

Master of Technology (Biochemical Engineering)

Programme Code: MBE

Duration – 2 Years Full time

**Programme Structure
And
Curriculum & Scheme of Examination
With
Choice Based Credit System (CBCS)
2017**

AMITY UNIVERSITY

RAJASTHAN

Credit Summary Sheet

Semester	CC	DE	VA	OE	Total
1	18	3	4	3	28
2	18	3	4	3	28
3	18	3	4	3	28
4	30	-	-	-	30
Total	84	09	12	09	114

Note:- CC - Core Course, VA - Value Added Course, OE - Open Elective, DE - Domain Elective

List of Open Electives						
From M. Tech. Biochemical Engg –I sem						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MBE130	Bioprocess Instrumentation & Control	DE	3	-	-	3
MBE131	IPR & Drug Regulatory Affairs	DE	3	-	-	3
From M. Tech. Biochemical Engg –II sem						
MBE231	Recombinant DNA Technology	DE	3	-	-	3
MBE232	Research Methodology and Scientific Writing	DE	3	-	-	3
From M. Tech. Biochemical Engg –III sem						
MBE304	Nanobiotechnology	CC	3		2	4
MBE305	Environmental Biotechnology	CC	3		-	3

M. Tech. Biochemical Engineering: I Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MBE101	Biochemistry & Metabolic Regulation	CC	3	-	-	3
MBE102	Advanced Microbial Technology	CC	3	1	-	4
MBE103	Advanced Biochemical Engineering	CC	3	-	-	3
MBE104	Cell & Molecular Biology	CC	3	1	-	4
MBE121	Biochemistry & Metabolic Regulation -Lab	CC	-	-	2	1
MBE122	Advanced Microbial Technology-Lab	CC	-	-	2	1
MBE123	Advanced Biochemical Engineering-Lab	CC	-	--	2	1
MBE124	Cell & Molecular Biology –Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
MBE130	Instrumentation in Biotechnology	DE	3	-	-	3
MBE131	IPR & Drug regulatory affairs	DE				
MBE132	Industrial Safety & Hazards	DE				
OE	Open Elective I	OE	3	-	-	3
MCS 111	Communicational Skills - I	VA	1	-	-	1
MSS 111	Behavioural Science - I	VA	1	-	-	1
FLF 111 FLG 111 FLS 111 FLC 111	Foreign Language - I French German Spanish Chinese	VA	2	-	-	2
	TOTAL					28

M. Tech. Biochemical Engineering: II Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MBE201	Bioprocess Plant Design & Technology	CC	3	-	-	3
MBE202	Microbial Engineering & Technology	CC	3	-	-	3
MBE203	Bioreactor Design and Analysis	CC	3	-	-	3
MBE204	Advance Biostatistics for Biologists	CC	3	-	-	3
MBE205	Research Methodology and Scientific Writing	CC	3	-	-	3
MBE221	Bioprocess Plant Design & Technology -Lab	CC	-	-	2	1
MBE222	Microbial Engineering & Technology-Lab	CC	-	-	2	1
MBE223	Bioreactor Design and Analysis-Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
MBE230	Environmental Biotechnology	DE	3	-	-	3
MBE231	Medical Biotechnology	DE				
MBE232	Pharmaceutical Technology & Biotechnology	DE				
OE	Open Elective -II	OE	3	-	-	3
MCS 211	Communicational Skills - II	VA	1	-	-	1
MSS 211	Behavioural Science - II	VA	1	-	-	1
FLF 211	Foreign Language - II	VA	2	-	-	2
FLG 211	French					
FLS 211	German					
FLC 211	Spanish					
FLC 211	Chinese					
	TOTAL					28

M. Tech. Biochemical Engineering: III Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MBE301	Immunology & Immunotechnology	CC	3	-	-	3
MBE302	Enzyme Engineering & Technology	CC	3	-	-	3
MBE303	Downstream Processing	CC	3	-	-	3
MBE304	Nanobiotechnology	CC	3	-	-	3
MBE305	Advanced Fermentation Technology	CC	2	-	-	2
MBE321	Immunology & Immunotechnology -Lab	CC	-	-	2	1
MBE322	Enzyme Engineering & Technology -Lab	CC	-	-	2	1
MBE323	Downstream Processing-Lab	CC	-	-	2	1
MBE324	Nanobiotechnology-Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
MBE330	Advanced Food Technology	DE	3	-	-	3
MBE331	Tissue Engineering	DE				
MBE332	Drug Discovery & Development	DE				
OE	Open Elective III	OE	3	-	-	3
MCS 311	Communicational Skills - III	VA	1	-	-	1
MSS 311	Behavioural Science - III	VA	1	-	-	1
	Foreign Language - III	VA	2	-	-	2
FLF 311	French					
FLG 311	German					
FLS 311	Spanish					
FLC 311	Chinese					
	TOTAL					28

M. Tech. Biochemical Engineering: IV Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MBE460	Major Project /Dissertation	-	-		-	30
	TOTAL					30

BIOCHEMISTRY AND METABOLIC REGULATION**Course Code: MBE101****Credit Unit:03****Theory****Course Objective:**

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.

Course Contents:**Module I**

Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II

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

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

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

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:**Text:**

- Lehninger, A. (2013). Principles of Biochemistry, 6th Ed., Nelson and Cox.
- Mathews, Van Holde & (2012). Ahern Biochemistry. 4th Edition.

References:

- Smith, E. L., Hill, R. L. Lehman, I. R. Lefkowitz, R. J. Handler, P. & White, A. (1983). Biochemistry 7th Ed. McGraw-Hill Book Company.
- Berg, J. M., Tymoczko, J. L. & Stryer, L. (1990). Biochemistry, 3rd Ed., W.H. Freeman and Company.
- Voet, D. V. & Voet, J. G. (2010). Biochemistry, 4th Ed. Wiley
- Conn, E. E. & Stumph, P. K. (1987). Outlines of Biochemistry, John Wiley & Sons.

ADVANCED MICROBIAL TECHNOLOGY**Course Code: MBE102****Credit Unit:04****Theory****Course Objective:**

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

Course Contents:**Module I**

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

Prokaryotic structure and function - Microbial nutrition and growth - Arithmetic and Geometric 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

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

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

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

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:**Text:**

- Pelczar, M.J., Chan, E.C.S. & Kreig, N.R. (2001). Microbiology 6th Ed. Tata McGraw Hill.
- Prescott, L.M. (2014). Microbiology, 9th Ed. McGraw by Hill Higher Education.

References:

- Stanier, R.Y., Ingraham, J.L., Wheelis M.L. & Painter, P.R. (2005). General Microbiology, 5th Ed. McMillan,
- Atlas, R.M. (1997). Principles of Microbiology 2nd Ed. WMT Brown Publishers.
- VanDemark, P.J. & Batzing, B.L. Menlo Park (1987). *The microbes: an introduction to their nature and importance*, Benjamin/Cummings Publishing Co.
- Tortora, G. J., Funke, B. R. and Case, C.L. (1994).Microbiology 5th Ed. Benzamin Cummings Inc. California.

ADVANCED BIOCHEMICAL ENGINEERING

Course Code: MBE103

Credit Unit:03

Objectives:

1. To introduce enzymes, enzymatic and microbial growth kinetics
2. To introduce transport of materials in biological systems with respect to mass transfer and heat transfer
3. To introduce different types of bio-reactors and special reactors like animal and plant cell reactors
4. To introduce immobilization and sterilization techniques

Outcome:

1. To determine the enzyme activity, parameters affecting activity and enzyme immobilization
2. To know gas liquid mass transfer. To determine the K_{La} and to know inter particle and intra particle diffusion
3. To know about working and analysis of all types of reactors
4. To know thermal death kinetics and sterilization of air and medium

Syllabus:

1. **Enzyme Kinetics:** effects on enzyme activity, deactivation, immobilized enzymes.
2. **Microbial growth kinetics:** Batch growth, unstructured models, growth in continuous culture, structured models, product formation kinetics, cell immobilization.
3. **Transport Phenomena:** Gas-liquid Mass transfer; Theoretical models for K_{La} , interfacial area and bubble oxygen transfer, gas-liquid mass transfer of components other than oxygen.
Mass transfer into solid particles: External transfer, intraparticle diffusion.
Heat transfer correlations.
4. **Bioreactors:** Review of various types of bioreactors used in the fermentation industry.
Multiphase bioreactors: packed bed, bubble-column, fluidized bed and trickle-bed reactors.
Alternate fermenters: new bioreactor configurations used in the fermentation technology.
Animal and plant cell reactor technology.
5. **Sterilization:** Sterilization methods, thermal death kinetics, design criterion, batch and continuous sterilization, air sterilization.

