AMITY UNIVERSITY

MADHYA PRADESH

Established vide Government of Madhya Pradesh Act No. 27 of 2010

Amity Institute of Biotechnology
Course Handout
Course : Cell Biology
Course Code : BSB101, Credits : 03, Session : 2022-23(Odd Sem.), Class : B.Sc. 1st Year
Faculty Name : Dr. Manish Kumar

A. Introduction: To acquaint the students to understand the basic concept of cell biology and cell as a unit of living system, its various organelles, their structure, function and metabolic processes. Further, to help students to understand the concept of cellular evolution. Enable students to strengthen the cellular structure of cell organelle and their function.

B. Course Outcomes: At the end of the course, students will be able to:

BSB101.1. To study cell as a basic unit of life. Cell Theory. Understanding cellular organisation of Plant and animal cells. Their tissue, organ and organisational structure.

BSB101.2. To develop understanding of ultrastructure of cell membrane and its function. Structure of different cell organelles viz. endoplasmic reticulum, ribosomes, cytoskeletal, mitochondria, chloroplast, lysosomes, peroxysomes and nucleus.

BSB101.3. Students will learn about Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome and eu and hetero-chromatin.

BSB101.4. To develop deeper knowledge about Cell cycle, interphase, mitosis and meiosis.

BSB101.5. Knowledge of cell locomotion, cell senescence and apoptosis.

BSB101.6. Understanding of mechanism of cell differentiation and difference between normal and cancer cell.

C. Programme Outcomes:

PO1. Knowledge: Biotechnology deals with developing knowledge of biological sciences and effective implementation of engineering technologies that manipulate

living organisms and biological systems to produce products for advance healthcare, medicine, agriculture, food, Pharmaceuticals and environment control etc.

PO2. General Scope: In general course structure emphasized on distribution, morphology and physiology of microorganisms, in addition to development of skills, working under several aseptic procedures, isolation and identification. This course also includes sophomore level material covering immunology, virology, microbiology, epidemiology and recombinant DNA technology.

PO3. Students understand: Basic Structure and metabolism of Biomolecules, along with instrumentation of several techniques involved in course structure, Atomic theory, Valiancy, Atomic weight.

PO4: Environment and sustainability: Development of fundamental concepts of Ecosystem, energy flow and role of biodiversity in maintaining sustainability.

PO5. Coverage: Courses contain topics covering of several commercial aspects of protecting commercial interests of the applied research, such as intellectual property (IPR) and patents, commercializing technology, promoting entrepreneurship, with lectures and case studies from specific domain business leaders and academic experts.

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

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

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

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

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

Programme Specific Outcomes:

PSO1: Develop knowledge base and competency in different biological thrust areas of cell and molecular biology, microbiology, genetics, biochemistry and metabolic regulation, immunology, bioinformatics, plant and animal biotechnology, recombinant DNA technology, omic approaches, instrumentation, environmental and industrial biotechnology etc.

PSO 2: Achieve the scientific acumen and ability to identify research-

based problems and develop suitable approach by designing protocols and their effective interpretation and implementation.

PSO.3: Enhance analytical, management, entrepreneurship skills along with effective communication and behavioral attributes.

D. Assessment Plan:

Component of Evaluation	**Description**	**Code**	**Weightage %**
Continuous Internal Evaluation	Mid Term	CT	15%
	Seminar/Viva-Voce/Quiz/Home Assignment	S/V/Q/HA	10%
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves Including medical leaves.	A	5%
End Semester Examination	End Semester Examination	EE	70%
Total			**100%**

E. Syllabus

Module I: Cell as a basic unit of living systems: The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles**:** Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes**:** Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle**:** Cell cycle, interphase, mitosis and meiosis.

Module V: Cell interaction: Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation: Mechanism of cell differention (e.g., RBC); difference between normal and cancer cells.

F. Examination Scheme:

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

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

G. Suggested Text/Reference Books:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology –Sheelar & Bianchi, John Wiley
- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell Becker, Klinshmith & Harden, Pearson

