	10%
Descriptors/Topics Measurement of bacterial population by dilution method.	
Module VI	10%
Descriptors/Topics Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.	
Module VII	10%
Descriptors/Topics Microscopic examination of bacteria by gram staining.	
Module VIII	10%
Descriptors/Topics Endospore staining	
Module IX	10%
Descriptors/Topics Capsule staining.	
Module X	10%
Descriptors/Topics Isolation and identification of Rhizobium from root nodules	

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Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: Molecular Biology Lab- Course Code BTB-323

Course Title: Molecular Biology Lab	Credit Units: 1
Course Level: UG Level	Course Code: BTB-323

Course Objectives: The course aims on understanding of the methods of extraction of nucleic acids and proteins from prokaryotes and eukaryotes. Also, students will learn about restriction digestion and ligation.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Preparation of DNA: genomic, Plasmid	30%
Module II Isolation of RNA & Isolation of Proteins	15%
Module III RFLP analysis	10%
Module IV Agarose Gel Electrophoresis, Gel filtration	15%
Module V Preparation of Competent Cells	15%
Module VI Restriction Digestion and Ligation of DNA	15%

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: DATA STRUCTURES THROUGH C++ LAB(CSE 222)

Course Title: DATA STRUCTURES THROUGH C++LAB **Credit Units: 1**

Course Level: UG Level **Course Code: CSE 222**

Course Objectives:

To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures. To understand the notations used to analyze the Performance of algorithms. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations. To choose an appropriate data structure for a specified application. To understand and analyze various searching and sorting algorithms. To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

Pre-requisites: Understand basics of C & C++ language Concepts thoroughly.

Course Contents/Syllabus:

	Weightage (%)
Module I Introduction to C++	**20%**
Descriptors/Topics 1.Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array. 2. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members. 3.Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary). 4.Write a C++ to illustrate the concepts of console I/O operations. 5.Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels. 6.Write a C++ program to allocate memory using new operator.	
Module II Introduction to DS	**20%**
Descriptors/Topics 1.Write a C++ program that uses stack operations to convert a given infix expression into its postfix equivalent, Implement the stack using an array. 2.Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers.	

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b) Search for an integer key in the above binary search tree non recursively. c) Search for an integer key in the above binary search tree recursively. 3.Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers. b) Search for an integer key in the above binary search tree non recursively. c) Search for an integer key in the above binary search tree recursively. 4.Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers. b) Search for an integer key in the above binary search tree non recursively. c) Search for an integer key in the above binary search tree recursively. 5.Write a C++ program to implement a double ended queue ADT using an array,using a doubly linked list. 6.Write a C++ program that uses functions to perform the following: a) Create a singly linked list of integers. b) Delete a given integer from the above linked list. c) Display the contents of the above list after deletion. 7.Write a template based C++ program that uses functions to perform the following: a) Create a doubly linked list of elements. b) Delete a given element from the above doubly linked list. c) Display the contents of the above list after deletion.	
Module III TREES	**20%**
1.Write a C++ program that uses functions to perform the following: a) Create a binary search tree of characters. b) Traverse the above Binary search tree recursively in preorder, in order and post order. 2.Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers. b) Traverse the above Binary search tree non recursively in inorder. 3.Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers. b) Search for an integer key in the above binary search tree non recursively. c) Search for an integer key in the above binary search tree recursively. 4. Programs to implement Tree Traversals on Binary Trees 5. Programs to implement operations on AVL Trees	
Module IV SEARCHING & SORTING	**20%**
1. Write a C++ program that uses function templates to perform the following: a) Search for a key element in a list of elements using linear search. b) Search for a key element in a list of sorted elements using binary search.	

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2. Write a template based C++ program that implements selection sort algorithm to arrange a list of elements in descending order. 3. Write a C++ program that implements Merge sort algorithm for sorting a list of integers in ascending order 4. Write a C++ program that implements Heap sort algorithm for sorting a list of integers in ascending order. 5. Write a template based C++ program that implements Quick sort algorithm to arrange a list of elements in ascending order. 6. Write a C++ program that implements Insertion sort algorithm to arrange a list of integers in ascending order. 7. Write a C++ program that implements Radix sort algorithm for sorting a list of integers in ascending order.	
Module V GRAPHS	**20%**
3. To find the BFS and DFS of the given graph 4. Program to create a graph and use Deapth First Search(DFS) 5. Graph Representation through Multi List Implementation 6. Write a C++ program to implement all the functions of a dictionary (ADT) 7. Program to implement Hashing	

Student Learning Outcomes:

- Ability to choose appropriate data structures to represent data items in real world problems.
- Ability to analyze the time and space complexities of algorithms.
- Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
- Able to analyze and implement various kinds of searching and sorting techniques.

Pedagogy for Course Delivery: The learning/teaching/working methods involved include lectures, open and closed labs, team work, design project, peer reviewing, an experimental project, and writing a scientific article. We give our arguments for applying these methods, what is their role from the pedagogical point of view, and discuss the experiences

Assessment/ Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

Note: A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text Reading:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd.
- Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mo Wiley student edition, John Wiley and Sons.

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Reference Reading:

- Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
- Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

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COMMUNICATION SKILL-III

UG: Semester III
Course Title: Communication Skills-III
Credit Units: 1
Course Code: BCU 341

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective:
To emphasize the essential aspects of effective written communication necessary for professional success.
Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary**	**35% Weightage**
	• Spellings • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	
2.	**Module II Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV Literature**	**10% Weightage**
	• Stench of Kerosene-Amrita Pritam (Short Story) • A Flowering Tree-A.K. Ramanujan (Short Story) • The Gift of the Magi- O. Henry (Short Story) • Indian Weavers – Sarojini Naidu (Poem)	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	

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7.

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.***

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: ***Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press*.**

Additional Reading: Newspapers and Journals

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Course Code: BS

Course Credit: 0

Behavioural Science – III

Course Objective:

To enable the students:

· Understand the process of problem solving and creative thinking.

· Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving (2 Hours)

· What is thinking: The Mind/Brain/Behavior

· Critical Thinking and Learning:

- Making Predictions and Reasoning

- Memory and Critical Thinking

- Emotions and Critical Thinking

· Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)

· Perception

· Expression

· Emotion

· Intellect

· Work environment

Module III: Problem Solving (2 Hours)

· Recognizing and Defining a problem

· Analyzing the problem (potential causes)

· Developing possible alternatives

· Evaluating Solutions

· Resolution of problem

· Implementation

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· Barriers to problem solving:

- Perception

- Expression

- Emotion

- Intellect

- Work environment

Module IV: Plan of Action (2 Hour)

· Construction of POA

· Monitoring

· Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)

· Definition and meaning of creativity

· The nature of creative thinking

- Convergent and Divergent thinking

- Idea generation and evaluation (Brain Storming)

- Image generation and evaluation

- Debating

· The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes

§ Student will be able to understand and solve the problems effectively in their personal and professional life.

§ Students will outline multiple divergent solutions to a problem,

§ Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Tota

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Weightage (%)	**5**	**10**	**15**	**70**	**100**

Suggested Readings:

·Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999 ·Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999

·Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998. ·Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996

·J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company

·Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

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Français-III

Course Code: FLU344 **Credit Units:02**

Course Objective:

Toenablethe students

- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

Course Contents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin, indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage, sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.

Grammaire :

1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupasscomposé
5. les indicateursdetemps(il ya,depuis)

Examination Scheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	

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Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.

Dwivedi

Prof. (Dr.) Vinay Dwivedi
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TERM PAPER

Course Code: BTB 330 **Credit Units: 02**

METHODOLOGY

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.

b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.

f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include de of possibilities for related future research

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10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.

[2] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach,

research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

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Course structure: Biochemistry-II- Course Code BTB-401

Course Title: Biochemistry-II Credit Units: 4
Course Level: UG Level Course Code: BTB-401
Course Objectives:
•The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	35%
Proteins -Amino acids and peptides - classification, chemical reactions and physical properties. Introduction to protein structure and function. Cis-trans peptide bond formation. Glycoproteins -structure and function, *Vitamins and Coenzymes*: structure and function of water soluble vitamins. Enzymes -Introduction to kinetic and catalytic mechanisms of enzymes; Regulation of enzyme activity; Effects of physical parameters on enzyme activity, enzyme inhibitors – types of inhibition.	
Module II Anatomy & Physiology of Rabbit	10%
Nucleic acids - nitrogenous bases, nucleotides, types, structure and properties of nucleic acids	
Module III	30%
Amino acid metabolism -Amino acid deamination, urea cycle, biosynthesis and breakdown of nutritionally non-essential amino acids (asparagines, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine, Tyrosine, Disorders of amino acid metabolism, Specialized Products of Amino Acids, Nitrogen fixation	
Module IV	25%
Nucleotide Metabolism -structure and metabolism of purines and pyrimidines, biosynthesis of nucleotide coenzymes (NAD, NADP, FAD, FMN; Catabolism of heam and clinical significance of bilirubin.	

Student Learning Outcomes:

- Understand relationships between structure and functions Amino acids and Proteins.
- Learn the concept of Enzymes, their mode of action and regulation.
- Understand the structure and properties of Nucleic acids – DNA and RNA.
- Learn and understand the amino acid metabolism.
- Understand the metabolism of purines and pyrimidines in the body.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

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Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

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Course structure: Genetics- Course Code BTB-402

Course Title: Genetics Credit Units: 4
Course Level: UG Level Course Code: BTB-402

Course Objectives:

•The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular and population genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology.
Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics The science of genetics -introduction, history, classical and molecular genetics, role of genetics in medicine, agriculture and society.	
Module II	25%
Descriptors/Topics Mendelian inheritance and its applications, Mendelian principles in human genetics and in agriculture. Extension of Mendelism - Allelic variations, influence of environment on expression, penetrance and expressivity, epistasis, pleiotropy. Chromosomal basis of inheritance; sex linkage,, crossing over and chromosome mapping in eukaryotes.	
Module III	15%
Descriptors/Topics Numerical changes and structural changes in chromosomes with emphasis on human disease/syndromes/plant breeding and genetic counseling.	
Module IV	15%
Descriptors/Topics Mutation and mutagenic agents, types of mutations, economic importance of mutation	
Module V	15%
Descriptors/Topics Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon &nutron) Benzer's work on r II locus in T_2 bacteriophage	
Module VI	15%
Descriptors/Topics Hardy- Weinburg Law and its deviations	

Student Learning Outcomes:

- Develops knowledge about the basic principles of genetics.
- Learn about concepts of classical, molecular and population genetics.
- Develops knowledge of genes and gene interactions.
- Learn about mutations and chromosomal aberrations.
- Understand role of genetic techniques in pharmaceutical industries.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students encouraged to engage in active interaction during classroom discussion on topic.

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List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genetics, P.K. Gupta, Rastogi Publication
- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education

References:

- Genetics, M.W. Strickberger, Prentice Hall College Division
- Genetics, P.J.Russell, Benjamin/Cummings
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.
- Genetics, R. Goodenough, International Thomson Publishing
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing

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Course structure: METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY-

Course Title: METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY
Course Code BTB-403
Credit Units: 3
Course Level: UG Level Course Code: BTB-403

Course Objectives:

•The students will be exposed to techniques and instruments that are used in biotech industries.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Electrophoresis	25%
Descriptors/Topics Agarose Gel electrophoresis, PAGE, SDS-PAGE, isoelectric focusing, two-dimensional electrophoresis, immuno electrophoresis, capillary electrophoresis	
Module II Chromatography	25%
Descriptors/Topics Paper, TLC, gel filtration, ion-exchange chromatography, affinity chromatography, HPLC and GLC.	
Module III Spectroscopy	30%
Descriptors/Topics UV and visible spectroscopy,Infrared and Atomic absorption spectroscopy, fluorescence spectroscopy, Mass Spectrometry, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy.	
Module IV	20%
Descriptors/Topics X-ray diffraction and X-ray Crystallography	

Student Learning Outcomes:

- know electrophoresis and their different types and their application.
- know chromatography techniques and their different types and their application.
- Understand different types of spectroscopes and their application analysis.
- Learn about the X-Ray crystallography and diffraction technique.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.

NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wi

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Course structure: Chemical Biology **Course Code BTB-404**

Course Title: Chemical Biology Credit Units: 3
Course Level: UG Level Course Code: BTB-404

Course Objectives:

•Chemical biology is that branch of life science, which deals with the study and manipulation of biological systems through the application of chemical techniques and tools. It differs from the more traditional disciplines of chemistry and biology in its emphasis on integrating a wider series of experimental techniques, ranging from synthetic organic chemistry, to biochemistry, to structural, molecular, and cellular biology. Chemical biology has historical and philosophical roots in medicinal chemistry, supramolecular chemistry (particularly host-guest chemistry), bioorganic chemistry, pharmacology, genetics, biochemistry and metabolic engineering.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Principles of chemical biology	35%
Descriptors/Topics Chemistry of carbohydrates, proteins and nucleic acids, strategies for identifying the cellular target ofphysiologically active natural products (paclitaxel, vancomycin), chemical aspects of signal transduction	
Module II Chemical reactions in living systems	35%
Descriptors/Topics Introduction to enzyme chemistry, Group transfer reactions, Substitutions, Carboxylation and decarboxylation,Isomerases, Eliminations and additions, Redox reactions (1), Redox reactions (2), Aldol and Claisen Reactions,One-carbon transfer reactions, Rearrangements	
Module IIIStructural chemical biology	30%
Descriptors/Topics Purine biosynthesis, polyamide biosynthesis, thiamine biosynthesis, vitamin E biosynthesis, proteases	

Student Learning Outcomes:

- Know relationships between structure and function carbohydrate, proteins and nucleic acid.
- Learn concept of chemical aspects of signal transduction and cellular targets
- Understand Enzymes and their functions.
- Understand different types of chemical and biochemical reactions.
- Understand the structural chemical biology.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Text & References:

Text:

- Chemical Biology by H. Gobind Khorana
- Chemical Biology: A practical course, Herbert Waldmann, Petra Janning, Wiley-VCH
- Foundations of Chemical Biology, C.M. Dobson, J.A. Gerrard, A.J. Pratt, Oxford Chemistry Primers
- Innovations in Chemical Biology, Sener Bilge, Springer
- Chemical biology by Stuart L. Shreiber, TarunKapoor, Gunther Wess, Wiley-VCH.

References:

- A General Method for Discovering Inhibitors of Protein−DNA Interactions Using Photonic Crystal Biosensors *Chem. Biol.*, **2008**, *3* (7), pp 437–448.
- Optimization of non-natural nucleotides for selective incorporation opposite damaged DNA Org. Biomol. Chem., 2007, 5, 3623 – 3630.

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JAVA PROGRAMMING

Course Code: CSE 403 **Credit Units: 3**

Total Hours: 30

Course Objective:

The objective is to impart programming skills used in this object oriented language java.The course explores all the basic concepts of core java programming. The students are expected to learn it enough so that they can develop the web solutions like creating applets etc.

Course Contents:

Module I (7 Hours)

Object Oriented Programming: Concept and features of object-oriented programming, create classes and objects and add methods to a class, Real World Comparison.Evolution of JAVA: History of Java, Requirements and Environment (JDK), Comparison with other languages, Basic Features & Java Architecture-Java Virtual Machine (JVM), Installing Java Development Kit, Program Structure- Data types, Variables and Operators. Arrays

Module II (7 Hours)

Classes and Objects in Java: Understanding Constructors, Dealing with Garbage Collection. Working with Inheritance in Java: Understanding Abstract Classes and Interfaces.Packages: Introduction to packages, How to implement a package, CLASSPATH Setting for Packages, Types and understanding packages.

Module III (6 Hours)

Multithreaded Programming:Basic concepts and needs of multi-threading, Life Cycle of a Thread, How to create a thread, Handling Thread Priorities, Enforcing Thread Synchronization, Maintaining Inter-thread Communication.Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally, throw, throws in Exception Handling.

Module IV (7 Hours)

GUI Programming -Introduction to AWT, Window Fundamentals, Working with Graphics, Using AWT Controls and Menus, Understanding Layout Managers. JFC and Swing - A Higher Level of User Interaction, Features of the Java Foundation Classes, Overview of Swing, Components and Containers, Swing Packages, Exploring Swing components ,Generating Swing Application

Module V (3 Hours)

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Event Handling -The Delegation Event Model, Event Classes, Event Listener Interfaces Handling Various Events.

Examination Scheme:

Components	A	CT	S/V/Q	HA	ESE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- JAVA The Complete Reference by Patrick Naughton & Herbert Schild, TMH
- Introduction to JAVA Programming a primar, Balaguruswamy.

References:

- "Introduction to JAVA Programming" Daniel/Young PHI
- Jeff Frentzen and Sobotka, "Java Script" , Tata McGraw Hill,1999

Course Outcomes:

The student will learn

- Students can perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- Students can demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- Students can demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- Students can demonstrate ability to implement multithreading in the programming.
- To learn syntax and features of exception handling
- Students can demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using Swings.
- To demonstrate the ability to handle Events in the Programming

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Course structure: Biochemistry Lab-II- Course Code BTB-420

Course Title: Biochemistry Lab-II — Credit Units: 1
Course Level: UG Level — Course Code: BTB-420

Course Objectives:

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	50%
Descriptors/Topics Colour reactions of proteins (Ninhydrin test, Biuret test, Xanthoprotein test). Estimation of proteins.	
Module II	50%
Descriptors/Topics Biochemical estimation of DNA Biochemical estimation of RNA Quantitative determination of DNA and RNA by spectrophotometric method using UV range. Determination of melting temperature of DNA from thermal denaturation characteristics.	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: Genetics Lab- Course Code BTB-421

Course Title: Genetics Lab	Credit Units: 1
Course Level: UG Level	Course Code: BTB-421

Course Objectives:

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics Study of gene interaction.	
Module II	15%
Descriptors/Topics Study of chromosomal translocation in Rhoeodiscolor	
Module III	20%
Descriptors/Topics Study of bacterial conjugation	
Module IV	20%
Descriptors/Topics Study of bacterial transduction	
Module V	15%
Descriptors/Topics Study of physical and chemical mutagens on growth of *E. coli*.	
Module VI	15%
Descriptors/Topics PTC test	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY LAB
Course Code BTB-422

Course Title: METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY LAB Lab
Credit Units: 1
Course Level: UG Level Course Code: BTB-422

Course Objectives:

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Cell disruption techniques	
Module II	20%
Descriptors/Topics Centrifugation – low speed and high speed	
Module III	20%
Descriptors/Topics Spectrophotometer techniques	
Module IV	20%
Descriptors/Topics Chromatography –Paper Chromatography and Thin Layer Chromatography	
Module V	20%
Descriptors/Topics Electrophoresis –SDS Page and Agarose gel electrophoresis	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course Structure: JAVA POGRAMMING LAB– CSE 423

Course Title: JAVA PROGRAMMING LAB **Credit Units:2**

Course Level: UG Level **Course Code: CSE 423**

Course Objectives:

Programming in the Java programming language, knowledge of object-oriented paradigm in the Java programming language, the use of Java in a variety of technologies and on different platforms.

Pre-requisites: Understand OOP's concept and Java Programming.

Course Contents/Syllabus:

	Weightage (%)
Module I Object Oriented Programming **Descriptors/Topics** Object Oriented Programming: Concept and features of object-oriented programming, create classes and objects and add methods to a class, Real World Comparison. Evolution of JAVA: History of Java, Requirements and Environment (JDK), Comparison with other languages, Basic Features & Java Architecture-Java Virtual Machine (JVM), Installing Java Development Kit, Program Structure- Data types, Variables and Operators. Arrays	**20%**
Module II Classes and Objects in Java **Descriptors/Topics** Understanding Constructors, Dealing with Garbage Collection. Working with Inheritance in Java: Understanding Abstract Classes and Interfaces. Packages: Introduction to packages, How to implement a package, CLASSPATH Setting for Packages, Types and understanding packages	**20%**
Module III Multithreaded Programming **Descriptors/Topics** Basic concepts and needs of multi-threading, Life Cycle of a Thread, How to create a thread, Handling Thread Priorities, Enforcing Thread Synchronization, Maintaining Inter-thread Communication. Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally, throw, throws in Exception Handling.	**20%**
Module IV GUI Programming **Descriptors/Topics** Introduction to AWT, Window Fundamentals, Working with Graphics, Using AWT Controls and Menus, Understanding Layout Managers. JFC and Swing - A Higher Level of User Interaction, Features of the Java Foundation Classes, Overview of Swing, Components and Containers,	**20%**

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Swing Packages, Exploring Swing components ,Generating Swing Application	
Module V Event Handling	**20%**
Descriptors/Topics The Delegation Event Model, Event Classes, Event Listener Interfaces Handling Various Events	

Student learning Outcomes:

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in Java language).
- To test and execute the programs and correct syntax and logical error
- To Implement object oriented programming concept using basic syntaxes of control Structures, strings, and function for developing skills of logic building activity
- Identify classes, objects, members of a class, and the relationships among them needed for finding the solution to specific problems.
- Demonstrates how to achieve reusability using inheritance, interfaces, and packages and describes faster application development that can be achieved.
- Identify, Design & develop complex Graphical user interfaces using Java Swing classes.
- Demonstrate and implement the exception handling mechanisms and concepts of multi-threading.

Pedagogy for Course Delivery: The objective of this course is to acquaint the students with the basics knowledge of the structure and model of the Java programming language. Make students understand the use of Java programming language for various programming technologies and develop software in the Java programming language that can help in solving real-life problems

List of Professional Skill Development Activities (PSDA): The student will learn to formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs, test and execute the programs and correct syntax and logical error, implement conditional branching, iteration, and recursion in the java programming language.

Assessment/Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

Text:

- Naughton, Schidt “The Complete Reference JAVA 2“, TMH

References:

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- Balaguruswamy “Programming in JAVA”
- Comer “Computer Networks & Internet”
- Deitel&Deitel, “Java™ How to Program, 6/E**”**
- Frouzan “Data communications and Networking”
- Gary Cornell “Core Java” The Sun Micro Systems Series

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COMMUNICATION SKILL –IV

COURSE CURRICUMUM

UG: Semester IV
Course Title: Communication Skills-IV
Credit Units: 1
Course Code: BCU 441

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective:
This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Literature**	**10% Weightage**
	• Pippa Passes by Robert Browning (Poem) • "The Lottery" 1948 – Shirley Jackson (Short Story) • The Eyes Have it- Ruskin Bond (Short Story) • Kallu- Ismat Chughtai (Short Story) One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop	

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	• Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***

Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: ***Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010.***

Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals

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Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**

Meaning & its type

Relationship between
Values and Ethics Its
implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**

Core Values-Respect, Responsibility, Integrity, Resilience,
Care, & Harmony Its process-Self Exploration

Nurturing Good values

Module III: Morality **(2 Hours)**

Difference between morality,
ethics &values Significance of
moral values

Module IV: Ethical Practice **(2 Hours)**

Ethical Decision
making Challenges in
its implementation
Prevention of
Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**

Personal values-Empathy, honesty,
courage, commitment Professional
Values-Work ethics, respect for others

Its role in personality development Character building- New-
self awarness

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Student learning outcomes

· Able to answer the question: What do I stand for?

· Ability to apply a coherent set of moral principles within professional and specialized contexts

· Willing to make unpopular but right decision

· Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.

Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

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Français-IV

Course Code: FLU444 **Credit Units:02**

Course Objective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

Course Contents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot

ActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl'imparfait,comparer(nometverbe),qualifier(qui,que)s' exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. l'imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

Examination Scheme:

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	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text & References:

Text:

Le livre àsuivre:

Andant,Christineetal.<u>A proposA1Livre del'élève</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Andant,Christineetal.<u>A proposA1Cahierd'exercices</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:Girardeau,Brunoet NellyMous.<u>RéussirleDELFA1.</u>Paris: Didi

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Course structure: PLANT BIOTECHNOLOGY **Course Code BTB-501**

Course Title: PLANT BIOTECHNOLOGY Credit Units: 3
Course Level: UG Level Course Code: BTB-501
Course Objectives:

•The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Historical perspective of plant tissue culture. Tissue culture lab and organization Sterilisation techniques Types of nutrient media and media composition Plant regeneration pathways Role of phytohormones Cell culture techniques- cell, tissue, organ cultures, callus culture, suspension culture Culture techniques Callus culture, cell culture and protoplast cultures.	
Module II	20%
Organogenesis and somatic embryogenesis. Applications of plant tissue and cell culture. Micropopogation, pathogen free plants. production haploids, Somaclonal variation.preservation of germplasm.	
Module III	20%
Genetic engineering in plants, - transformation vectors Gene transfer techniques-vector meditated and vector less gene transfer. Transgenic plants Tran's gene integration and expression	
Module IV	20%
Transgenic crop with new traits-herbicide tolerance, insect and disease resistance, Therapeutic proteins and compounds Oral vaccines Production of secondary metabolites through plant tissue culture, root culture/A. rhizogene transformation and industrial applications Bioethics of plant genetic engineering.	
Module V:	15%
Success stories in plant biotechnology for some of the important crops like Banana, Cotton etc, Fundamental of automation in plant tissue culture and disruptive technologies like sensors etc.	

Student Learning Outcomes:

- Explain the basics, methodology and applications of plant tissue culture.
- Understand sterilization and Media preparation and organ culture.
- Learn *invitro* germination, micropopogation and Somaclonal variation.
- Understand knowledge of isolation and transformation gene in plants.
- Learn various applications of GM crops.

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Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

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Course structure: ANIMAL BIOTECHNOLOGY **Course Code BTB-502**
Course Title: ANIMAL BIOTECHNOLOGY Credit Units: 3
Course Level: UG Level Course Code: BTB-502

Course Objectives:

The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering. Cell-culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures.	20%
Module II In-Vitro Fertilization (IVF) and Embryo Transfer Technology (ETT).	15%
Module III Somatic cell hybridization, Hybridoma technology and Production of Monoclonal antibodies.	20%
Module IV Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer, Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc. Bioethical issues related to animal biotechnology.	20%
Module V Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin).	15%
Module VI Fundamentals of Stem cell based therapy, Regenerative medicines	10%

Student Learning Outcomes:

- Concepts of animal biotechnology and its commercial applicability
- Understand sterilization techniques, understanding of organ culture.
- Learn methods of animal cell culture and maintenance and immobilization techniques.
- Understand concepts in-vitro fertilization and embryo transfer for live stock improvement.
- Become familiar with concept of somatic hybridization and transgenic technology.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

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Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References

- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

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Course structure: Structural Biology **Course Code BTB-503**

Course Title: Structural Biology Credit Units: 3

Course Level: UG Level Course Code: BTB-503

Course Objectives:

The course aims to provide an understanding of the principles and applications of proteins, enzymes and nucleic acids for their role in biochemical pathway as well as interactions among themselves.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Chemistry of amino acids and peptides	25%
Descriptors/Topics Side chain structure and function in protein folding and functionality: Secondary structure of proteins -helices, sheets, loops and turns; Structural and functional proteins. Tertiary structure of proteins, homo and hetero-dimers, trimers and tetramers; forces governing protein-protein interactions; open tertiary structure; Classification of proteins; Structure and function of an antibody; structure of hemoglobin, muscle proteins; Sequence and structural motifs in proteins.	
Module II Protein-ligand interactions	25%
Descriptors/Topics Lock and key versus handshake mechanism of substrate recognition; structural basis of recognition; reaction mechanisms of enzymes, G-Protein coupled receptors.	
Module III Protein solubility, protein stability and stabilization	25%
Descriptors/Topics Salting in and salting out, Parameters affecting; enthalpic and entropic stabilization, mutations increasing stability, .helix capping; Native, partially denatured and denatured proteins; Protein denaturation, Physical and chemical denaturants; Refolding	
Module IV DNA structure	25%
Descriptors/Topics Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT and GC pairing, DNA models, The Watson Crick model; Crystal structure of B-DNA, major and minor groves, dyad symmetry, base pair stacking, propellor twist, A and Z- DNA, triple stranded DNA, telomeric sequences and structure, G-quartcts, palindromic and tandem sequences, Base pair flipping and DNA bulges, DNA methylation; Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules - Rasmol, Deepview, Whatif.	

Student Learning Outcomes:

- Understand the structure of protein emphasizing on significance of side chain.
- Know the classical theories of enzyme substrate interaction, description of cell signaling.
- Understand the protein denaturation, refolding and stabilization.
- Understand structural parameters of DNA molecule.
- Understand the protein-DNA interaction and its mechanism.

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Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemistry, R.H. Abeles, P.A. Frey and W.A. Jencks, Jones and Bartlett.
- Essentials of Molecular Biology, D. Freifelder, Jones and Bartlett Publications.
- Genes VII, B. Lewin, Oxford University Press.

References:

- Introduction to Protein Structure, C. Branden and J Tooze, Garland Publishing Company.
- Protein Structure, M. Perutz, Oxford University Press.
- Proteins (Structures and Molecular Properties), T.E. Creighton, W.H. Freeman and Company.
- Database Annotation in Molecular Biology, Arthur M. Lesk.
- From Genes to Clones, E.L. Winnacker.
- Genes & Genomes, M.S. Paul Berg.
- Structure and Machanism in Protein Science, Alan Fersht.

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CHEMICAL ENGINEERING PRINCIPLES

Course Code: BTB 504 **Credit Units: 03**

Course Objective:

The knowledge gained through chemical reaction engineering and material and energy balances will help the students to understand the tools and techniques of biotechnology.

Course Contents:

Module I: Material and Energy Balances

Units and dimensions, Dimensional analysis; Simple problems on material balance calculations involving unit processes and reactive systems; Available electron balances.

Basic energy concepts -enthalpy changes in chemical/biochemical reactions and in non-reactive processes, Energy balance calculations, Use of Steam tables; Heat of reaction and energy balance for microbial processes.

Module II: Chemical reaction engineering

Kinetics of homogenous reactions: Concepts of reaction rate, order of reaction and molecularity, Analysis of batch reactors for kinetic interpretation of data and isothermal reactor design for single and multiple reactions, Design equations for CSTR and plug flow reactors.

Module III: Instrumentation and process control

Principles of measurement: error, accuracy and sensitivity; Measurement of flow, pressure, temperature, level, pH, viscosity and chemical composition.

Basic concepts of feedback control, control loop and its elements, Dynamic behaviour of first, second and higher order physical systems, controller hardware, choice of controllers and settings. Introduction to advanced control systems: feed forward, cascade and ratio control.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

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Text:

- Basic Principles and Calculations in Chemical Engineering, D.M. Himmelblau, Prentice Hall
- Basic Principles of Chemical Engineering, E.I. Shaheen, Houghton Mifflin

References:

- Chemical Process Control, An introduction to Theory and Practice, G. Stephanopoulos, Prentice Hall Inc.
- Chemical Reaction Engineering, O. Levenspiel, John Wiley and Sons Inc.
- Elementary Principles of Chemical Processes, R.M. Felder and R.W. Rousseau, John Wiley and Sons Inc.
- Fundamentals of Chemical Reaction Engineering, C.D. Holland and R.G. Anthony, Prentice Hall Inc.
- Process Modelling, Simulation and Control for Chemical Engineers, W.L. Luyben, McGraw Hill

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Course structure: BASIC BIOANALYTICAL TECHNIQUES Course Code BTB-505

Course Title: BASIC BIOANALYTICAL TECHNIQUES Credit Units: 3

Course Level: UG Level Course Code: BTB-505

Course Objectives:

The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Solution and Buffers	20%
Descriptors/Topics Preparation of solutions, concept of pH and buffer, types of buffers and their preparation, pH meter.	
Module II Centrifugation	20%
Descriptors/Topics Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation.	
Module III Microscopy	20%
Descriptors/Topics Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy. Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy	
Module IV Radioisotope techniques	20%
Descriptors/Topics Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio – immunoassay	
Module V	20%
Descriptors/Topics Cell Disruption techniques, ultra filtration, dialysis and reverse osmosis.	

Student Learning Outcomes:

- Get familiar with working principles, tools and methods of analytical techniques.
- Understand the strengths and limitations of the basic instruments used in a biotechnology lab.
- Get an overview of the instruments used in separation and isolation of biomolecules.
- Learn the basic principle of microscopy and the concept of radioisotopes and their applications.
- Learn physical, chemical and biological method of cell disruption, reverse osmosis.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

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Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.

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ADVANCED PROGRAMMING THROUGH PYTHON

Course Code: CSE 510 **Credit Units: 03**

Total Hours: 30

Course Objective:

To understand the basic concepts such as lists, tuples and dictionary Data structures. To understand concepts like networking and website development using frameworks of python. To understand working third party libraries in python. To understand Scientific programming paradigm.

Course Contents:

Module I: Introduction of Python: (08 Hours)

History of Python, Features of Python Programming, Applications of Python, Use of python, install and Run Python in Windows/Linux, Keyword and Identifier, Statements and Comments, Python Variables, Python Data types, Python Type Conversion,Python I/O and Import, Python Operators, Python Namespace.

Python If-else statements, Python for Loop, while loop, break and continue, String manipulation, List Tuple, dictionaries, pass statement, looping technique, functions, function arguments, recursion,anonymous function, python global, local and Nonlocal.

Module II: Object and Class: (05 Hours)

Python modules, python package, File operation, Python directory, Python exception, Exception Handling, User-Define Exception, Python OOP, class, inheritance, multiple inheritance, operator overloading.

Module III: Regular Expression, CGI and Database: (08 Hours)

Match function, Search function, matching vs. searching, modifier, pattern, Introduction of CGI,CGI Architecture, CGI environment Variable, GET/POST Method, Cookies,File upload, Introduction of Database, connections, Executing queries, transactions, handling errors.

Module IV: GUI Programming: (09 Hours)

Tkinter Programming, Tkinter widgets, Standard Attributes, CGI Programming, Introduction to Web Framework: - Django, Application Lifecycle, creating a Django Project, Creating Admin Interface, Creating Views, URL Mapping, Template System, Creating Database Models, Interfacing database: - PostgreSQL with the Django Project, Page Redirection, Form Processing.

Course Outcomes:

- Ability to create client-server application for real world problems.
- Ability to apply Regular Expression, CGI and Database.
- Ability to apply GUI Programming in real world problems.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text & References:

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Text:

- Core Python Programming , Wesley J. Chun, Publisher: Prentice Hall PTR, First Edition.
- Django Unleashed, Andrew Pinkham, SAMS, second edition
- OpenCV 4, Roy Shilkrot, Packt Pub, third edition
- Elegant Scipy, Juan Nunez, O’Reilly, third edition.

Reference:

- Learning Python, Mark Lutz, O’Reilly. Ltd., Second Edition.
- Python CookBook, Alex Martelli, O’Reilly. Ltd., Third Edition.