TEXT BOOK:

Shuler, M. L and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd ed., Prentice Hall India, New Delhi, 2003.

REFERNCES:

1. Lee, J. M., Biochemical Engineering (e Book), Prentice Hall, Englewood Cliffs, 2001.
2. Bailey, J. E., and D. F. Ollis, Biochemical Engineering Fundamentals, 2nd edition, Mcgraw-Hill, New York, 1986.
3. Blanch, H. W., and D. S. Clark, Biochemical Engineering, Marcel Dekker, New York, 1996.
Swamy,A.V.N., ' Fundamentals of Biochemical Engineering' , BS publications, 2007

CELL AND MOLECULAR BIOLOGY**Course Code: MBE104****Credit Unit:04****Theory****Course Objective:**

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.

Course Contents:**Module I**

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

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

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 Ca²⁺ and diacylglycerol as second messengers.

Module IV: Replication

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

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: Translation

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, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:**Text:**

- Albert, B. (2002). Molecular Biology of the Cell 4th Ed., Garland Science New York.
- Darnell, L. and Baltimore (2012). Molecular Biology, Mac Millan
- Watson et al., (2013). Molecular Biology of the gene, 7th Ed., Pearson.

References:

- Lewis, B. (2003). Genes VIII, Benjamin Cummings.
- Goodenough, U. W. (1984). Genetics 2nd Ed. Saunders (W.B.) Co Ltd.
- Swanson, C. P., Merz, T. & Young, W.J. (1981). Cytogenetics, Prentice Hall
- Berg, J. M., Tymoczko, J. L. & Stryer, L. (2002). Biochemistry, 3rd Ed. W.H. Freeman and Company, ,
- Brown, T.A. (1990). Genomes 2nd Ed. Oxford: Wiley-Liss,

BIOCHEMISTRY AND METABOLIC REGULATION -Lab**Course Code: MBE121****Credit Unit:01****Course Contents:****Module I: Proteins**

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 Acid

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.

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

Note: Minor variation could be there depending on the examiner.

ADVANCED MICROBIAL TECHNOLOGY -Lab**Course Code: MBE122****Credit Unit:01****Course Contents:****Module I**

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

Biochemical test – Indole test, methyl red test, voges proskaeur 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

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

Note: Minor variation could be there depending on the examiner.

BIOINFORMATICS -Lab

Course Code: MBE123

Credit Unit:01

Course Objective:

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

Course Contents:

Module I

Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein

Module II

Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment
Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm

Module III

Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing

Module IV

Phylogenetic prediction and analysis

Module V

Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.

Module VI

Finding transcription regulatory signals

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

Note: Minor variation could be there depending on the examiner.

CELL AND MOLECULAR BIOLOGY -Lab**Course Code: MBE124****Credit Unit:01****Course Objective:**

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

Course Contents:

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.
5. Study of in vitro transcription.
6. Study of DNA repair mechanism
7. Site-directed mutagenesis

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

Note: Minor variation could be there depending on the examiner.

INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: MBE130

Credit Unit:03

Theory

Course Objective:

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.

Course Contents:

Module I: Ultracentrifugation

Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.

Module II: Gel electrophoresis

Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.

Module III

TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.

Module IV

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

Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.

Module VI

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

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Wilson, K. & Walker, J. (2000). Practical Biochemistry, Principles & Techniques 5th Ed. Cambridge University Press.
- Friefelder, D. (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Biology 2nd Ed. W. H. Freeman

References:

- Hoppert, M. (2005). Microscopic Techniques in Biotechnology, Wiley-Blackwell.
- Venn, R. F. (2002). Principles and Practice of Bioanalysis 1st Ed. Taylor and Francis, London.
- Van Impe, J.F.M., Vanrolleghem, P. A. & Iserentant, D. M. (1998). Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, Springer Science + Business media
- Glusker, J.P. & Trueblood, K.N. (1985). Crystal Structure Analysis: a primer by Oxford University Press.
- Rhodes, G. (1993). Crystallography Made Crystal Clear: A Guide for Users of Macromolecular Models, Academic Press Inc.
- Gunter, H. (1992). NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, Wiley India Pvt. Limited.
- Van Holde, K. E., Johnson, W. C. & Ho, P. S. (2006). Principles of Physical Biochemistry” by Prentice Hall

IPR & DRUG REGULATORY AFFAIRS**Course Code: MBE131****Credit Unit:03****Theory:****Course Objective:**

It will familiarize the students of the IPR issues and regulatory issues pertaining to health care industries. The unit will also cover the regulatory legislation and associated approvals and permissions required to conduct high-quality single-centre, national and international clinical trials.. Ethical issues will be considered throughout the unit.

Module-I (Intellectual Property Rights-I)

Regulatory affairs and its importance.

General Principles of Intellectual Property: Copyright, Trademark, Inventions-Patentable, Geographical Indications, Industrial Designs, Integrated Circuits, Trade Secrets. Patents: need of patents, major types of patents, International registration of patents, patent term and extension The Patents Act, 1970 – Salient features.

Module-II (Intellectual Property Rights-II)

Organization: Intellectual Property Rights, World Trade Organization (WTO), World Intellectual Property Organization (WIPO), Paris Convention, Berne Convention, TRIPS Agreement, the Doha Declaration, Patent Cooperation Treaty (PCT), Madrid Protocol.

Module-III (Drug Regulatory Affairs)

New Drug Application: Steps involved in the development of new drug. New drug applications as per WHO guidelines and abbreviated NDA. Requirement and guidelines on clinical trials, Investigational New Drug Application (IND).

Generic Drug Products: Drug Regulations – IND and NDA, Drug Regulations – ANDA, Generic Drug Product Development, Generic Drug Product Approval, SUPAC.

Introduction about GMP, cGMP, GLP, GCP, CDSCO, CPCSEA, US-FDA

Introductory drugs Jurisprudence: Drugs & Cosmetic Act & Rules

Evaluation:

Components	Other Components	Attendance	MTE	ESE
Weightage (%)	10	5	15	70

Texts & References

1. Dr. N.S. Vyawahare and Sachin Itkar, (2011). Drug Regulatory Affairs, Nirali Prakashan
2. C.V.S. Subrahmanyam & J. ThimmaSetty, (2012). Pharmaceutical Regulatory Affairs, Vallabh Prakashan
3. Quality Assurance of Pharmaceutics Vol I & II (1999). WHO publications
4. WIPO website study material
5. Nair, Kanakkan Raghavan Gangadharan, and Ashok Kumar, (1994), Intellectual property rights. No. 1. Allied Publishers.
6. Cell, I. P. R. (2002), "Intellectual property rights."
7. Yan, Huang. (1996), "Intellectual property rights."

INDUSTRIAL SAFETY AND HAZARDS

Course Code: MBE132

Credit Unit:03

Theory

Course Objective:

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.

Course Contents:

Module I: Hazards

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

Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

Module III: Occupational diseases and control

Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

Module IV: Management

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

Factory Act. ESI Act, Environmental Act. Workmen - compensation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Association. Van Nostrand Reinhold Company, New York.
- Anonymous (1972). Guide for Safety in the Chemical Laboratory, 2nd Ed., Van Nostrand Reinhold Co., Litton Educational Publishing, Inc., New York
- Fawcett, H.H. & Wood, W.S. (1982). Safety and Accident Prevention in Chemical Operation, 2nd Ed. John Wiley and sons, New York.

References:

- Industrial Safety and Laws by Indian School of Labour Education, Madras.

COMMUNICATION SKILLS – I**Course Code:** MCS 111**Credit Unit:01****Course Objective:**

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:**Module I: Listening Skills**

Effective Listening: Principles and Barriers

Listening Comprehension on International Standards

Module II: Speaking Skills

Pronunciation and Accent

Reading excerpts from news dailies & magazines

Narrating Incident; Story telling.