H. Lecture Plan

Lecture	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Cell Theory	Lecture	BSB101.1	Mid Term, Quiz & End Sem Exam
2	Precellular Evolution	Lecture	BSB101.1	Mid Term, Quiz & End Sem Exam
3	Broad Classification of Cell Types	Lecture	BSB101.1	Mid Term, Quiz & End Sem Exam
4	Eukaryotic Microbes	Lecture	BSB101.1	Mid Term, Quiz & End Sem Exam
5	Plant and animal cells, tissues and organs	Lecture	BSB101.1	Mid Term, Quiz & End Sem Exam
6	Different levels of organization	Lecture	BSB101.1	Mid Term, Quiz & End Sem Exam
7	Ultrastructure of cell membrane and function	Lecture	BSB101.2	Mid Term, Quiz & End Sem Exam
8	Structure of cell organelles	Lecture	BSB101.2	Mid Term, Quiz & End Sem Exam
9	Golgi bodies, Endoplasmic Reticulum (Smooth and Rough), Ribosomes	Lecture	BSB101.2	Mid Term, Quiz & End Sem Exam
10	Cytokeletal Structures (Actin and Microtubules)	Lecture	BSB101.2	Mid Term, Quiz & End Sem Exam
11	Mitochondria, Chloroplast	Lecture	BSB101.2	Mid Term, Quiz &

				End Sem Exam
12	Lysosomes and Peroxisomes	Lecture	BSB101.2	Mid Term, Quiz & End Sem Exam
13	Nucleus Structure	Lecture	BSB101.2	Mid Term, Quiz & End Sem Exam
14	Nuclear Membrane, Nucleoplasm, Nucleolus	Lecture	BSB101.2	Mid Term, Quiz & End Sem Exam
15	Structural organisation of chromosomes	Lecture	BSB101.3	Mid Term, Quiz & End Sem Exam
16	Chromatids	Lecture	BSB101.3	Mid Term, Quiz & End Sem Exam
17	Centromere and Telomere	Lecture	BSB101.3	Mid Term, Quiz & End Sem Exam
18	Streptomycin and Tatracycline	Lecture	BSB101.3	Mid Term, Quiz & End Sem Exam
19	Chromatin and Nucleosome Organization	Lecture	BSB101.3	Mid Term, Quiz & End Sem Exam
20	Eu and Hetero-Chromatin	Lecture	BSB101.3	Mid Term, Quiz & End Sem Exam
21	Cell Cycle	Lecture	BSB101.4	Quiz & End Sem Exam
22	Interphase	Lecture	BSB101.4	Quiz & End Sem Exam
23	Mitosis	Lecture	BSB101.4	Quiz & End Sem Exam

24	Meiosis	Lecture	BSB101.4	Quiz & End Sem Exam
25	Cell Locomotion	Lecture	BSB101.5	Quiz & End Sem Exam
26	Amoeboid, Flagellar and Cilliar	Lecture	BSB101.5	Quiz & End Sem Exam
27	Cell Senescence	Lecture	BSB101.5	Quiz & End Sem Exam
28	Cell Death	Lecture	BSB101.5	Quiz & End Sem Exam
29	Apoptosis	Lecture	BSB101.5	Quiz & End Sem Exam
30	Cell Division	Lecture	BSB101.5	Quiz & End Sem Exam
31	Mechanisms of Cell Differentiation	Lecture	BSB101.6	Quiz & End Sem Exam
32	RBCs	Lecture	BSB101.6	Quiz & End Sem Exam
33	Cancer	Lecture	BSB101.6	Quiz & End Sem Exam
34	Carcinogens	Lecture	BSB101.6	Quiz & End Sem Exam
35	p53 Gene and its role in cancer development	Lecture	BSB101.6	Quiz & End Sem Exam
36	Difference between normal and cancer cell	Lecture	BSB101.6	Quiz & End Sem Exam

I. Course Articulation Matrix (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAMME OUTCOMES	CORRELATION WITH PROGRAMME SPECIFIC OUTCOMES

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
BSB101.1	To study cell as a basic unit of life. Cell Theory. Understanding cellular organization of Plant and animal cells. Their tissue, organ and organizational structure.	3	2	2	2	2	2	2	2	2	2	3	2	3
BSB101.2	To develop understanding of ultrastructure of cell membrane and its function. Structure of different cell organelles viz. endoplasmic reticulum, robosomes, cytoskeletal, mitochondria, chloroplast, lysosomes, peroxysomes and nucleus.	3	2	2	2	2	2	2	2	3	2	3	3	2
BSB101.3	Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome and eu and hetero-chromatin.	3	2	2	3	2	2	2	2	3	2	3	3	2
BSB101.4	To develop deeper knowledge about Cell cycle, interphase, mitosis and meiosis.	3	3	2	3	2	2	2	1	3	2	3	2	2

BSB101.5	Knowledge of cell locomotion, cell senescence and apoptosis.	3	2	2	2	2	2	2	2	2	2	3	2	2
BSB101.6	Understanding of mechanism of cell differentiation and difference between normal and cancer cell.	3	3	2	2	2	2	2	2	2	2	3	2	2