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Course structure: Plant BiotechnologyLab- Course Code BTB-520

Course Title: Plant BiotechnologyLab Credit Units: 1
Course Level: UG Level Course Code: BTB-520
Course Objectives:
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	30%
Sterilization of glasswares and equipments. Preparation of cotton plugs and culture media Preparation of stocks for culture media Preparation of culture media	
Module II	30%
Preparation and sterilization of different explants Inoculation of explants on culture media	
Module III	30%
Study of viability of seeds Embryo culture,	
Module IV	10%
Agrobacterium mediated transformation studies in plants	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: Animal BiotechnologyLab- Course Code BTB-521

Course Title: Animal BiotechnologyLab Credit Units: 1
Course Level: UG Level Course Code: BTB-521
Course Objectives:
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Descriptors/Topics Preparation, standardization and sterilization of culture media	
Module II	25%
Descriptors/Topics Inoculation of specific tissues for callusing	
Module III	25%
Descriptors/Topics Inoculation and maintenance of cell lines	
Module IV	25%
Descriptors/Topics Study of toxicity on cell lines	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

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Course structure: Structural BiologyLab- Course Code BTB-522

Course Title: Structural BiologyLab Credit Units: 1
Course Level: UG Level Course Code: BTB-522
Course Objectives:
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Study of physical properties of proteins.	
Module II	20%
Descriptors/Topics Analysis of protein structure	
Module III	15%
Descriptors/Topics Study of protein finger printing	
Module IV	15%
Descriptors/Topics Study of protein fractionation	
Module V	15%
Descriptors/Topics Study of protein folding	
Module VI	15%
Descriptors/Topics Study of protein degradation	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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ADVANCED PROGRAMMING THROUGH PYTHON LAB

Course Code: CSE 530 **Credit Units: 01**
Total Hours: 20

Course Objective:

To write and execute programs in python to solve problems using data structures such as lists, tuples, dictionaries.
To write and execute write programs in python to implement various networking, web applications

SOFTWARE REQUIREMENTS: Python 3

List of experiments/demonstrations:

1. Write a python program to demonstrate working of lists.**: (02 Hours)**
2. Write a python program to demonstrate working of tuples. **: (02 Hours)**
3. Write a python program to demonstrate working of dictionaries and conditional statements**: (02 Hours)**
4. Write a python program to demonstrate working of Inheritance and other OOP concepts. **: (02 Hours)**
5. Write a python program to demonstrate regular expressions like match function, search function, pattern search function. **: (02 Hours)**
6. Write a python program for reading data from CSV file. **: (02 Hours)**
7. Write a python program for writing data in CSV file. **: (02 Hours)**
8. Write a python program for reading data from text file. **: (02 Hours)**
9. Write a python program for writing data from text file. **: (01 Hour)**
10. Write a python program for image analysis using openCV. **: (01 Hour)**
11. Write a program to demonstrate connection with postgresql **: (01 Hour)**
12. Develop a dynamic website using Django framework and postgresql as backend. **: (1 Hour)**

Course Outcomes:

- Ability to create client-server application for real world problems.
- Ability to develop multithreaded application.
- Ability to create web application for real world problem.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

Note: IA –InternalAssessment, EE- External Exam, A- Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Core Python Programming , Wesley J. Chun, Publisher: Prentice Hall PTR, First Edition.
- Python: The Complete Reference, Martin C Brown, McGraw Hill Publications.
- Programming Python, Mark Lutz, O'Reilly. Ltd., Second Edition.

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COMMUNICATION SKILL-V

COURSE CURRICULUM

UG : Semester V
Course Title : Communication Skills-V
Credit Units: 1
Course Code: BCU 541

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Report Writing**	**35% Weightage**
	➢ **Report Writing** • Purpose/Significance • Types • Format	
2.	**Module II Comprehension Skills**	**25% Weightage**
	• Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in Presentation Skills • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Literature** • Success is Counted Sweetest – Emily Dickinson (Poem) • My Wood - E.M.Forster (Prose) • I have a Dream-Martin Luther King (Prose) • Spoken English and Broken English-G.B. Shaw (Prose)	**10% Weightage**
5.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse.	

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6.	• Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:** (see tables below)	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: **Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.**

Effective English for Engineering Students, B Cauveri, Macmillan India

***Creative English for Communication*, Krishnaswamy N, Macmillan**

Reference: ***A Textbook of English Phonetics*, Balasubramanian T, Macmillan**

Additional Reading: Newspapers and Journals

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BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**

Total Hours: 10

Course Objective:

· To inculcate in the students an elementary level of understanding of group/team functions

· To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

§ Definition and Characteristics

§ Importance of groups

§ Classification of groups

§ Stages of group formation

§ Benefits of group formation

Module II: Group Functions (2 Hours)

§ External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies

etc.

§ Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter

group conflict.

§ Group Cohesiveness and Group Conflict

§ Adjustment in Groups

Module III: Teams (2 Hours)

· Meaning and nature of teams

· External and internal factors effecting team

· Building Effective Teams

· Consensus Building

· Collaboration

Module IV: Leadership (2 Hours)

· Meaning, Nature and Functions

· Self leadership

· Leadership styles in organization

· Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

· Meaning and Nature

· Types of power

· Relevance in organization and Society

Student learning outcomes

§ Students will Develop critical and reflective thinking abilities

§ Students will Demonstrate an understanding of group dynamics and effective teamwork

§ Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others

§ Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.

§ Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

· Organizational Behaviour, Davis, K.

· Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers

· Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books

· Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour

· Dressers, David and Cans, Donald: The Study of Human Interaction

· Lapiere, Richard. T – Social Change

· Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psycholo Addison –Welsley, US.

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· Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.

· LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi

· J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer &

Company

· Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

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Français-V

Course Code: FLU544 **Credit Units:02**

Course Objective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

- narratingevents inthe past, markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriate logical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensemble

ActesdeCommunication:

Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,

l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

Examination Scheme:

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	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

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SUMMER PROJECT - I

Course Code: BTB 560 **Credit Units: 05**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.

The students will be supervised by the internal faculty during the tenure of training.

The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

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1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

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Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

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3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

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- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

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For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

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Course structure: RECOMBINANT DNA TECHNOLOGY Course Code BTB-601

Course Title: RECOMBINANT DNA TECHNOLOGY Credit Units: 3
Course Level: UG Level Course Code: BTB-601
Course Objectives:
A complete understanding of molecular techniques can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I Enzymes used in RDT	15%
Descriptors/Topics Restriction endonuclease, methyltransferase, ligase, polymerase, kinase, phosphatase, nuclease, transferase, reverse transcriptase.	
Module II Cloning vectors	15%
Descriptors/Topics Plasmids, bacteriophages (Lambda and M13), phagemids, cosmids, artificial chromosomes (YAC, BAC). expression vectors (Bacteria and yeast), vector engineering (fusion tags, antibiotic markers), codon optimization, host engineering	
Module III Blotting techniques and hybridization	15%
Descriptors/Topics Southern, Northern and Western blotting techniques. Radioactive and non-radioactive probes.	
Module IV Nucleic acid amplification and its applications	15%
Descriptors/Topics Principles of PCR, designing of primers	
Module V Cloning Techniques	15%
Descriptors/Topics Basic cloning experiment: Design of cloning strategy and stepwise experimental procedure, Complementation, colony and plaque hybridization, restriction, PCR, plus-minus screening, immune-screening.	
Module VIDNA Libraries	15%
Descriptors/Topics Purpose of constructing DNA libraries. Construction of cDNA and genomic libraries	
Module VII Sequencing of DNA	10%
Descriptors/Topics DNA sequencing (Maxam Gilbert, Sanger's and automated), protein engineering	

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Student Learning Outcomes:

- Learn manipulating DNA sequences with versatile DNA modifying enzymes.
- Designing cloning experiments, genomic and cDNA library construction etc.
- Understand PCR amplification, DNA modifying enzymes and blotting techniques.
- Learn genomic sequences analysis by using different techniques.
- Develop knowledge in conducting experiments involving genetic manipulation.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc.
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company.

References:

- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press.
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

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Course structure: ENZYMOLOGY AND ENZYME TECHNOLOGY Course Code BTB-602

Course Title: ENZYMOLOGY AND ENZYME TECHNOLOGY Credit Units: 3
Course Level: UG Level Course Code: BTB-602
Course Objectives:
The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I Enzymes	15%
Descriptors/Topics Introduction and scope, Nomenclature, Mechanism of Catalysis.	
Module II Enzyme Kinetics	20%
Descriptors/Topics Single substrate steady state kinetics; MichaelisMenten equation, Linear plots, King-Altman's method; Inhibitors and activators; Multisubstrate systems; ping-pong mechanism, Alberty equation, Sigmoidal kinetics and Allosteric enzymes	
Module III	15%
Descriptors/Topics Immobilization of Enzymes; Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects.	
Module IV Enzyme reactors	15%
Descriptors/Topics Reactors for batch/continuous enzymatic processing, choice of reactor type; idealized enzyme reactor systems, Mass transfer in enzyme reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reaction	
Module V Bioprocess Design	15%
Descriptor/Topics Physical parameters, reactor operational stability, Immobilized cells	
Module VI Challenges and future trends	20%
Descriptors/Topics Enzyme catalysis in organic media; catalytic antibodies and non protein biomolecules as catalysts, biocatalysts from extreme thermophilic and hyper thermophilicArchae and Bacteria.	

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Student Learning Outcomes:

- Undertsnad the principles of enzymes therapeutic, clinical diagnosis, mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn applications of immobilization of enzymes in industrial production of antibiotics etc.
- Learn enzyme reactors and various parameters for bio-process design.

Learn the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.

References:

- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner.
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience.
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc.

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Course structure: IMMUNOLOGY AND IMMUNOTECHNOLOG Course Code BTB-603

Course Title: IMMUNOLOGY AND IMMUNOTECHNOLOGY **Credit Units: 4**
Course Level: UG Level Course Code: BTB-603

Course Objectives:
Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

	Weightage (%)
Module I: **Introduction to immune system**	20%
Phylogeny of Immune System, Innate and acquired immunity. Clonal selection theory Immune response. Types of immunity- innate, acquired, active and passive. Organization and structure of lymphoid organs. Hematopoiesis and differentiation, lymphocyte trafficking, B-Lymphocytes, T -Lymphocytes, macrophages, dendritic cells, natural killer, lymphokines and lymphokine activated killer cells, eosinophils, neutrophils and mast cells	
Module II: **Antigen and Antibody**	20%
Nature and Biology of antigens and super antigens. Antigen processing and presentation. Antibody structure types and functions. Measurement of antigen – antibody interaction: Affinity, Avidity, Cross reactivity, Agglutination, Precipitation Immunodiffusion, Immuno-electrophoresis, ELISA, RIE, Western blotting, Fluorescent antibody techniques. Generation of antibody diversity, Heavy chain and light chain gene rearrangement Hybridoma technology and its applications.	
Module III: **Nature and function of cell surface molecule**	10%
MHC: Types, structure and MHC restriction. B-Cell Receptor: Structure and Roles, B-cell co-receptor. Ig superfamily, T-Cell Receptor : Structure and Roles, Organization and Rearrangement of TCR Genes, T-Cell Receptor Complex: TCR-CD3, T-Cell Accessory. Alloreactivity of T Cells.	
Module IV: **Cell activation and differentiation**	20%
T-Cell Maturation, Activation, and Differentiation. B-Cell Generation, Activation, and Differentiation, cytokines and their role in immune regulation	
Module V: **Mechanism of Immune Response**	20%
Complement system: Classicle, lectin and alternative pathways and their regulation. Biological Consequences of Complement Activation Hypersensitivity: Type I, II,III and IV hypersensitivity reaction and role of immune system. Cell mediated toxicity: Mechanism of T cell and NK cell mediated lysis and macrophage mediated cytotoxicity Immune Response to Infectious Diseases (viral, bacterial and protozoan) Autoimmunity: Organ-Specific Autoimmune Diseases ■ Systemic Autoimmune Diseases. Tumor immunology. Transplantation Immunology	

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Vaccines: General consideration, ideotype network hypothesis, Synthetic vaccines	
Module VI: **Immunophysics and Immunoinformatics**:	10%
Immunoinformatics: Immunomics B cell and T cell databases. Webservers and tools for prediction of B-cell epitopes, T-cell epitopes, allergy and *in-silico* vaccine designing. Introduction of immunophysics techniques and applications.	

Pre-requisites: The students must possess fair understanding of immunology and immunotechnology.
Course Contents/Syllabus:

Student Learning Outcomes:

- Understand the phylogeny of immune system, types of immunity and immune response.
- Understand the organization and structure of lymphoid organs and immune cells
- Understand and explain the concept of antibody and antigen.
- Understand and explain the concept and types of hypersensitivity and vaccination.
- Understand the mechanism of autoimmune disorders, transplantation and immune response against tumor

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.

Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Free

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Course structure: COMPUTATIONAL BIOLOGY Course Code BTB-604

Course Title: COMPUTATIONAL BIOLOGY Credit Units: 3
Course Level: UG Level Course Code: BTB-604
Course Objectives:
The objective is to describe relational data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures genetic mapping etc.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I Introduction and overview	15%
Descriptors/Topics The NCBI data model; sequence databases, sequence retrieval, sequence file formats, submitting DNA and proteinsequences.	
Module II Major Sequence alignment	25%
Descriptors/Topics Global and local alignments, statistical significance of alignments, scoring matrices and gap penalties, filtering, position specific scoring matrices, internet resources, Pairwise and multiple alignment, uses of pairwise and multiple sequence alignment, programs and methods for sequence alignment, pattern searching programs, family and superfamily representation, structural inference, dynamic programming algorithms, alignment by hidden Markov models, consensus word analysis, more complex scoring.	
Module III Phylogenetic prediction	20%
Descriptors/Topics Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.	
Module IV Predictive methods using DNA and protein sequences	15%
Descriptors/Topics ESTs – databases, clustering, gene discovery and identification, and functional classification. Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification	
Module V	25%
Descriptor/Topics Molecular modeling – PDB and MMDB, structure file formats, visualizing structural information, advance structure	

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modeling, Internal and external co-ordinate system, cartesian and cylindrical polar co-ordinate system, Potential energy calculations using semiempirical potential energy function, Molecular mechanics and dynamics, Docking of Molecules, Knowledge base structure prediction, Molecular Design, structure similarity searching; Secondary structure prediction in proteins, prediction of buried residues in proteins;	

Student Learning Outcomes:

- Understand the nucleotide and protein sequence retrieval, submission, analysis through NCBI.
- Understand the nucleotide and protein sequence alignment methods through different algorithm.
- Understand the use of nucleotide sequence for the prediction of phylogenetic tree and evolutionary relationship are emphasized.
- Know the concept of gene discovery and identification along with structural description.
- Know the vast description of molecular modeling and protein-ligand docking.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F Quellette, Wiley – interscience.
- Bioinforamtics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.

Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. Von Heijne and G. Von Heijne, Academic Press.

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Course structure: FUNDAMENTALS OF BIOCHEMICAL ENGINEERING
Course Code BTB-605

Course Title: FUNDAMENTALS OF BIOCHEMICAL ENGINEERING Credit Units: 3
Course Level: UG Level Course Code: BTB-605

Course Objectives:
The course material on the kinetics of microbial growth, substrate utilization and product formation etc. may help the students to understand the various principles involved in instrumentation and control of bioprocess.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Descriptors/Topics Kinetics of microbial growth, substrate utilization and product formation	
Module II	25%
Descriptors/Topics Sterilization of air and medium.	
Module III	25%
Descriptors/Topics Batch, continuous ,cell recycle and fed batch reactors; mass and energy balance in microbial processes, Bioreactor design, Different types of bioreactors, their parts and functions. Different types of valves.	
Module IV	25%
Descriptors/Topics Mass transfer in Biological reactions; Scale-up principles; Instrumentation and control of bioprocesses.	

Student Learning Outcomes:
- Learn the different phases of microbial growth, kinetics of substrate utilization and product formation.
- Understand various sterilization techniques and its principles.
- Familiarize themselves with the different parts, function and types of bioreactors and valves.
- Understand the mass transfer phenomenon, principles involved in instrumentation and control of bioprocess.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

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List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Biochemical Engineering Fundamentals, J E Baily and D F Oillis, McGraw Hill
- Bioprocess Engineering Principles, P Doran, Academic Press

References:

- Chemical Engineering, J M Coulson, and J F Richardson, Butterwirth Heinemann
- Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, HC Vogel, CL Todaro, CC Todaro, Noyes Data Corporation/Noyes Publications

Process Engineering in Biotechnology, A T Jackson, Prentice Hall

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Course structure: RECOMBINANT DNA TECHNOLOGY LAB
Course Code BTB-620

Course Title: RECOMBINANT DNA TECHNOLOGY LAB Credit Units: 1
Course Level: UG Level Course Code: BTB-620
Course Objectives: The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	40%
Descriptors/Topics Study of cloning (GFP CLONING)	
Module II	30%
Descriptors/Topics Study of PCR	
Module III	30%
Descriptors/Topics Study of Southern hybridization	
Module IV	30%
Descriptors/Topics Study of RAPD	
Module V	30%
Descriptors/Topics Site directed mutagenesis	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

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Course structure: ENZYMOLOGY AND ENZYME TECHNOLOGY LAB
Course Code BTB-621

Course Title: ENZYMOLOGY AND ENZYME TECHNOLOGY LAB Credit Units: 1
Course Level: UG Level Course Code: BTB-621
Course Objectives: The laboratory will help the students to isolate enzymes from different sources, enzyme assays and studying their kinetic parameters which have immense importance in industrial processes.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics Isolation of enzymes from plant and microbial sources	
Module II	20%
Descriptors/Topics Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulase, protease.	
Module III	15%
Descriptors/Topics Purification of Enzyme by ammonium sulphate fractionation.	
Module IV	20%
Descriptors/Topics Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity, determination of Michaelis-Menten constant (K_m) and Maximum Velocity ($V_{max.}$) using Lineweaver-Burk plot.	
Module V	15%
Descriptors/Topics Effect of Temperature and pH on enzyme activity.	
Module VI	15%
Descriptors/Topics Enzyme immobilization	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

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Text:

- ***Practical Biochemistry, Sawhney and Singh***

References:

Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

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Course structure: IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB
Course Code BTB-622

Course Title: IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB Credit Units: 1
Course Level: UG Level Course Code: BTB-622
Course Objectives:
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	10%
Descriptors/Topics Blood film preparation and identification of cells.	
Module II	10%
Descriptors/Topics Identification of blood group	
Module III	10%
Descriptors/Topics Isolation of serum.	
Module IV	10%
Descriptors/Topics Lymphoid organs and their microscopic organization	
Module V	10%
Descriptors/Topics WIDAL Test	
Module VI	10%
Descriptors/Topics Radial Immuno Diffusion Test	
Module VII	10%
Descriptors/Topics Ouchterlony Double diffusion Test	
Module VIII	10%
Descriptors/Topics DOT, SANDWICH	
Module IX	10%
Descriptors/Topics Purification of lgG through affinity chromatography	
Module X	10%
Descriptors/Topics Immunohistochemistry	

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Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- ***Practical Biochemistry, Sawhney and Singh***

References:

Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

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Course structure: COMPUTATIONAL BIOLOGY LAB Course Code BTB-623

Course Title: COMPUTATIONAL BIOLOGY LAB Credit Units: 1
Course Level: UG Level Course Code: BTB-623
Course Objectives:
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	10%
Descriptors/Topics Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein	
Module II	10%
Descriptors/Topics Local and Global Alignment- concepts Pair wise sequence alignment	
Module III	10%
Descriptors/Topics Multiple sequencealignment	
Module IV	20%
Descriptors/Topics Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm	
Module V	10%
Descriptors/Topics Motif and pattern searching	
Module VI	10%
Descriptors/Topics Phylogentic prediction and analysis	
Module VII	10%
Descriptors/Topics Structure predicition	
Module VIII	10%
Descriptors/Topics Finding transcription regulatory signals	
Module IX	10%
Descriptors/Topics Docking	

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Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

Text & References:

Text:

- ***Practical Biochemistry, Sawhney and Singh***

References:

Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

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COMMUNICATION SKILLS VI

COURSE CURRICULUM

UG: Semester VI
Course Title: Communication Skills- VI

Credit Units: 1
Course Code: BCU 641

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
1	0	0	0	1

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.
Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk/Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Verbal Ability** • **Comprehension**	**35% Weightage**

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- **Analogy**
- **Sentence Order**
- **Active and Passive Voice**
- **Error Sorting**

4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011***

- ***Communication and Organizational Culture*. Keyton. Joann. Sage Publications**
- ***Social Communication (Frontiers of Social Psychology).*Fiedler, Klaus. Psychology Press**

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

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BEHAVIOURAL SCIENCE -VI

Course Code: BSU-643

Course Credit: 01

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies

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- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

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FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:

i) express their sentiments, emotions and opinions, reacting to information, situations;

ii) narrate incidents, events;

iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser

2. Faire + verbe

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

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Course structure: Bioprocess Technology- BTB 701

Course Title: Bioprocess Technology **Credit Units: 03**

Course Level: UG Level **Course Code: BTB 701**

Course Objectives:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Descriptors/Topics Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation, Cell culture techniques; Inoculum development and aseptic transfers. Different types of pumps, valves, and line materials, piping conventions etc. used in Biochemical Process	
Module II	25%
Descriptors/Topics : Process technology for the production of primary metabolites, eg. Biomass, ethanol, acetone-butanol, citric acid, amino acids, polysaccharides and plastics. **Ethanol:** production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains. Computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. Power alcohol – definition, uses, merits and demerits of various technologies for its production. **Amino Acid:** Genetic Control of metabolic pathway. **Lysine:** Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism. **Biomass:** Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses. What are mushroom, different forms of common mushroom production from agro based raw materials and uses. Biofertilizers, biocompost and biopesticides	
Module III	25%
Descriptors/Topics : Production of secondary metabolites – penicillin, cephalosporins, streptomycin, tetracycline etc. Metabolites from plant and animal cell culture **Penicillin:** Classification, various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery, uses of various forms etc. **Streptomycin:** chemical structure, production, harvest and recovery, use by-product of streptomycin fermentation etc. **Tetracycline:** chemical structure, production, harvest and recovery, use by-product of tetracycline fermentation etc.	
Module IV:	25%
Descriptors/Topics Microbial production of industrial enzymes – glucose isomerase, penicillin acylase, cellulase, amylase, lipase, protease etc.	

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Student Learning Outcomes:

After successful completion of the course student will be able to:

- Know the advantages of biochemical processes and its conventions.
- Develop skill of process technology for ethanol, amino acids and biomass production.
- Gain understanding of production of secondary metabolites and antibiotics.
- Get knowledge of industrial production of enzymes.
- Develop knowledge of growth and death kinetics.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Bioprocess Engineering Basic Concepts, M.L. Shuler and F. Kargi, Prentice Hall
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D’Elia, John Wiley and Sons Inc.
- Bioprocess Engineering Principles, P Doran, Academic Press
- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press
- Process Engineering in Biotechnolgy, A T Jackson , Prentice Hall
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Course structure: Downstream Processing- BTB 702

Course Title: Downstream Processing **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 702**
Course Objectives:
The syllabus will help the students to characterize the Bioproducts due to downstreaming process of biotechnological importance.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics Characteristics of Bioproducts; Coagulation, Flocculation and conditioning of broth.	
Module II	15%
Descriptors/Topics : Protein precipitation and separation	
Module III	15%
Descriptors/Topics : Protein precipitation and separation	
Module IV:	15%
Descriptors/Topics Aqueous- two- phase extraction, Adsorption-desorption processes	
Module V:	15%
Descriptors/Topics Chromatographic methods of separation based on size, charge, hydrophobic interactions and biological affinity	
Module VI:	15%
Descriptors/Topics Membrane based separation; Dialysis, Electrodialysis; Micro filtration, Ultra filtration; Electrophoresis	
Module VII:	10%
Descriptors/Topics Crystallization; Drying	

Student Learning Outcomes:
After successful completion of the course student will be able to:

- Learn the principles and application of downstream processing.
- Understand comprehensive knowledge of bio-product and their characteristics.
- know protein precipitation and separation methods.
- Learn basics and applications of various chromatography techniques.
- Know about membrane based sepration of bio-products such as dialysis, filtration etc.
- Learn various crystallization and drying techniques.

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Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill.
- Bioseparatioins, P.A. Belter, E.L. Cussler and W.S. Hu, John Wiley and Sons Inc.Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering / Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society.
- Protein Purification, M.R. Ladisch, R.C. Willson, C.C. Painton and S.E. Builder, American Chemical Society.