Extempore & Role Plays

Module III: Reading Skills

Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones

Idioms & phrases

Foreign words in English

Module IV: Writing Skills

Writing Paragraphs

Précis Writing

Letter writing

Coherence and structure

Essay writing

Module V: Activities

News reading

Picture reading

Movie magic

Announcements

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

BEHAVIOURAL SCIENCE - I
(SELF-DEVELOPMENT AND INTERPERSONAL SKILLS)
Course Code: MSS 111 **Credit Unit:01**

Course Objective:

This course aims at imparting an understanding of:
 Self and the process of self exploration
 Learning strategies for development of a healthy self esteem
 Importance of attitudes and their effect on work behaviour
 Effective management of emotions and building interpersonal competence.

Course Contents:**Module I: Understanding Self**

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

Module II: Self-Esteem: Sense of Worth

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

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

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

Understanding Attitudes
 Formation of Attitudes
 Types of Attitudes
 Effects of Attitude on
 Behaviour
 Perception
 Motivation
 Stress
 Adjustment
 Time Management
 Effective Performance
 Building Positive Attitude

Module VI: End-of-Semester Appraisal

Viva based on personal journal
 Assessment of Behavioural change as a result of training
 Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- 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.

FRENCH – I**Course Code:** FLF 111**Credit Unit:**02**Course Objective:**

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:**Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2**

Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1 : Découvrir la langue française : (oral et écrit)

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

1. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futur proche

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:

- le livre à suivre: Campus: Tome 1

GERMAN – I**Course Code:** FLG 111**Credit Unit:**02**Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Course Contents:**Module I: Introduction**

Self introduction: heissen, kommen, wohnen, lernen, arbeiten, trinken, etc.

All personal pronouns in relation to the verbs taught so far.

Greetings: Guten Morgen!, Guten Tag!, Guten Abend!, Gute Nacht!, Danke sehr!, Danke!, Vielen Dank!, (es tut mir Leid!),

Hallo, wie geht's?: Danke gut!, sehr gut!, prima!, ausgezeichnet!,
Es geht!, nicht so gut!, so la la!, miserabel!

Module II: Interviewspiel

To assimilate the vocabulary learnt so far and to apply the words and phrases in short dialogues in an interview – game for self introduction.

Module III: Phonetics

Sound system of the language with special stress on Diphthongs

Module IV: Countries, nationalities and their languages

To make the students acquainted with the most widely used country names, their nationalities and the language spoken in that country.

Module V: Articles

The definite and indefinite articles in masculine, feminine and neuter gender. All Vegetables, Fruits, Animals, Furniture, Eatables, modes of Transport

Module VI: Professions

To acquaint the students with professions in both the genders with the help of the verb “sein”.

Module VII: Pronouns

Simple possessive pronouns, the use of my, your, etc.

The family members, family Tree with the help of the verb “to have”

Module VIII: Colours

All the color and color related vocabulary – colored, colorful, colorless, pale, light, dark, etc.

Module IX: Numbers and calculations – verb “kosten”

The counting, plural structures and simple calculation like addition, subtraction, multiplication and division to test the knowledge of numbers.

“Wie viel kostet das?”

Module X: Revision list of Question pronouns

W – Questions like who, what, where, when, which, how, how many, how much, etc.

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:

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

SPANISH – I**Course Code:** FLS 111**Credit Unit:**02**Course Objective:**

To enable students acquire the relevance of the Spanish language in today's global context, how to greet each other. How to present / introduce each other using basic verbs and vocabulary

Course Contents:**Module I**

A brief history of Spain, Latin America, the language, the culture...and the relevance of Spanish language in today's global context.

Introduction to alphabets

Module II

Introduction to '*Saludos*' (How to greet each other. How to present / introduce each other).

Goodbyes (*despedidas*)

The verb *llamarse* and practice of it.

Module III

Concept of Gender and Number

Months of the years, days of the week, seasons. Introduction to numbers 1-100, Colors, Revision of numbers and introduction to ordinal numbers.

Module IV

Introduction to *SER* and *ESTAR* (both of which mean To Be).Revision of '*Saludos*' and '*Llamarse*'. Some adjectives, nationalities, professions, physical/geographical location, the fact that spanish adjectives have to agree with gender and number of their nouns. Exercises highlighting usage of *Ser* and *Estar*.

Module V

Time, demonstrative pronoun (*Este/esta, Aquel/aquella* etc)

Module VI

Introduction to some key AR /ER/IR ending regular verbs.

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:

- Español, En Directo I A
- Español Sin Fronteras

CHINESE – I**Course Code:** FLC 111**Credit Unit:**02**Course Objective:**

There are many dialects spoken in China, but the language which will help you through wherever you go is Mandarin, or Putonghua, as it is called in Chinese. The most widely spoken forms of Chinese are Mandarin, Cantonese, Gan, Hakka, Min, Wu and Xiang. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

Course Contents:**Module I**

Show pictures, dialogue and retell.

Getting to know each other.

Practicing chart with Initials and Finals. (CHART – The Chinese Phonetic Alphabet Called “Hanyu Pinyin” in Mandarin Chinese.)

Practicing of Tones as it is a tonal language.

Changes in 3rd tone and Neutral Tone.

Module II

Greetings

Let me Introduce

The modal particle “ne”.

Use of Please ‘qing’ – sit, have tea etc.

A brief self introduction – Ni hao ma? Zaijian!

Use of “bu” negative.

Module III

Attributives showing possession

How is your Health? Thank you

Where are you from?

A few Professions like – Engineer, Businessman, Doctor, Teacher, Worker.

Are you busy with your work?

May I know your name?

Module IV

Use of “How many” – People in your family?

Use of “zhe” and “na”.

Use of interrogative particle “shenme”, “shui”, “ma” and “nar”.

How to make interrogative sentences ending with “ma”.

Structural particle “de”.

Use of “Nin” when and where to use and with whom. Use of guixing.

Use of verb “zuo” and how to make sentences with it.

Module V

Family structure and Relations.

Use of “you” – “mei you”.

Measure words

Days and Weekdays.

Numbers.

Maps, different languages and Countries.

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:

- “Elementary Chinese Reader Part I” Lesson 1-10

BIOPROCESS PLANT DESIGN & TECHNOLOGY

Course Code: MBE201

Credit Units:03

Theory:

Course Objective:

The Objective of this paper is to include not only application of chemical engineering principles/ unit operation to bioprocess system 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:

Module I

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.

Module II

Design of bioreactors; 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.

Module III

Introduction to Bioprocess Technology, Microbial growth kinetics-batch, continuous, cell recycle & fed- batch. 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 IV

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.

Examination Scheme:

Components	H/Q	S	CT	EE
Weightage (%)	10	10	10	70

Text & References:

Text:

- Bausbacher, E., & Hunt, R. (1990). Process plant layout and piping design. E. Bausbacher, R. Hunt, 366 pages+ 10.
- Deen, W. M. (1998). Analysis of Transport Phenomena, Topics in Chemical Engineering (Vol. 3). Oxford University Press, New York.
- Ludwig, E. E. (1997). Applied Process Design for Chemical and Petrochemical Plants: Volume 2 (Vol. 2). Gulf Professional Publishing.
- Crueger, W., & Crueger, A. (2006). Biotechnology: a textbook of industrial microbiology.

- Stanbury, P. F., Whitaker, A., & Hall, S. J. (2013). Principles of fermentation technology. Elsevier.
- Belter, P. A., Cussler, E. L., & Hu, W. (1987). Bioseparations: downstream processing for biotechnology.

References:

- Peters, M. S., Timmerhaus, K. D., West, R. E., Timmerhaus, K., & West, R. (1968). Plant design and economics for chemical engineers (Vol. 4). New York: McGraw-Hill.
- Enfors, S. O., & Häggström, L. (2000). Bioprocess technology: fundamentals and applications. Royal Institute of Technology.
- Lee, J. M. (1992). Biochemical engineering (pp. 21-31). Englewood Cliffs, NJ: Prentice Hall.
- Chaudhuri, J. B. (1995). Bioprocess engineering: Systems, equipment and facilities. The Chemical Engineering Journal and The Biochemical Engineering Journal, 1(57), 73-74.
- Wilson, K., & Walker, J. M. (2000). Principles and techniques of practical biochemistry. Cambridge University Press.
- Rogers, P. L., Shin, H. S., & Wang, B. (1997). Biotreatment, Downstream Processing and Modelling.
- Costa, C. A., & Cabral, J. S. (Eds.). (2012). Chromatographic and membrane processes in biotechnology (Vol. 204). Springer Science & Business Media.