Sample Question Paper

<table>
<tr><td colspan="7">Amity Institute of Biotechnology
MID-SEMESTER 2022-23</td></tr>
<tr><td colspan="7">Class: BSB101 (Biotech) I Semester</td></tr>
<tr><td colspan="3">Subject Name:
BSB 101 Cell Biology</td><td colspan="2">Time: 2 Hrs</td><td colspan="2">Max. Marks: 30</td></tr>
<tr><td>Levels of the questions as per Blooms Taxonomy</td><td>Remembering</td><td>Understanding</td><td>Applying</td><td>Analyzing</td><td>Evaluating</td><td>Creating</td></tr>
<tr><td>Question Mapping</td><td>Q. 1,4</td><td>Q. 2,3</td><td>Q. 4</td><td>Q. 2,5,6</td><td></td><td></td></tr>
<tr><td colspan="7">Student will be able to
CO1: To understand cell as a basic unit of life. Cell Theory. Understanding cellular organization of Plant and animal cells, their tissue, organ and organizational structure.
CO2: To develop understanding of ultrastructure of cell membrane and its function. Structure of different cell organelles viz. endoplasmic reticulum, ribosome’s, cytoskeleton, mitochondria, chloroplast, lysosomes, peroxysomes and nucleus.</td></tr>
<tr><td>CO Map</td><td>Question No.</td><td colspan="4">Question</td><td>Marks</td></tr>
<tr><td>CO1</td><td>Q.1</td><td colspan="4">Explain in brief the Cell Theory.</td><td>3</td></tr>
<tr><td></td><td>Q.2a</td><td colspan="4">What are different cytoskeletal structures?</td><td>3</td></tr>
</table>

CO1	Q.2b	How is mode of functioning of Peroxysomes and lysosomes are different from each other ?	3
CO1	Q.3	How Nucleosome organization affects eu and heterochromatin region of DNA ?	6
CO2	Q.4	Explain the different stages of cellular reductional division i.e. Meiosis.	3

Attainments		**Rubric**
Level	1	IF 60 % of students secure more than 60 % marks then level 1
Level	2	IF 70 % of students secure more than 60 % marks then level 2
Level	3	IF 80 % of students secure more than 60 % marks then level 3

Course outcome: Based on internal and external assessment the level of Course outcome attainment of the course **CELL BIOLOGY/BSB 101** is **level 3** for the academic year 2022-23.

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Established vide Government of Madhya Pradesh Act No. 27 of 2010

Amity Institute of Biotechnology
Course Handout
Course : Microbiology
Course Code : BTB303, Credits : 04, Session : 2022-23(Odd Sem.), Class : B.Tech 2nd Year
Faculty Name : Dr. Manish Kumar

A. Introduction: This fundamental paper discusses the importance of microorganisms. The course throws light on types of microorganisms in and around humans. At the end of the course, the student has understanding on the metabolism and mechanism of microbial life. Students will gain knowledge about the different cell organelles of microorganisms and their detailed functions. Students will also study the growth and control of microbes as well as different bacteriological techniques involved in microbiology. Students will learn about the biomolecules by studying their structures and types.

B. Course Outcomes: At the end of the course, students will be able to:

BTB303.1. Students will learn about the historical perspective of microbial world, spontaneous generation, role of microbes, pure culture, microbial nutrition, culture media, and sterilization.

BTB303.2. Students will gain knowledge of prokaryotic cell, structural and functional anatomy of cell and organelles. Growth and growth curve, culture types – batch and continuous, culture collection and maintenance of cultures.

BTB303.3. Students will gain knowledge about the Systematics and taxonomy of bacteria, ribotyping, nomenclature and Bergey's manual.

BTB303.4. Students will know about the Metabolic Diversity among microorganisms, microbial photosynthesis, photosynthetic pigments, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions.

BTB303.5. Students will develop deeper understanding of Archae, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles. Viruses – Bacterial and Animal, their structure, reproduction. Viroids and Prions. Algae and Fungi – their reproduction and classification.

BTB303.6. Students will learn about the Host-parasite relationship, micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections, types of toxins (Exo, endo, entro) and their mechanism of action. Microbial pathogenesis and sexually transmitted disease.

BTB303.7. Students will have knowledge of Chemotherapy/antibiotics - Antimicrobial agents, sulfa drugs, penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics.

C. Programme Outcomes:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.

PO9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding

of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

D. Programme Specific Outcomes:

PSO.1: Develop knowledge base and competency in different thrust areas of cell biology, molecular biology, microbiology, biochemistry, genetics, instrumentation, chemical biology, immunology, structural biology, omic approaches, computational biology, plant and animal biotechnology, recombinant DNA technology, fundamental of biochemical engineering, bioprocess technology, biostatistics, enzymology, instrumentation, drug delivery systems, environmental and industrial biotechnology etc.