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Course structure: Statistic for Biology- BTB 703

Course Title: Statistic for Biology **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 703**
Course Objectives:
The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques, methodology and the safe laboratory practice
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	16%
Descriptors/Topics Statistics and Biostatistics: Preliminary concepts. Measures of Central Tendency: Mean, Median, Mode Measures of Dispersion: Range, Standard deviation, Variance	
AModule II	20%
Descriptors/Topics : Probability: Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes' Theorem. Expectation.	
Module III: Continuous Distribution	16%
Descriptors/Topics : Normal Distribution, Properties of Normal distribution	
Module IV: Correlation	16%
Descriptors/Topics Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard Error, Probable error of Correlation Coefficient. Rank correlation, some examples.	
Module V:Regression	16%
Descriptors/Topics Definition, Regression lines and Regression Coefficients, Properties of Regression Coefficients, Some examples. Method of least square: Fitting of straight line	
Module VI:Introduction to the following Statistical terms	16%
Descriptors/Topics	

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Parameter, Statistic, Null hypothesis, Alternative hypothesis, Critical region, Type1 Error, Type 11 Error, Level of significance, P-value and its applications. Test of Significance for Small samples: One sample t-test, Paired t-test, Degrees of freedom for t-test, F test for equality of Population variances, Degrees of freedom for F-test. Test of Significance for Large samples: Normal test for sample mean and population mean, Normal test for two sample means. Chi-square Test: Test of goodness of fit, Test of Independence of attributes, Degrees of freedom for Chisquare test, Coefficient of contingency, Yates' correction for continuity. Analysis of Variance: One way and two way (only Examples)	

Student Learning Outcomes:

After successful completion of the course student will be able to:

- Fundamental knowledge of basic statistical Techniques.
- Relationship between Statistics and Biostatistics
- Various Statistical Tools used in data presentation and interpretation
- Correlation and Regression Techniques.
- Application of statistical methods to handle biological data.
- Application of Biostatistical Tools in hypothesis testing.

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Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee, Publisher: Elsevier.
- Statistical Methodology, S.P. Gupta, Publisher: S. Chand & Co.
- Fundamentals of Statistics, S.C. Gupta. Publisher: S.Chand& Co.

References:

- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. VisweswaraRao. Publisher: Jaypee Brothers Biostatistics: A foundation for analysis in the Health Sciences, W.W. Daniel, Publisher: John Wiley and Sons

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- Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Publisher: S.Chand& Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics, H.C. Saxena, and V.K. Kapoor: S. Chand & Company
- Biostatistics, P.N. Arora and P.K. Malhan, Publisher: Himalaya Publishing House.

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Course structure: Biosensors- BTB 704

Course Title: Biosensors **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 704**

Course Objectives:

The course aims at developing an understanding of Biosensor technology needed critically for the development of small, sensitive, and selective biosensor devices and detection systems that can reliably operate in real time and in extreme and diverse physical environments. Biosensors are important tools in food safety diagnostics, medical monitors, and detection systems for biological warfare agents.

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Introduction to MEMS	
Module II: Biosensors	40%
Descriptors/Topics : Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH4+ cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.	
Module III:Biomedical sensors	40%
Descriptors/Topics :	

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Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and trnsducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.	

Student Learning Outcomes:

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

- Affinity Biosensors: Techniques and Protocols, K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applicatrions, V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors, B.R. Eggins, John Wiley and Sons Inc.
- Sensors and Sensing in Biology and Engineering, F.G. Barth, wt al, Springer Verlag.

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Course structure: Thermodynamics of Biological Systems - BTB 705

Course Title: Thermodynamics of Biological Systems **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 705**

Course Objectives:

The main aim is to understand the basis of theories related to combustion and dissolution. It will help in the study of heat evolution, control of dissipation and will suggest ways for solving the rate phenomena through the dynamics of mass transfer applicable to biological process

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Descriptors/Topics Energy, thermodynamics and living processes - an introduction	
AModule II	10%
Descriptors/Topics : Energetic processes in the biosphere: The ecosystem.	
Module III:	15%
Descriptors/Topics : Thermodynamics systems: equilibrium, activity coefficients and phase equilibrium functions of state, cyclic processes, work, energy and metabolic heat; Mechanical equivalent of heat, energy as a function of state.	
Module IV: The laws of thermodynamics	15%
Descriptors/Topics Second law; Reversible vs. irreversible processes entropy, work; Combination of the first and second law, Free energy, useful work and delta G. Entropy: Ideality and Molecular Cohesion, Probabilistic nature of Entropy, Order and Disorder.	
Module V:Biological systems as open, non-equilibrium systems	15%
Descriptors/Topics Failure of classical thermodynamics in describing biological processes, Standard free energy changes and equilibrium constants, direction and rate.	
Module VI:Chemical potential	20%
Descriptors/Topics Visualization of the potential velocity and steady flow; Fick's law and diffusion. Local Equilibria and steady state: Energy vs. Power; Transducers in biological states, Constitutive equations, Dynamic efficiency and Onsager (nonequilibrium thermodynamics), Prigogine's principle, Spontaneous coupling and entropy production.	
Module VII: Non-equilibrium thermodynamics	20%
Descriptors/Topics Reversible work, exact differentials and function of state, first and second law, The electrochemical potential, External forces an steady state, Fick's Law, chemical reactions in the steady state, internal entropy production,	

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cells as non-equilibrium stationary states; Diffusion and membrane transport. Thermodynamic analysis of oxidative photophospghorylation, stability of non-equilibrium stationary states, ordering in time and space far from equilibrium, glycolytic oscillations, biological clocks, routes to chaos.	

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Bioenergetics, A.L. Lehninger, W.A. Benjamin Inc.
- Biological Thermodynamics, D.T. Haynie, Cambridge University Press.
- Biophysical Chemistry, C.R. Cantor and P.R. Schimmel, Freeman
- Physical Chemistry: Principles and Applications in Biological Sciences, I. Tincoco, K.Sauer and J.C. Wang, Prentice Hall College Division.
- Physical Chemistry for the Chemical and Biological Sciences, R. Chang, University Science Books
- Thermodynamics and Kinetics for the Biological Sciences, G.G. Hammes, John Wiley and Sons Inc.

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Course structure: Pharmaceutical Chemistry and Drug Design- BTB 706

Course Title: Pharmaceutical Chemistry and Drug Design **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 706**

Course Objectives:

The main objective of this course is to make the students well conversant with different molecules that exert a pharmacological action in the body and how the specific action is generated. The contents will introduce them to various drug molecules used in treatment, mitigation and cure of different disease. The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Descriptors/Topics Introduction of pharmaceutical Chemistry, Overview of drug discovery process. Physicochemical Properties in Relation to Biological Action – Effects of route of administration, sites of loss, Solubilities and partition coefficients (Ferguson, Hansch), Drug-receptor interactions, Steric features of drugs, The drug receptor, structure-Activity Relationships, Representatives physicochemical properties as relation to biological action	
Module II: Drug Targets and their validation	20%
Descriptors/Topics : Drug targets classification-DNA, RNA, post-translational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins Validation Strategies	
Module III: Drug Design Strategies	20%
Descriptors/Topics : A. Structure-based design-Docking and denovo methods B.Design and development of combinatorial libraries for new lead generation The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, chemiometrics in drug design. C. QSAR Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, drug design to discovery and development, drug metabolism, toxicity and	

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pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development.	
Module IV:	20%
Descriptors/Topics Drug toxicity, tolerance, dependence, addiction, Dose Response curves	
Module V:	20%
Descriptors/Topics Survey of various Drug Classes – Anaesthetics (general, local), Analgescis, Neurotransmitters (adrenergic, cholinergic effects; psychopharmacology), CNS depressants (sedative/hypnotic, major/minor tranquilizers), CNS, Stimulants, Antibiotics (especially b-lactam), Steroids- Mechanism of action and applications	

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press
- Pharmaceutical Dosage forms and Drug Delivery Systems, H.C. Ansel , L.V. Allen, N.G. Popovich, Lippincott Williams and Wilkins Publishers
- Review of Organic Functional Groups: Introduction to Medicinal Organic Chemistry, T.L. Lemke, Lea and Febiger

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Course structure: Current Topics in Biotechnology- BTB 707

Course Title: Current Topics in Biotechnology **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 707**
Course Objectives:
A complete understanding of the application of biotechnology in various fields can be understood by studying the various modules of this paper. Success of biotechnology depends largely on how it can be effectively utilized in finding solutions to many vexed problems of present day society. The objective of this paper is to familiarize the students with some of the frontier areas if biotechnological applications where a huge scope for further contributions for betterment of the society exists. The paper shall be a interface between the students and the social at large
Course Contents/Syllabus:

	Weightage (%)
Module I Bioremediation	10%
Descriptors/Topics Introductory concept, Bioremediation principles, mechanism for Bioremediation of air, water and soil pollutants, bioremediation examples, commercial application of bioremediation techniques, recombinant DNA technology and bioremediation, bioremediation models, bioremediation software	
Module II:Genetically modified organisms	15%
Descriptors/Topics : Genetically modified food crops, food animals – examples and mode of production, future goals in GM food crops and animals, scientific evaluation of public concerns, legal requirements in production of GMO, current trends and consumer acceptance.	
Module III:Molecular medicine	15%
Descriptors/Topics : Gene mutation, point mutation, allele specific oligonucleotides, ARMS, oligonucleotide ligation, disease diagnosis with linked genetic markers, fluorescently labeled DNA sequencing.	
Module IV:Nano-biotechnology	10%
Descriptors/Topics Introduction, definition, hybrid nanopracticles, smrat drug delivery, gene sensors, biomolecule control, nanofluids, nanotechnology in medicine.	
Module V: Stem Cell	10%
Descriptors/Topics Definition, properties, proliferation, culture of stem cells, medical applications of stem cells, ethical and legal issues in use of stem cells.	
Module VI: Cancer Biology	15%
Descriptors/Topics Types of cancer, development, causes and properties of cancer, viruses (Hepatitis B & C, SV4U, polymo marines, pupillomarines, adenosines,	

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retrovineses); retroviral oncogenes, proto-oncogenes, turmor suppressor genes, recent advances in detection and treatment of cancer.	
Module VII: Forensic Biotechnology	15%
Descriptors/Topics MLP, SLP technology, PCR technology in crime detection, STR and databases, mitochondrial DNA and Y chromosome analysis in forensic science, DNA chip technology, role of molecular biology and biotechnology in crime detection.	
Module VIII: Bio Sensor	10%
Descriptors/Topics Biological reaction, amperometric biosensor, potentiometric biosensor, conductimetricbioseosors, calorimetric biosensor, piezoelectric biosensor, whole-cell biosensor, immunosensors.	

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- The Cell – A molecular Approach, 3rdEdn, Geoffrey M. Cooper and Robert E. Hausman, ASM Press
- Molecular Biology and Biotechnology, 4thEdn, J.M Walker and R. Rapley, Panima Books
- Cell Biology, David. E. Sadava, Panima Books
- Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press
- Environmental Microbiology, 2nd Edition, Ian L.Pepper and Charles P. Gerba, Elsevier Pub.

Environmental Biotechnology – Concepts and Application, Hans – Joachim Jordening and Jesefwinter – Wiley –

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Course structure: Environmental Biotechnology- BTB 708

Course Title: Environmental Biotechnology **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 708**

Course Objectives:
Environment constitutes one of the most important ingredients because of the global problems. Thus, it is imperative to understand the Bioremeditation of different components of environment. The present course will make them competent academically to envisage the different problems.

Course Contents/Syllabus:

	Weightage (%)
Module I :	
Introduction Ecology and ecosystem. Environmental pollution Water, soil and air, noise and thermal pollution,their sources and effects.	20%
Module II:	
Waste water (sewage and industrial effluents) treatments Anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic, and fermentative bacteria-technical process and conditions, emerging biotechnological processes in waste - water treatment.	20%
Module III:	
Solid waste management Landfills, composting, earthworm treatment, recycling and processing of organic residues. Hazardous wastes Hazardous wastes: source management and safety.	20%
Module IV:	
Biodegradation Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution Microbial leaching and mining Microbial leaching and mining: Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.	20%
Module V:	
Wasteland: Uses and management, bioremediation and bio-restoration of contaminated lands. Environmental genetics Environmental genetics: degradative plasmids, release of genetically engineered microbes in environment.	20%

Student Learning out comes:
After successful course completion the course students will be able to-

- Understand environmental components and their delicate interrelationship and pollutions.
- Learn concepts of waste water treatment using biotechnological interventions.
- Understand the concept and theory of solid waste disposal methods.
- Understand microbial role in bioremediation of various xenobiotic.