MICROBIOLOGICAL ENGINEERING & TECHNOLOGY**Course Code: MBE202****Credit Unit:03****Theory:****Course Objective:**

The course material deals with kinetics of microbial growth, substrate utilization, product formation along with their mathematical modeling applicable to different modes of microbial cultures.

Course Contents:**Module I**

Kinetics of microbial growth, substrate utilization, product formation in batch culture. Computation of specific growth rate, generation time. Quantifying growth kinetics, use of unstructured nonsegregated models to predict specific growth rate. Models with growth inhibitors.

Module II

Continuous (single and multistage), cell recycle and fed batch culture, mass and energy balance in microbial process.

Module III

Mass transfer in biological reaction, Aeration and agitation, Rheology of fermentation broth.

Module IV

Sterilization of air and medium

Examination Scheme:

Components	H/Q	S	CT	EE
Weightage (%)	10	10	10	70

Text & References:**Text:**

- Stanbury, P. F., Whitaker, A., & Hall, S. J. (2013). Principles of fermentation technology. Elsevier.
- Shuler, M. L., & Kargi, F. (2002). Bioprocess engineering (pp. 249-254). New York: Prentice Hall.

References:

- Bronzino, J. D., & Peterson, D. R. (2014). Biomedical engineering fundamentals. CRC Press.

BIOREACTOR DESIGN AND ANALYSIS**Course Code: MBE203****Credit Unit:03****Theory:****Course Objective:**

Objective of the course are the application of basic chemical principles to understand different bioreactor configuration, design and optimum operations, process involving microbial flocks and films and scale-up of bioreactors.

Course Contents:**Module I**

Thermodynamics and rate concept of biological systems; Bioreactor configuration - batch, continuous stirred-tank, tubular, plug flow, packed bed, air lift, fluidized bed.

Module II

Kinetic expression; Monod's equation and its generalization; Bioreactor design and optimum operations – Mixing characteristics; Residence time distribution (RTD) in bioreactors and non ideality, Concentration distribution and Temperature distribution.

Module III

Analysis of multiple interacting microbial populations, Biological system parameters; Processes involving microbial flocs; Bioreactors containing microbial films.

Module IV

Basic concept of scale-up of bioreactors

Examination Scheme:

Components	H/Q	S	CT	EE
Weightage (%)	10	10	10	70

Text & References:**Text:**

- Shuler, M. L., & Kargi, F. (2002). Bioprocess engineering (pp. 249-254). New York: Prentice Hall.
- Stanbury, P. F., Whitaker, A., & Hall, S. J. (2013). Principles of fermentation technology. Elsevier.

References:

- Doran, P. M. (1995). Bioprocess engineering principles. Academic press.

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: MBE204

Credit Units:03

Theory:

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics

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

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

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

Applications of statistical methods using statistical software

Evaluation:

Components	Other Components	Attendance	MTE	ESE
Weightage (%)	10	5	15	70

Text & References:

- Wayne. W Daniel (1987). Biostatistics: A foundation for analysis in the Health Sciences, John Wiley and Son
- P.N. Arora (2007). Comprehensive Statistical methods, S. Chand Limited

RESEARCH METHODOLOGY AND SCIENTIFIC WRITING**Course Code: MBE205****Credit Unit:03****Theory****Course Objective:**

To develop understanding of information and library science research issues in the domain of bioinformatics through review of journal articles, invited talks, and critical group discussions of methods. The main objectives for this course are to develop: familiarity with information and library science-oriented problems in the biomedical sciences, an understanding of research methods in the biomedical domain, critical thinking and evaluation skills and presentation and summarization skills.

Course Contents:**Module I**

Introduction: Science, Scientific Field and Biological research. Role of a researcher in different stages of a project, Routes to research funding (academic and commercial)

Module II

Research – Definition – Importance and Meaning of research – Characteristics of research – Types of Research – Steps in research – Identification, Selection and formulation of research problem – Research questions – Research design – Formulation of Hypothesis – Review of Literature.

Module III: Sampling techniques

Sampling theory – types of sampling – Steps in sampling – Sampling and Non-sampling error – Sample size – Advantages and limitations of sampling. Collection of Data: Primary Data – Meaning – Data Collection methods – Secondary data – Meaning - Relevance's, Limitations and cautions. Statistics in Research.

Module IV

Type of Articles (review, letters etc). Scientific paper format (Abstract, Introduction, Materials and Methods, Results, Discussion). Writing, evaluating, presenting and publishing the results of scientific research in the academic press (journals, conferences etc). Choosing the appropriate journal (Sources, Information, Instructions to authors, peer review system, journal evaluation)

Module V

Case studies of areas of current research. Formulating a research plan and its presentation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:**Text:**

- Statistical Methods By S.P. Gupta

References:

- Research Methodology Methods and Techniques by C.R. Kothari
- Statistics(Theory and Practice) by B.N. Gupta
- Research Methodology Methods and statistical Techniques by Santosh Gupta
- Scientific journals and magazines

BIOPROCESS PLANT DESIGN & TECHNOLOGY-Lab
Course Code: MBE221 **Credit Unit:01**

Course Objective:

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.

Course Contents:**Module I**

Isolation of industrially important micro organisms for microbial processes.

Module II

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 III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

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

Note: Minor variation could be there depending on the examiner.

MICROBIOLOGICAL ENGINEERING & TECHNOLOGY-Lab**Course Code: MBE222****Credit Unit:01****Course Contents:****Module I**

Determination of growth curve of a supplied microorganism and also determine substrate degradation profile and product profile.

Module II

Computation of specific growth rate, growth yield, generation time and maintenance coefficient.

Module III

Determination of thermal death point and Thermal death time of microorganism for design of a sterilizer.

Module IV

Comparative studied of ethanol production using different substrates by batch and fed batch culture.

Module V

Microbial Production of antibiotics (Penicillin)

Examination Scheme:

Major Experiments	40
Minor Experiments	20
Spotting	10
Viva	20
Records	10

Total: 100

Note: Minor variation could be there depending on the examiner

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: MBE230

Credit Unit:03

Theory**Course Objective:**

The objective of this course is to familiarize the students with the processes and micro organism that can be employed for a cleaner environment. The students will be applying basic knowledge of microbiology for developing the practices for a cleaner environment, water, fuel, fertilizer, pesticides etc. The course also aims to make the students aware of legislation and acts prevalent to control the degradation of our eco system.

Course Contents:**Module I**

Treatment of municipal wastes and industrial effluents (Physico-Chemical, biological analysis of waste water), Rr. Sec and test waste water treatment sludge treatment and disposal treatment of wastes from paper, textile, dairy, petrochemical and pharmaceutical industry .

Module II

Bioremediation and phytoremediation of toxic compounds like pesticides, hydrocarbons, polymers, surfactants, biotransformation and bioaccumulation

Module III

Renewable and non-renewable energy resources, clean fuel technology, biofuels.

Module IV

Biofertilizers and biopesticides – a cleaner agricultural practice, concept of N₂ - fixation, azolla, cyanobacteria, Rhizobium and VAM as biofertilizers.

Module V

Biomining – microbe assisted microbial leaching, bioaccumulation and bio sorption
Biosensors and biomarkers for ecotoxicity measurement, EIA and Environmental audit.

Module VI

Principles in ecotoxicology; animal toxicity tests; statistical concepts of LD₅₀; dose-effect and dose response relationship; frequency response and cumulative response; Biological and chemical factors and influence toxicity; global dispersion of toxic substance; dispersion and circulating mechanisms of pollutants; Aquatic toxicity testes; statistical tests; response of planktons to toxicants; EC₅₀;

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:**Text:**

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Introduction to Environmental Biotechnology, Milton Wainwright

References:

- Waste Water Engineering, Metcalf and Eddy. Publisher: Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology: Methods and Protocols, Alicia L. Ragout De Spencer, Jonh F.T. Spencer
Principles of Environmental Engineering, Gilbert Masters

MEDICAL BIOTECHNOLOGY**Course Code: MBE 231****Credit Unit:03****Theory****Course Objective:**

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

Course Contents:**Module I**

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

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

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

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.

Module VI

Management of Clinical Data.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd 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), Lubert Stryer
- 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.

PHARMACEUTICAL TECHNOLOGY and BIOTECHNOLOGY

Course Code: MBE232

Credit Units:03

Theory:**Course Objective:**

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

Pharmaceutical Technology:**Module –I:**

Introduction to Physical Pharmaceutics – Metrology, Calculations and Posology.

Pharmacopoeias & Formularies: IP,BP,USP

Packaging of Pharmaceuticals: Polymer Science and Applications, Formulations and Development, Packaging

Particulate Technology: Particle Size, Size reduction, Size Separation, Powder Flow and Compaction

Unit Operations: Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, Sterilization, and Drying

Module-II**Pharmaceutical Dosage Forms & New Drug Delivery Systems:**

Introduction to different dosage forms, their classification with examples (Official formulation), their relative application. Various route of drug administration.

Drug delivery systems: transdermal, parenteral, oral, mucosal, ocular, buccal, rectal and pulmonary delivery. Novel formulation approaches for better delivery of biotechnology derived drugs, such as reverse micelles, liposomes, microemulsions and microencapsulation.

Pharmaceutical Biotechnology:**Module III****Immunity & Immunological preparations.**

Introduction about Immunity, Types of Immunity, Immunological preparations, Classification of Immunological preparations, Bacterial & Viral Vaccines, Method of preparation using animals, Alternative method using eggs, Diagnostic preparations containing bacterial toxins, Preparation containing antibodies used to produce passive immunity.

Blood & blood Products:

Blood Products and Plasma Substitutes: Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, fibrin foam, plasma substitutes: ideal requirements, PVP, dextran.

Module-IV**Pharmaceutical Biotechnology based drug Products:**

Introduction, Method of Preparation and Use of :Activase, Humulin,Streptokinase Humatrope, Hepatitis B vaccine.

Introduction, Method of Preparation and Use of : Penicillins, streptomycins, tetracyclines, vitamin B12 & ethanol.

Evaluation:

Components	Other Components	Attendance	MTE	ESE
Weightage (%)	10	5	15	70

Text & References:

1. Daan J. A. Crommelin and Robert D. Sindelar, (2014). Pharmaceutical Biotechnology, 3rd Ed. Informa Healthcare USA, Inc.
2. Chandrakant Kokate, Pramod H.J and S.S. Jalalpure, (2012). Textbook of Pharmaceutical Biotechnology, Elsevier Health Sciences.
3. Vyas S.P and Dixit V.K. (2007) Pharmaceutical Biotechnology 1stEd.CBS Publishers & Distributors.

COMMUNICATION SKILLS - II**Course Code:** MCS 211**Credit Unit:**01**Course Objective:**

To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:**Module I: Fundamentals of Communication**

Role and purpose of communication: *7 C's of communication*

Barriers to effective communication

Enhancing listening

Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)

Business Letter

Social correspondence

Writing resume and Job applications

Module III: Speaking skills

Conversational English

Guidelines to give an effective presentation

Activities to include:

Presentations by students

Just a minute

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL SCIENCE - II (BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT)

Course Code: MSS 211

Credit Unit:01

Course Objective:

This course aims at imparting an understanding of:
 Process of Behavioural communication
 Aspects of interpersonal communication and relationship
 Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication

Scope of Behavioural Communication
 Process – Personal, Impersonal and Interpersonal Communication
 Guidelines for developing Human Communication skills
 Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships

Principles
 Types of issues
 Approaches
 Understanding and importance of self disclosure
 Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships

Elements of satisfying relationships
 Conforming and Disconfirming Communication
 Culturally Relevant Communication
 Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication

Imperatives for Interpersonal Communication
 Models – Linear, Interaction and Transaction
 Patterns – Complementary, Symmetrical and Parallel
 Types – Self and Other Oriented
 Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development

Relationship circle – Peer/ Colleague, Superior and Subordinate
 Initiating and establishing IPR
 Escalating, maintaining and terminating IPR
 Direct and indirect strategies of terminating relationship
 Model of ending relationship

Module VI: End-of-Semester Appraisal

Viva based on personal journal
 Assessment of Behavioural change as a result of training
 Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- 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 Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: FLF 211

Credit Unit:01

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47 : Unité 3 : Objectif 3, 4, 5, 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical:

Unité 3: Organiser son temps

1. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour ...
 - i) prendre un rendez-vous/ accepter et confirmer/ annuler
 - ii) inviter/accepter/refuser
3. Faire un programme d'activités
imaginer une conversation téléphonique/un dialogue
Propositions- interroger, répondre

Unité 4: Découvrir son environnement

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

Unité 5: s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
 - i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut.... »/ «il ne faut pas... »
5. passé composé
6. Questions directes/indirectes

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:

- le livre à suivre: Campus: Tome 1

GERMAN – II**Course Code:** FLG 211**Credit Unit:**02**Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Introduction to Grammar to consolidate the language base learnt in Semester I

Course Contents:**Module I: Everything about Time and Time periods**

Time and times of the day.

Weekdays, months, seasons.

Adverbs of time and time related prepositions

Module II: Irregular verbs

Introduction to irregular verbs like to be, and others, to learn the conjugations of the same, (fahren, essen, lessen, schlafen, sprechen und ähnliche).

Module III: Separable verbs

To comprehend the change in meaning that the verbs undergo when used as such

Treatment of such verbs with separable prefixes

Module IV: Reading and comprehension

Reading and deciphering railway schedules/school time table

Usage of separable verbs in the above context

Module V: Accusative case

Accusative case with the relevant articles

Introduction to 2 different kinds of sentences – Nominative and Accusative

Module VI: Accusative personal pronouns

Nominative and accusative in comparison

Emphasizing on the universal applicability of the pronouns to both persons and objects

Module VII: Accusative prepositions

Accusative prepositions with their use

Both theoretical and figurative use

Module VIII: Dialogues

Dialogue reading: 'In the market place'

'At the Hotel'

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:

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

SPANISH – II**Course Code:** FLS 211**Credit Unit:**02**Course Objective:**

To enable students acquire more vocabulary, grammar, Verbal Phrases to understand simple texts and start describing any person or object in Simple Present Tense.

Course Contents:**Module I**

Revision of earlier modules.

Module II

Some more AR/ER/IR verbs. Introduction to root changing and irregular AR/ER/IR ending verbs

Module III

More verbal phrases (eg, Dios Mio, Que lastima etc), adverbs (*bueno/malo, muy, mucho, bastante, poco*). Simple texts based on grammar and vocabulary done in earlier modules.

Module IV

Possessive pronouns

Module V

Writing/speaking essays like my friend, my house, my school/institution, myself....descriptions of people, objects etc, computer/internet related vocabulary

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:

- Español, En Directo I A
- Español Sin Fronteras

CHINESE – II**Course Code:** FLC 211**Credit Unit:**02**Course Objective:**

Chinese is a tonal language where each syllable in isolation has its definite tone (flat, falling, rising and rising/falling), and same syllables with different tones mean different things. When you say, “ma” with a third tone, it mean horse and “ma” with the first tone is Mother. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

Course Contents:**Module I**

Drills, Practice reading aloud

Observe Picture and answer the question.

Tone practice.

Practice using the language both by speaking and by taking notes.

Introduction of basic sentence patterns.

Measure words.

Glad to meet you.

Module II

Where do you live?

Learning different colors.

Tones of “bu”

Buying things and how much it costs?

Dialogue on change of Money.

More sentence patterns on Days and Weekdays.

How to tell time. Saying the units of time in Chinese. Learning to say useful phrases like – 8:00, 11:25, 10:30 P.M. everyday, afternoon, evening, night, morning 3:58, one hour, to begin, to end etc.

Morning, Afternoon, Evening, Night.