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- Build up understanding the mechanism of microbial leaching and mining of metals from ores, wasteland and their restoration and the role of genetically modified microbes.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Biotechnology by PK Mohapatra

References:

- Comprehensive Biotechnology (Vol. 1-4): M.Y.Young (Eds.), Pergamon Press, Oxford.
- Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Microbial Gene Technology: H. Polasa (ED.) South Asian Publishers, New Delhi.
- BiotreatmentSystems, Vol.22, D. L. Wise (Ed.), CRCPress, INC.
- Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association.

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Course structure: Bioprocess Plant Design- BTB 709

Course Title: Bioprocess Plant Design **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 709**
Course Objectives:
The objective of this paper is to include not only the application of chemical engineering principles/unit operations to bioprocess systems but also to include the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.
Course Contents/Syllabus:

	Weightage (%)
Module I : Introduction	10%
Descriptors/Topics Introduction; general design information; Mass and energy balance; Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment; Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries; Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.	

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion
List of Professional Skill Development Activities (PSDA): NA
Lab/ Practical details: NA
Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Applied Process Design for Chemical and Petrochemical Plants, E.E. Ludwig, Butterworth-Heinemann
- Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth-Heinemann
- Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling, F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design, E. Bausbacher and R. Hunt, Prentice Hall PTR.

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Course structure: Artificial Neural Network- BTB 710

Course Title: Artificial Neural Network **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 710**

Course Objectives:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, beides the closely related aspects of artificial neural networks.

Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Descriptors/Topics Historical background, Why is learning hard?	
Module II:	25%
Descriptors/Topics : Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multi-layer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning,	
Module III:	25%
Descriptors/Topics : The backpropagation algorithm, Aspects of Learning Theory and Generlization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?	
Module IV:	25%
Descriptors/Topics Neural networks and analog VLSI, Selected Applications	

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Neural Networks: A Comprehensive Foundation, S. Haykin, Prentice Hall
- Neutral Networks for Pattern Recognition, C. Bishop, Oxford University Press

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RELATIONAL DATABASE MANAGEMENT SYSTEMS

Course Code: CSE 710 **Credit Unit: 03**
Total Hours: 30

Course Objective:

The objective of this course is to get students familiar with Databases and their use. They can identify different types of available database model, concurrency techniques and new applications of the RDBMS.

Course Contents:

Module I: Introduction:

Concept and goals of DBMS, Database Languages, Database Users, Database Abstraction.

Basic Concepts of ER Model, Relationship sets, Keys, Mapping, Design of ER Model, Concept of Generalization, Aggregation and Specialization. transforming ER diagram into the tables. Various data models.

Module II: Relational Data models:

Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages: SQL-DDL, DML, integrity constraints, Complex queries, various joins, indexing, Relational algebra and relational calculus, Relational algebra operations like select, Project, Join, Division, outer union.

Module III: Relational Data Base Design:

Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies.

Module IV: Transaction Processing Concepts:

Transaction System, Serializability of schedules, recoverability, Checkpoint,s Concurrency Control Techniques: – Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation-based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction.

Module V: Trends in RDBMS:

Overview of Physical Storage Media, RAID, File Organization, Organization of Records in Files, Indexing and Hashing, Ordered Indices, Spatial and multimedia databases, Mobile and web databases

Course Outcomes:

The student will learn

- Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
- Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
- Learn and apply Structured query language (SQL) for database definition and database manipulation.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization database.

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- Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination.

Text & References:

Text:

- Korth, Silberschatz, "Database System Concepts", 4th Ed., TMH, 2000.
- Steve Bobrowski, "Oracle & Architecture", TMH, 2000

References:

- Date C. J., "An Introduction to Database Systems", 7th Ed., Narosa Publishing, 2004
- Elmsari and Navathe, "Fundamentals of Database Systems", 4th Ed., A. Wesley, 2004
- Ullman J. D., "Principles of Database Systems", 2nd Ed., Galgotia Publications, 1999.

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Course structure: Bioprocess Technology Lab - BTB 720

Course Title: Bioprocess Technology Lab **Credit Units: 01**

Course Level: PG Level **Course Code: BTB 720**

Course Objectives:

The course aims to develop competency and hand on expertise in the bioprocess technology methods and applications

Course Contents/Syllabus:

	Weightage (%)
Module I	%
Descriptors/Topics Isolation of industrially important micro organisms for microbial processes.	
Module II:	%
Descriptors/Topics : Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer	
Module III:	
Descriptors/Topics : Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.	
Module IV:	
Descriptors/Topics : Comparative studies of ethanol production using different substrates.	
Module V:	
Descriptors/Topics : Production of single cell protein	
Module VI :	
Descriptors/Topics : Production and estimation of alkaline protease	
Module VII:	
Descriptors/Topics : SauerKrant fermentation	
Module VIII :	
Descriptors/Topics : Use of alginate for cell immobilization	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advanceBioprocess technology experiments.
- Understanding of inductrial production biomolecule technique

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

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Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:
Lab Manual

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Course structure: Downstream Processing Lab - BTB 721

Course Title: Downstream Processing Lab **Credit Units: 01**

Course Level: PG Level **Course Code: BTB 721**

Course Objectives:

The laboratory will help the students to extract different bioproducts during their characterization since any of these products may be of biotechnological importance. They can be exploited in exploring the future biotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module I	%
Descriptors/Topics Conventional filtration and membrane based filtration	
Module II:	%
Descriptors/Topics : Protein precipitation and recovery	
Module III :	
Descriptors/Topics : Aqueous two-phase separation	
Module IV :	
Descriptors/Topics : Ion exchange chromatography	
Module V :	
Descriptors/Topics : Gel Permeation chromatography	
Module VI :	
Descriptors/Topics : Electrophoresis	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advance Downstream processing technology experiments.
- Understanding of industrial production biomoleculetechnique

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment. experiment performance, data collection and analysis.

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List of Professional Skill Development Activities (PSDA): NA
Lab/ Practical details:
Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:
Lab Manual

- ***Practical Biochemistry, Sawhney and Singh***

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

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RELATIONAL DATABASE MANAGEMENT SYSTEMS LAB

Course Code: CSE 730 **Credit Unit: 01**

Total Hours: 20

Software Required: Oracle and MySQL

Topics covered in lab will include the following Programs: (02 Hours)

1. Using create command design three specific table and the table structure is given below.
Table name- Book

ISBN	TITLE	PUB_YEAR	UNIT_PRICE	AUTHOR_NAME	PUB_NAME
1001	Oracle	2004	399	Arora	phi
1002	Dbms	2004	400	Basu	technical
2001	Dos	2003	250	Sinha	nirali
2002	Adbms	2004	450	Basu	technical
2003	Unix	2000	300	Kapoor	scitech

Table name- Author

AUTHOR_NAME	COUNTRY
Arora	U.S.A
Kapoor	Canada
Basu	India
Sinha	India

Table name- Publisher

PUB_NAME	PUB_ADD1
Phi	Delhi
Technical	Pune mainmarket
Nirali	Mumbai
Scitech	Chennai

2. Write the SQL query to find the name of all publisher from Book relation. **(02 Hours)**
3. Write the SQL query to display the name of all publisher using distinct clause.**(02 Hours)**
4. Write the SQL query to find the names of author from the author table where the first two characters of names are ‘ba’.**(02 Hours)**
5. Write the SQL query to display title of books published in year 2004.**(02 Hours)**
6. Write the SQL query to display title of books having price between 300 to 400.**(01 Hour)**
7. Write the SQL query to display title of books having price between 300 to 400 using operators.**(01 Hour)**
8. Write the SQL query to display title of books with author_name and country published in year 2004.**(01 Hour)**
9. Write the SQL query to display all title and (unit_price*10) as an attribute from book table using arithmetic expression.**(01 Hour)**
10. Write the SQL query to add the new column in all three tables.**(01 Hour)**
11. Study the concept of Views and their utility in DBMS ,write the SQL query to design a view.**(01 Hour)**
12. Write the SQL query to make the attribute ISBN as a primary key in Book relation.**(01 Hour)**
13. Write the SQL query to display the all the titles of Books with price and year in descending order.**(01 Hour)**
14. Write the SQL query to study the use of Delete and Drop command in DBMS. **(01 Hour)**
15. Study the concept of Triggers, cursors and stored procedures in DBMS. **(01 Hour)**

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Course Outcomes:

- At the end of lab session students would be able to design the Database application for the real life projects.
- Students would be able to perform insertion, deletion and updation operation on Databases.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

Note: IA –InternalAssessment, EE- External Exam, A- Attendance, PR- Performance, LR – Lab Record, V – Viva

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SUMMER PROJECT - II

Course Code: BTB 760 **Credit Units: 06**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.

The students will be supervised by the internal faculty during the tenure of training.

The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

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1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

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Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing sh
be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, fi

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and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

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- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**
- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

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1.2 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	

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Course structure: Genomic Proteomics- BTB 801

Course Title: Genomic Proteomics **Credit Units: 04**
Course Level: UG Level **Course Code: BTB 801**

Course Objectives:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic system has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamentals of genomics and Proteomics

Course Contents/Syllabus:

	Weightage (%)
Module I :Genome Evolution	15%
Descriptors/Topics Origin of genomes, Acquisition of new genes, DNA sequencing – chemical and enzymatic methods, The origins of introns, Genetics to genomics to functional genomics. Forward genetics (Phenotype to gene structure) and Reverse genetics (Gene structure to phenotype).	
Module II: Structural Genomics	15%
Descriptors/Topics : Chromosome structure and Genome organization, Genome assembly, Gene identification methods, Sequences Comparison Techniques, Genome annotation techniques.	
Module III: Comparative Genomics	15%
Descriptors/Topics : Phylogeny, COGS [Cluster of orthologues genes], paralogues and gene displacement, Metabolic Reconstruction, The Basic Principles and Methodology.	
Module IV: Functional Genomics	15%
Descriptors/Topics ESTs, SAGE, cDNA Microarrays, Oligonucleotide Microarray Chips, Cancer and genomic microarrays, Application of Microarrays with examples, Microarray Data Analysis; Real Time PCR; Gene finding tools	
Module V: Genotyping Background and Applications.	20%
Descriptors/Topics Genetic and physical mapping: Introduction to molecular markers-RFLP, RAPD, AFLP, SSRs and others. Genetic and physical maps, map based cloning, mapping population, southern and *in situ* hybridization for genome analysis, DNA fingerprinting; Single nucleotide polymorphisms, RNA interference, antisense RNA, siRNA, MiRNA, ; Human Genome Project; Pharmacogenomics: Ethical considerations of genetic testing; Genomics in drug discovery.	
Module VI: Fundamentals of Proteomics	20%

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Descriptors/Topics Proteomics Basics and 2D Gel Electrophoresis, Protein Identification and Analysis: a. Protein preparation and Separationb. Protein Identification by mass spectrometryc. Identification of post translation modification Protein Expression Mapping,High-throughput cloning of ORFs,Protein Protein Interaction Mapping: Experimental and Computational. Its application in health and disease. Microarray - the technique, Experimental design & mass spectrometric data analysis, Application of Microarray in proteome analysis, Proteins Arrays and Protein Chips, Proteomics Tools and Databases	

Student Learning Outcomes:
After successful completion of the course student will be able to:

- Understand the basic concept of evolution of genome in prokaryotes and eukaryotes
- Understand the concept of structural organization of genome and annotation. .
- Know the functional genes or coding genome and the understanding of functional genomics.
- Understand concept of biogenesis of RNAi, molecular markers and their application.
- Understand the various aspects of proteomics and protein identification.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Microarrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- Biotechnology and Genomics by P.K.Gupta

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology : Principles and Practice, Arthur M. Lesk
- DNA : Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown

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- Genes & Genomes, Maxine Singer and Paul Berg
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Functional Genomics – A Practical Approach, S.P. Hunt and R. Livesey, Oxford University Press
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

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Course structure: Drug Delivery System- BTB 802

Course Title: Drug Delivery System **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 802**

Course Objectives:

The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents/Syllabus:

	Weightage (%)
Module I :: Basic concepts of Drug Delivery	25%
Descriptors/Topics Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics	
Module II: Advanced Drug Delivery and Targeting	25%
Descriptors/Topics : Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)	
Module III :Drug administration	25%
Descriptors/Topics : Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery	
Module IV: Delivery of Genetic material	15%
Descriptors/Topics Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy	
Module V: New generation technologies in Drug delivery and targeting	25%
Descriptors/Topics Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.	