Module III

Use of words of location like-li, wai hang, xia

Furniture – table, chair, bed, bookshelf,.. etc.

Description of room, house or hostel room.. eg what is placed where and how many things are there in it?

Review Lessons – Preview Lessons.

Expression ‘yao’, ‘xiang’ and ‘yaoshi’ (if).

Days of week, months in a year etc.

I am learning Chinese. Is Chinese difficult?

Module IV

Counting from 1-1000

Use of “chang-chang”.

Making an Inquiry – What time is it now? Where is the Post Office?

Days of the week. Months in a year.

Use of Preposition – “zai”, “gen”.

Use of interrogative pronoun – “duoshao” and “ji”.

“Whose”??? Sweater etc is it?

Different Games and going out for exercise in the morning.

Module V

The verb “qu”

Going to the library issuing a book from the library

Going to the cinema hall, buying tickets

Going to the post office, buying stamps

Going to the market to buy things.. etc

Going to the buy clothes Etc.

Hobby. I also like swimming.

Comprehension and answer questions based on it.

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:

- “Elementary Chinese Reader Part I” Lesson 11-20

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: MBE 301

Credit Unit:03

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immunogenetics 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:

Module I: Introduction

Concept of immunity- Innate and acquired, Active and Passive immunity, Cell mediated and Humoral immunity, Primary and secondary immune response, Factors affecting individual immunity Clonal nature of Immune Response.

Module II:

Immune system: Central and peripheral immune system

Primary lymphoid organs: Thymus and Bone marrow, T and B cell development

Secondary lymphoid organs: Spleen, lymphnode and MALT

Hematopoiesis, Cells of the immune system- Eosinophils, Neutrophils, Basophils, B and T-lymphocytes, macrophages, Null cells, dendritic cells, Mast cells.

Receptors: BCR and TCR, Fc receptor

Module III:

Nature and biology of Antigen: Immunogen vs. Antigen, factors affecting immunogenicity, Hapten and carriers, Adjuvants, Super antigens

Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes. Monoclonal antibodies: production and applications, Generation of antibody diversity

Module IV

MHC: Structure of MHC class I, II & III, exogenous and endogenous antigen presentation by MHC, MHC restriction, Self-tolerance in relation to MHC.

Autoimmunity and autoimmune diseases, Role of MHC in autoimmune diseases

Transplantation immunology, immunosuppressive therapy, tissue typing, immunologically privileged sites.

Module V

Complement system, Vaccines, Tumor immunology, Concept of inflammation and hypersensitivity

Antigen - antibody interaction based diagnostics: agglutination and precipitation, ELISA, RIA, IFA

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Owen J., Punt J., and StranfordSharon (2013): Immunology, 7th Edition, Macmillan higher education, New York. ISBN-13: 978-1-4292-1919-8.

Delves P., Martin S., Burton D. and Roitt I.(2006): Roitt's Essential Immunology, 11th Edition, Blackwell Publishers, Oxford.

References:

- Abbas AK, Lichtman AH, Pillai S (2010) Cellular and Molecular Immunology, 6th Edition, Saunders Elsevier, ISBN:978-0-8089-2411-1

ENZYME ENGINEERING AND TECHNOLOGY

Course Code: MBE 302

Credit Units: 03

Course Objective:

The course objective covers an understanding of the principles and application of protein, secondary metabolites and enzyme biochemistry applicable to industrial bioprocesses. Process design, operation strategies of various enzyme reactors.

Course Contents:

Module I: Enzymology

Nomenclature of enzymes, Catalytic mechanisms, Regulation strategies, Inhibition of enzymes Single and multiple substrate systems, Allosteric enzymes, Enzyme kinetics.

Module II: Enzyme engineering

Concepts of enzyme stabilization: Chemical and Molecular mechanisms; Rational design Site directed mutagenesis : olinucleotide and cassette mutagenesis, Importance of rare cutting endonucleases, de novo enzyme design, structure-guided engineering , High throughput screening Examples: Subtilisin, Lactate dehydrogenase, promiscuous enzymes, artificial metalloenzymes

Module III Enzyme technology

Immobilization of enzymes, Process design and operation strategies for immobilized enzyme reactors of enzyme and Immobilization of multiple enzyme system,

Module IV: Applications

Abzymes, ADAPT and ADEPT, Application of enzyme - Industrial, Analytical and therapeutics, Textile processing

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- Enzyme Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palmer.
- Steiner, K., & Schwab, H. (2012). Recent advances in rational approaches for enzyme engineering. Computational and Structural Biotechnology Journal, 2, e201209010. <http://doi.org/10.5936/csbj.201209010>
- Allan Svendsen Enzyme Functionality: Design: Engineering, and Screening 2003 CRC Press 1st edition.
- Turanli-Yildiz, B., Alkim, C., & Cakar, Z. P. (2012). *Protein Engineering Methods and Applications*. INTECH Open Access Publisher.

References:

- Enzyme: A Practical Introduction to structure, Mechanism and data analysis, R.A. Copeland, John Wiley & Sons Inc.
- James C. Samuelson Enzyme Engineering: Methods and Protocols (Methods in Molecular Biology) 2013 Humana Press

DOWNSTREAM PROCESSING

Course Code: MBE 303

Credit Unit:03

Course Objective:

The syllabus will help the students to characterize the Bioproducts of biotechnological importance and to get expertise in their downstream processing.

Course Contents:

Module I

Characteristics of Bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.

Module II

Aqueous - two-phase extraction; Adsorption-desorption processes; Membrane based separation: Dialysis, Electro dialysis, Micro filtration, Ultra filtration.

Module III

Chromatographic methods of separation based on size, charge, reverse phase, hydrophobic interactions, and biological affinity, HPLC, FPLC, MS-LC, Gas chromatography.

Module IV

Electrophoresis, principle, types on the basis of support media, 1D, 2D gel electrophoresis, continuous and capillary electrophoresis.

Module V

Crystallization, Drying, Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
- Bioseparations: Principles and Techniques, Sivasankar, Prentice-Hall
- Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill
- 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. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

NANOBIOTECHNOLOGY

Course Code: MBE 304

Credit Unit:03

Course objective: Nanotechnology is one of the most important and influential fields in today's scenario. It holds tremendous potential and have shown significant impact on both basic and applied sciences. The major objective of this course is to introduce this contemporary area to the students so that they can apply their knowledge to develop new applications in the field of biomedicine.

Course contents

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, various rules governing the health and safety standards related to the use of chemicals and nanomaterials, the physical environment required for working with nanomaterials.

Module II: Investigation and manipulation of nanomaterials

Construction, working principle and applications of electron microscopies, scanning probe microscopies, optical microscopies, Fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy and X-ray diffraction for nanosciences and technology.

Module III: Nanostructures for medicinal applications

Overview of nanobiotechnology and nanomedicine with future perspectives. Biological barriers to nanocarrier-mediated delivery of therapeutic and imaging agents, nanoparticle contrast agents for molecular magnetic resonance imaging, micro- and nanoscale control of cellular environment for tissue engineering. Nanotechnology in cancer.

Module IV: Societal implications of Nanoscience

From the first industrial revolution to the nano revolution, implications of Nanoscience and nanotechnology on Society, Nano policies, Nano arms race, public perception and public involvement in the nano discourse, Harnessing nanotechnology for economic and social development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Books:

- Nanobiotechnology: Concepts, Applications and Perspectives by Christof M. Niemeyer and Chad A. Mirkin, First Wiley 2006, ISBN: 978-3-527-60591-0.
- Nanobiotechnology II: More Concepts and Applications by Chad A. Mirkin and Christof M. Niemeyer, Wiley 2007, ISBN: 978-3-527-31673-1.
- Nano: The essentials - Understanding the nanoscience and technology by T. Pradeep, Tata McGraw-Hill Publishing Company Limited 2008, ISBN-10:0-07-154829-7 / 0071548297.

ADVANCED FERMENTATION TECHNOLOGY

Course Code: MBE 305

Credit Unit: 02

Course Objective:

Objective of the course is for the acquaintance of large scale cultivation of microbes for production of industrially important products.

Course Contents:

Module I

Selection of industrially important cultures; Isolation of pure culture & genetic improvement of industrial microorganisms.

Module II

Process technology for the production of primary metabolites, Baker's yeast, SCP, ethanol.

Module III

Biosynthesis and fermentative production of antibiotics – penicillin, semi-synthetic penicillin, streptomycin, tetracyclines, chloramphenicol; Microbial production of antifungal antibiotics; Metabolic regulations in industrial fermentation; Microbial production of amino acids – lysine, glutamic acid; microbial transformation of steroids; Microbial production of vitamins – β -carotene, vitamin B₁₂, vitamin B₆; microbiological assay techniques for estimation of antibiotics and vitamins.

Module IV

Application of antibiotics in animal nutrition and food preservation, mycotoxins and microbial insecticides, use of microbes in mineral beneficiation; Production of biodegradable polymers, biofertilizers, microbial exopolysaccharides – xanthan, gellan.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnology, A Text book of Industrial Microbiology, W. Crueger and A. Crueger, Sinauer Association.
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.

References:

- Bioprocess Engineering: basic concepts, Michael L. Shuler and Fikret Kargi
- Bioprocess Engineering, B. K. Lydersen, K.L. Nelson, B.K. Lydersen and N.D'Elia, John Wiley and Sons Inc.

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB**Course Code:****MBE321****Credit Units: 01****Course Contents:****Module I**

Blood film preparation and identification of cells, identification of blood group, Preparation of serum and plasma

Module II

Lymphoid organs and their organization

Module III

WIDAL test, immunoelectrophoresis, Ouchterlony Double Diffusion Test, ELISA: DOT or SANDWICH

Module IV

Purification of IgG through affinity chromatography.

Separation of IgG on SDS-PAGE

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

Note: Minor variation could be there depending on the examiner.

ENZYME ENGINEERING AND TECHNOLOGY LAB

Course Code: MBE 322

Credit Units: 01

Course Contents:

1. Effect of pH on enzyme activity
2. Effect of temperature on enzyme activity
3. Determination of K_m and V_m from LB plot.
4. Solid/ liquid state fermentation
5. Design of oligonucleotide for Site directed mutagenesis
6. Site directed mutagenesis.
7. Immobilization of enzyme

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

Note: Minor variation could be there depending on the examiner.

DOWNSTREAM PROCESSING LAB**Course Code:** MBE 323**Credit Units:** 01**Course Objective:**

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:**Module I**

Conventional filtration and membrane based filtration

Module II

Protein precipitation and recovery

Module III

Aqueous two-phase separation

Module IV

Ion exchange chromatography

Module V

Gel Permeation chromatography

Module VI

Electrophoresis

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

Note: Minor variation could be there depending on the examiner.

NANOBIOTECHNOLOGY LAB**Course code: MBE 324****Credit units : 1**

1. Demonstration about occupational health and safety (OHS) or workplace health and safety (WHS) in nanotechnology.
2. Preparation of aqua regia, its handling and role in washing glass-wares for metal nanoparticles synthesis.
3. Surface plasmon resonance (SPR) properties of silver nanoparticles synthesised by plant extracts.
4. Optimization of temperature for metal nanoparticles preparation using biological molecules.
5. Investigation of UV-Vis spectroscopic feature of metal nanoparticles developed after temperature optimization.
6. Construction of bimetallic nanoparticles and their studies on their optical properties.
7. Interaction of nanoparticles with biological cells (Haemolysis or antimicrobial potential of metal nanoparticles).
8. Preparation of polymeric film for nanomedicine applications.
9. Functionalization of nanoparticles with drug or fluorescent molecules and confirmation of functionalization.

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

Note: Minor variation could be there depending on the examiner.

ADVANCED FOOD TECHNOLOGY**Course Code: MBE 330****Credit Unit: 03****Course Objective:**

The purpose of the food biotechnology major is to produce professional 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.

Course Contents:**Module I**

Processing and preservation technologies used in 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

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 III

Development of environment - friendly packaging materials based on product characteristic and performance properties packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminum containers, and retortable pouches based on heat penetration studies and sterilization value.

Module IV

Starter culture, prebiotics, probiotics - their use as flavor enhancer and diseases/ infection combats, application in production of cheese, butter, ice-cream, yoghurt, application in biomedical research, e.g. recombinant LABs as vaccine; modified milk proteins.

Module V

Production of SCP (Single cell protein), baker's yeast, brewing industry, application of transgenic plants in food production, transgenic fish, transgenic poultry.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:**Text:**

- Food technology by Frazier.
- Food Microbiology, 2nd edition by Adams and Moss.

References:

- Introduction to food Biotechnology. Green, Perry Johnson 2002. CRC Press, Boca Raton Florida.
- Food Biotechnology- Techniques and application. Gauri S. Mittal 1992. Technomic Publishing Co., Inc., Lancaster.

TISSUE ENGINEERING

Course Code: MBE 331

Credit Unit:03

Course Objective:

This course will cover topics related to the design and functional assessment of bioengineered tissue substitutes. Strategies for engineering tissues with a load-bearing function will be of particular focus. Strategies to study cell-surface and cell-cell interactions to physical stimuli, bioreactors, biological scaffolds and 3D cell-tissue constructs will be explored through recent papers.

Course Contents:

Module I: Fundamentals of tissue engineering

Basic definition, History, Concepts and overview, Principles and components, current scope of development; use in therapeutics and in vitro testing

Module II: Engineering materials

Scaffolds: Functions, Types (ECM-like Scaffolds, Tissue-Derived Scaffolds, Fibrin Gel, Natural Sponge; Injectable Scaffolds, Elastic Scaffolds, Inorganic Scaffolds Composite Scaffolds). Biomaterials: properties, cellular adhesion, surface modifications. Polymers (Natural such as Protein and Polysaccharides; Synthetic such as Poly(α -hydroxyacids, Hydrogels and Polyurethanes), Composite.

Module III: Cell Sources:

Fundamental properties of cells, autologous, allogeneic, syngeneic, and xenogeneic cells, and genetically engineered cells, Stem and progenitor cells. Cell Extraction, Biomolecules /synthetic ECM: Growth Factors (Representative Growth factors), Delivery of Growth factors

Module IV: Tissue Culture & Engineering Design Aspects

Biomechanics aspects of tissue engineering: application of physical forces, Principles of Scaffold Design – Material considerations, 2 D cell expansion, 3D Tissue Architecture and Function Transport considerations, Bioreactors, Cell seeding and metabolism considerations, Design of Polymeric Scaffolds, Interface Biology – Biocompatibility/Immunogenicity.

Module V: Case Studies

Musculoskeletal Tissue Engineering, Cardiovascular Tissue Engineering, Neural Tissue Engineering, Visceral Tissue Engineering. Other Key Issues and Emerging Areas of Interest: Nanobiotechnology, Ethical Issues, FDA and Regulatory Issues, Tissue Engineering Market

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Frontiers in Tissue Engineering (ISBN 0080426891), Patrick, Mikos, McIntire, Pergamon
- Principles of Tissue Engineering (ISBN 0124366309), Lanza, Langer, Vacanti, Academic Press

References:

- **Tissue Engineering: Engineering Principles for the Design of Replacement Organs and Tissues** By W. Mark Saltzman; Published Oxford University Press US, 2004, pp 523
- Tissue engineering Fundamentals and Applications By Yoshito Ikada, Published Elsevier, 2006, pp 469
- Tissue Engineering Methods & Protocols (ISBN 0896035166, Morgan and Yarmush, Humana Press.

DRUG DISCOVERY & DEVELOPMENT

Course Code: MBE 332

Credit Unit:03

Course Objective:

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**Module: I****Drug discovery & development:**

General Introduction of drug design and development, Strategies for Target Identification and validation, Lead Identification and Optimization, Pre-Clinical Research and Clinical Research & Pharmacovigilance.

Module: II**Drug development considerations:**

Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics. Pharmacokinetic, Pharmacodynamic and Toxicological considerations in drug development, Physiochemical properties of drugs in relations to their biological activity, Rout of drugs administrations, Various types of dosage formulations, Stability of drugs.

Module: III**Drug Receptor Theories:**

Principles of drug action, Mechanisms of drug action, Drug-receptor interactions, Types of drug targets, G-Protein coupled receptor, Ion Channels, Ligand Gated Ion Channels, Enzymatic drug receptor and Transducer mechanisms, Dose response relationship, Factors modifying drug action.