Student Learning Outcomes:

After successful completion of the course student will be able to:

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- Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

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Course structure: MANAGEMENT ACCOUNTING AND COST CONTROL - BCH 621

Course Title: MANAGEMENT ACCOUNTING AND COST CONTROL

Credit Units: 01

Course Level: UG Level Course Code: BCH621

Course Objectives:

- Enable students to understand the concepts of financial, cost and management accounting,
- The course aims to help students to develop skills for preparation and analysis of financial statements to enhance management planning and control, cost classification, allocation and how the costing techniques are useful in the process of managerial decision-making.

Pre-requisites: NA

Course Contents/Syllabus:

	Weightage (%)
Module I	**25%**
Descriptors/Topics Relevance of management accounting, Difference between management, financial and cost accounting, Basics concepts of accounting, financial statements	
Module II:	**25%**
Descriptors/Topics Cost accounting fundamentals, cost behaviour / classification, cost volume profit analysis, cost allocation, overhead application	
Module III	**25%**
Descriptors/Topics Variable and Absorption costing, Job-Costing and Process-Costing Systems,	
Module IV	2
Descriptors/Topics Tools for planning and control, Master budget, Flexible Budgets and Variance analysis	**25%**

Student Learning Outcomes:

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- Understand the concepts cost and management accounting
- Analyze and provide recommendations to improve the operations of organisations through the application of cost and management accounting techniques;
- Evaluate the costs and benefits of different conventional and contemporary costing systems
- Enable students to demonstrate mastery of costing systems, cost management systems, budgeting systems.

Pedagogy for Course Delivery: The course will use a mix of numerical problems, case studies, workshops and hands-on exercises. Participants are encouraged to engage in active interaction through classroom participation

Lab/ Practical details, if applicable: N/A Assessment/

Examination Scheme:

Components	**Mid term**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**End term**
Weightage (%)	15	5	10	70

Text Reading:

1. Cost Accounting, C.Horngreen, Prenctice Hall
2. Cost and Managerial Accounting, J.O. Cherrington, E.D. Hubbard and D.H. Luthy, WCB Publications.

References:

- Management Accounting, C. Horngreen, Prenctice Hall

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Project Management: BCH 622

Course Title: Project Management **Credit Units: 1**

Course Level: UG Level Course Code: BCH 622

Course Objectives:

- Enable students to understand the concepts of project management to prepare students for an exciting career in today's competitive era.
- The course aims at making an understanding of the tools and the framework necessary to build a cohesive workflow plan that will help develop industry-standard process.
- Students will also learn project management skills specifically to all design and redesign projects, from the simplest to the most complex

Pre-requisites: The students must possess fair understanding of basic management concepts and also have adequate knowledge of financial management.

Course Contents/Syllabus:

	Weightage (%)
Module I Introduction	**15%**
Descriptors/Topics Conceiving a project, Strategic Management and Project Selection, Work Breakdown Structure	
Module II Project Training	**30%**
Descriptors/Topics Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Project in Contemporary Organizations.	
Module III Project initiation	**20%**
Descriptors/Topics Project implementation– Scheduling, Resource Allocation, Monitoring and Information, Project Control	
Module IV Managing Risk	

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Descriptors/Topics Risk Management Process: Risk Identification, Risk Assessment. Risk Response Development: Risk Response Control	**20%**
Module V Project Termination	**15%**
Descriptors/Topics Project Auditing and Termination	

Student Learning Outcomes:

- Understand the concepts of Project Management.
- Analyze the various skills required for Project Management.
- Identify, implement and evolve skills need in project management.
- Enable students to become future project Managers.

Pedagogy for Course Delivery: The course will use a mix of case studies, workshops and hands-on exercises. Participants are encouraged to engage in active interaction through classroom participation.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Project Management: A Managerial Approach, J.P. Meredith and S.J. Mantel, John Wiley and Sons Inc.

References:

- Project Management: The Managerial Process, Clifford F. Gray and Erik W. Larson

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Principles of Management and Entrepreneurship Development: BCH 623

Course Title: Principles of Management and Entrepreneurship Development

Credit Units: 1

Course Level: UG Level Course Code: BCH 623

Course Objectives:

- Enable students to understand the Management functions and Entrepreneurship so as to prepare students for an exciting career in today's competitive era.
- Help students to practice and apply the knowledge to cope up with the changing environment because of the advent of technology and other influences.
- Enable students to develop and strengthen the required entrepreneurship skills from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Pre-requisites: The students must possess fair understanding of entrepreneurship and also have adequate knowledge of Organization Behavior

Course Contents/Syllabus:

	Weightage (%)
Module I	**30%**
Descriptors/Topics Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.	
Module II	**20%**
Descriptors/Topics Formal and informal organization, Performance appraisal, Training and development.	
Module III	
Descriptors/Topics Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.	**20%**
Module IV	

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Descriptors/Topics Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.	**30%**

Student Learning Outcomes:

- Understand the concepts of Management functions and Entrepreneurship development.
- Analyze various skills required for Entrepreneurial Development.
- Identify, implement and evolve managerial and entrepreneur skills.
- Evaluate the learning outcomes.
- Enable students to become future leaders and entrepreneurs.

Pedagogy for Course Delivery: The course will use a mix of case studies, workshops and hands-on exercises. Participants are encouraged to engage in active interaction through classroom participation.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O’Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

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Course Structure: ASP.NET – CSE 804

Course Title: ASP.NET **Credit Units: 03**

Course Level: UG Level **Course Code: CSE - 804**

Course Objectives:

- The main objective of this course is to create web based applications using ASP.NET and c#. Learns to create window based applications

Pre-requisites: Understand computer programming language like C, C++ and HTML.

Course Contents/Syllabus:

	Weightage (%)
Module I Introduction to .NET technologies	
Descriptors/Topics Features of .NET, .NET Framework, CLR, MSIL, .NET class library, .NET Languages, CTS, assemblies, manifest, and metadata, What is ASP.NET?, Difference between ASP and ASP.NET.	**15%**
Module II Controls in ASP.NET	
Descriptors/Topics Overview of Dynamic Web page, Understanding ASP.NET Controls, Applications, Web servers, Installation of IIS. Web forms, web form controls -server controls, client controls. Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box. Adding controls at runtime. Running a web Application, creating a multiform web project. Form Validation: Client side validation, server Side validation, validation Controls: Required Field Comparison Range. Calendarcontrol, Ad rotator Control, Internet Explorer Control.	**25%**
Module III Overview of ADO.NET and XML	**20%**

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Descriptors/Topics What is ADO.NET, from ADO to ADO.NET. ADO.NET architecture, Accessing Data using Data Adapters and Datasets , using Command & Data Reader, binding data to data bind Controls, displaying data in data grid, XML basics, attributes, fundamental XML classes: Document, text writer, text reader. XML validations, XML in ADO.NET, The XML Data Document.	
Module IV ASP.NET Applications	**20%**
Descriptors/Topics Creating, tracking, caching, error handling, Securing ASP.NET applications- form based applications, window based application	
Module V Web services	**20%**
Descriptors/Topics Introduction, State management- View state, Session state, Application state, Building ASP.NET web services, working with ASP.NET applications, creating custom controls.	

Student Learning Outcomes:
The student will learn

- To Develop dynamic web applications, create and consume web services.
- To Use appropriate data sources and data bindings in ASP.NET web applications.
- To Make Websites.

Pedagogy for Course Delivery: The objective of this course is to acquaint the students with the concepts of Website development programming, it's working and stepwise procedure to build a Web Page structure. Participants are encouraged to engage in active interaction by giving experiments in ASP.NET.

List of Professional Skill Development Activities (PSDA): The student will learn to work with Visual Studio environment. They will learn to apply ASP.NET with C#.NET concepts and learn to implement its programming.

Lab/Practical Details :

List of Experiments :

- Write a program to display a feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and UNIX, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.
- Write a simple ASP.NET program to display the following Web Controls:
  1. A button with text "clicks me". The button control must be in the center of the fc
  2. A label with a text hello.

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3. A checkbox.
The form name must be Web Controls

- Write a program to display “Welcome To Radiant” in the form when the “click” button is clicked. The form title must be ASP.NET.
- Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.
- Write a program containing the following controls:
  1. A ListBox
  2. A Button
  3. An Image
  4. A Label

  The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.
- Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.
- Write a program that uses a textbox for a user input name and validate it for RequiredFieldValidation.
- Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button must validates the values entered.
- Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.
- Check the length of the string in the TextBox using CustomValidator.

Assessment/ Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**HA**	**ESE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text Reading:

- ASP.NET Unleashed by Stephen Walther, SAMS publications

References:

- ASP.NET, Wrox Publications
- ASP.NET and VB.NET, Wrox Publication
- ASP.NET and C#.NET, Wrox publication.

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Course structure: Genomics and Proteomics Lab **BTB 820**
Course Title: Genomics and Proteomics Lab **Credit Units: 01**
Course Level: UG Level **Course Code: BTB 820**

Course Objectives:

The course aims to develop competency and hand on expertise in the Genomics and Proteomics methods and applications.

Course Contents/Syllabus:

	Weightage (%)
Module I	15%
Three dimensional Structures – In silico study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins	
Module II:	15%
DNA sequencing method: Method to find out the unknown DNA sequence by Sanger sequencing	
Module III :	10%
Gene finding tools and Genome annotation	
Module IV :	10%
Comparison of two given genomes	
Module V :	10%
Analysis of 2D – IEF data	
Module VI :	10%
Microarray and Microarray data analysis	
Module VII :	10%
Inference of protein function from structure	
Module VIII :	10%
Inference of protein function and structure	
Module IX:	10%
Two-hybrid methods	

Student Learning Outcomes:

Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advance Genomic and proteomics techniques and experiments.

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Lab Manual

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ASP.NET LAB

Course Code: CSE 824 **Credit Units: 01**

Total Hours: 20

Course Objective:

This course is designed to provide the knowledge of Dot Net Frameworks along with C#

Software Required: Visual Studio and SQL server

Topics covered in lab will include the following Programs:

- Write a program to display a feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and UNIX, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.
- Write a simple ASP.NET program to display the following Web Controls:

1. A button with text "clicks me". The button control must be in the center of the form.
2. A label with a text hello.
3. A checkbox.

- The form name must be Web Controls
- Write a program to display "Welcome To Radiant" in the form when the "click" button is clicked. The form title must be ASP.NET.

IV. Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.

- Write a program containing the following controls:

1. A ListBox
2. A Button
3. An Image
4. A Label

The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

VI. Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.

VII. Write a program that uses a textbox for a user input name and validate it for RequiredField Validation.

VIII. Write a program that gets user input such as the user name, mode of payment. appropriate credit card. After the user enters the appropriate values the Valida button must validates the values entered.

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IX. Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.

X. Check the length of the string in the TextBox using CustomValidator.

Course Outcomes:

After completion of the course the student will be able to use the features of Dot Net

Framework along with the features of C#

Examination Scheme:

IA				**EE**	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

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MAJOR PROJECT

Course Code: BTB 860 **Credit Units: 16**

Course Objective:

The students are expected to utilize their scheduled periods by undertaking the project that would be completed during the semester

Every student shall undertake a major Project. The major Project shall be undertaken in some biotechnology industry or laboratory of repute. Each student shall be assigned to a faculty who shall continuously monitor the progress of the Project in the concerned laboratory or industry. The faculty, in consultation with the concerned scientist of the industry/laboratory, shall decide the topic of the project. At the conclusion of the project the student shall submit a seminar and a dissertation. The dissertation shall be evaluated by the internal faculty/examiner. The student then shall have to appear for the viva voce axamination.

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

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Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One ch follow immediately after another. Do not use an intervening blank or title page between chapters.

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Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

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3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be gi

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- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. Fi... paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**
- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

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Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

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ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

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Dissertation:	100
Viva Voce:	100
Total:	**200**