Module: IV**Rational Drug Design:**

Introduction, Types of drugs design: Legand based, Structure based, Rational drug discovery, Computer Aided drug design, De novo drug design methodologies.

Structure activity relationships in drug design, Statistical techniques behind QSAR, Molecular descriptors 3D QSAR and COMFA, Molecular modeling, Molecular docking and dynamics.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Suggested Books:

- New Drug Development: Design, Methodology, and Analysis, by J. Rick Turner, Published by John Wiley & Sons, 2007.
- Essentials of Medical Pharmacology by K D Tripathi, Published by JAYPEE Brothers Medical Publishers (P) Ltd. 7th Edition 2010.
- Biopharmaceutics & Pharmacokinetics by DM Brahmankar & SB Jaiswal, Published by Vallabh Prakashan; 3rd Edition 2012.
- Drug Discovery and Clinical Research, by S.K Gupta, Published by JAYPEE Brothers Medical Publishers (P) Ltd

COMMUNICATION SKILLS - III

Course Code: MCS311

Credit Units: 01

Course Objective:

To initiate the learners with the basic mechanics of writing skills and facilitate them with the core skills required for communication in the professional world.

Course Contents:

Module I: Mechanics and Semantics of Sentences

Writing effective sentences
Style and Structure

Module II: Developing writing skills

Inter - office communication: Business Letter; E mails; Netiquette
Intra – office communication: Memos, Notices, Circulars, Minutes
Report Writing

Module III: Business Presentations

Planning, design and layout of presentation
Information Packaging
Audience analysis
Audio visual aids
Speaking with confidence
Case Studies

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

Text & References:

- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.

BEHAVIOURAL SCIENCE - III (LEADING THROUGH TEAMS)

Course Code: MSS311

Credit Units: 01

Course Objective:

This course aims to enable students to:

Understand the concept and building of teams

Manage conflict and stress within team

Facilitate better team management and organizational effectiveness through universal human values.

Course Contents:

Module I: Teams: An Overview

Team Design Features: team vs. group

Effective Team Mission and Vision

Life Cycle of a Project Team

Rationale of a Team, Goal Analysis and Team Roles

Module II: Team & Sociometry

Patterns of Interaction in a Team

Sociometry: Method of studying attractions and repulsions in groups

Construction of sociogram for studying interpersonal relations in a Team

Module III: Team Building

Types and Development of Team Building

Stages of team growth

Team performance curve

Profiling your Team: Internal & External Dynamics

Team Strategies for organizational vision

Team communication

Module IV: Team Leadership & Conflict Management

Leadership styles in organizations

Self Authorized team leadership

Causes of team conflict

Conflict management strategies

Stress and Coping in teams

Module V: Global Teams and Universal Values

Management by values

Pragmatic spirituality in life and organization

Building global teams through universal human values

Learning based on project work on Scriptures like Ramayana, Mahabharata, Gita etc.

Module VI: End-of-Semester Appraisal

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judith D. Effective Small Group and Team Communication, 2002, Harcourt College Publishers
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- 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

FRENCH - III

Course Code: FLF311

Credit Units: 02

Course Objective:

To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: Unité 6: se faire plaisir

1. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
2. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
3. parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

1. maîtriser les actes de la communication sociale courante
(Salutations, présentations, invitations, remerciements)
2. annoncer un événement, exprimer un souhait, remercier,
s'excuser par écrit.
3. caractériser une personne (aspect physique et caractère)

Contenu grammatical:

1. accord des adjectifs qualificatifs
2. articles partitifs
3. Négations avec de, ne...rien/personne/plus
4. Questions avec combien, quel...
5. expressions de la quantité
6. ne...plus/toujours - encore
7. pronoms compléments directs et indirects
8. accord du participe passé (auxiliaire « avoir ») avec
l'objet direct
9. Impératif avec un pronom complément direct ou indirect
10. construction avec « que » - Je crois que/ Je pense que/ Je
sais que

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:

- le livre à suivre : Campus: Tome 1

GERMAN - III**Course Code: FLG311****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Course Contents:**Module I: Modal verbs**

Modal verbs with conjugations and usage
Imparting the finer nuances of the language

Module II: Information about Germany (ongoing)

Information about Germany in the form of presentations or "Referat"- neighbors, states and capitals, important cities and towns and characteristic features of the same, and also a few other topics related to Germany.

Module III: Dative case

Dative case, comparison with accusative case
Dative case with the relevant articles
Introduction to 3 different kinds of sentences – nominative, accusative and dative

Module IV: Dative personal pronouns

Nominative, accusative and dative pronouns in comparison

Module V: Dative prepositions

Dative preposition with their usage both theoretical and figurative use

Module VI: Dialogues

In the Restaurant,
At the Tourist Information Office,
A telephone conversation

Module VII: Directions

Names of the directions
Asking and telling the directions with the help of a roadmap

Module VIII: Conjunctions

To assimilate the knowledge of the conjunctions learnt indirectly so far

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:

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

SPANISH – III**Course Code: FLS311****Credit Units: 02****Course Objective:**

To enable students acquire knowledge of the Set/definite expressions (idiomatic expressions) in Spanish language and to handle some Spanish situations with ease.

Course Contents:**Module I**

Revision of earlier semester modules

Set expressions (idiomatic expressions) with the verb *Tener, Poner, Ir...*

Weather

Module II

Introduction to *Gustar...* and all its forms. Revision of *Gustar* and usage of it

Module III

Translation of Spanish-English; English-Spanish. Practice sentences.

How to ask for directions (using *estar*)

Introduction to IR + A + INFINITIVE FORM OF A VERB

Module IV

Simple conversation with help of texts and vocabulary

En el restaurante

En el instituto

En el aeropuerto

Module V

Reflexives

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:

- Español, En Directo I A
- Español Sin Fronteras -Nivel Elemental

CHINESE – III**Course Code: FLC311****Credit Units: 02****Course Objective:**

Foreign words are usually imported by translating the concept into Chinese, the emphasis is on the meaning rather than the sound. But the system runs into a problem because the underlying name of personal name is often obscure so they are almost always transcribed according to their pronunciation alone. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

Course Contents:**Module I**

Drills
 Dialogue practice
 Observe picture and answer the question.
 Introduction of written characters.
 Practice reading aloud
 Practice using the language both by speaking and by taking notes.
 Character writing and stroke order

Module II

Measure words
 Position words e.g. inside, outside, middle, in front, behind, top, bottom, side, left, right, straight.
 Directional words – beibian, xibian, nanbian, dongbian, zhongjian.
 Our school and its different building locations.
 What game do you like?
 Difference between “hii” and “neng”, “keyi”.

Module III

Changing affirmative sentences to negative ones and vice versa
 Human body parts.
 Not feeling well words e.g. ; fever, cold, stomach ache, head ache.
 Use of the modal particle “le”
 Making a telephone call
 Use of “jiu” and “cal” (Grammar portion)
 Automobiles e.g. Bus, train, boat, car, bike etc.
 Traveling, by train, by airplane, by bus, on the bike, by boat etc.

Module IV

The ordinal number “di”
 “Mei” the demonstrative pronoun e.g. mei tian, mei nian etc.
 use of to enter to exit
 Structural particle “de” (Compliment of degree).
 Going to the Park.
 Description about class schedule during a week in school.
 Grammar use of “li” and “cong”.
 Comprehension reading followed by questions.

Module V

Persuasion-Please don't smoke.
 Please speak slowly
 Praise – This pictorial is very beautiful
 Opposites e.g. Clean-Dirty, Little-More, Old-New, Young-Old, Easy-Difficult, Boy-Girl, Black-White, Big-Small, Slow-Fast ... etc.
 Talking about studies and classmates
 Use of “it doesn't matter”
 Enquiring about a student, description about study method.
 Grammar: Negation of a sentence with a verbal predicate.

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:

- “Elementary Chinese Reader Part I, Part-2” Lesson 21-30

PROJECT

Course code: MBE 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:

➤ 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.

➤ 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 sections, 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**

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

➤ **Future prospects**

➤ **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

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