PSO.2: Achieve the scientific acumen and ability to identify research-based problems and develop suitable approach by designing protocols and their effective interpretation and implementation.

PSO.3: Develop knowledge base of applied physics, applied chemistry, applied mathematics, computer programming, electrical sciences etc. for effective multidisciplinary implementation.

PSO.4: Enhance analytical, project management, accounting and cost control, entrepreneurship skills along with effective communication and behavioral attributes.

E. Assessment Plan:

Component of Evaluation	Description	Code	Weightage %
Continuous Internal Evaluation	Mid Term	CT	15%
	Seminar/Viva-Voce/Quiz/Home Assignment	S/V/Q/HA	10%
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified	A	5%

	for taking up the End Semester examination. The allowance of 25% includes all types of leaves Including medical leaves.		
End Semester Examination	End Semester Examination	EE	70%
Total			**100%**

F. Syllabus

Module I: Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization.

Module II: Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, Fed batch culture, continuous culture, culture collection and maintenance of cultures.

Module III: Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV: Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-ironnitrite- oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophilesViruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI: Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII: Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

G. Examination Scheme:

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

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

H. Suggested Text/Reference Books:

General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
The microbes An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
The Microbial World, Roger Y. Stanier, Prentice Hall
Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
Industrial Microbiology, Casida, New Age International
Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC.Brown Publisher.

I. Lecture Plan

Lecture	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Discovery of the microbial world	Lecture	BTB303.1	Mid Term, Quiz & End Sem Exam
2	Controversy over spontaneous generation	Lecture	BTB303.1	Mid Term, Quiz & End Sem Exam
3	Role of microorganisms in transformation of organic matter and in the causation of diseases	Lecture	BTB303.1	Mid Term, Quiz & End Sem Exam
4	Development of pure culture methods	Lecture	BTB303.1	Mid Term, Quiz & End Sem Exam
5	Methods in Microbiology	Lecture	BTB303.1	Mid Term, Quiz & End Sem Exam
6	Principles of microbial nutrition, Culture media	Lecture	BTB303.1	Mid Term, Quiz & End Sem Exam
7	Theory and practice of sterilization	Lecture	BTB303.1	Mid Term, Quiz & End Sem Exam
8	Prokaryotic structure and function	Lecture	BTB303.2	Mid Term,

				Quiz & End Sem Exam
9	Functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule	Lecture	BTB303.2	Mid Term, Quiz & End Sem Exam
10	Functional anatomy of bacteria: surface appendages, cytoplasm and cytoplasmic Inclusions	Lecture	BTB303.2	Mid Term, Quiz & End Sem Exam
11	Growth - The definition of growth, mathematical expression of growth, growth curve	Lecture	BTB303.2	Mid Term, Quiz & End Sem Exam
12	Measurement of growth, Synchronous growth	Lecture	BTB303.2	Mid Term, Quiz & End Sem Exam
13	Fed batch culture, continuous culture	Lecture	BTB303.2	Mid Term, Quiz & End Sem Exam
14	Culture collection and maintenance of cultures	Lecture	BTB303.2	Mid Term, Quiz & End Sem Exam
15	Systematics and taxonomy	Lecture	BTB303.3	Mid Term, Quiz & End Sem Exam
16	New approaches to bacterial taxonomy	Lecture	BTB303.3	Mid Term, Quiz & End Sem Exam
17	Classification including ribotyping	Lecture	BTB303.3	Mid Term, Quiz & End Sem Exam
18	Ribosomal RNA sequencing	Lecture	BTB303.3	Mid Term, Quiz & End Sem Exam
19	Characteristics of primary domains	Lecture	BTB303.3	Mid Term, Quiz & End Sem Exam
20	Taxonomy, nomenclature	Lecture	BTB303.3	Mid Term, Quiz & End Sem Exam
21	Bergey's manual	Lecture	BTB303.3	Quiz & End Sem Exam
22	Metabolic Diversity among microorganisms	Lecture	BTB303.4	Quiz & End Sem Exam
23	Photosynthesis in microorganisms	Lecture	BTB303.4	Quiz & End Sem Exam

24	Role of bacteriochlorophylls, carotenoids and phycobilins	Lecture	BTB303.4	Quiz & End Sem Exam
25	Chemolithotrophy, hydrogen-iron-nitrite-oxidizing bacteria	Lecture	BTB303.4	Quiz & End Sem Exam
26	Nitrate and Sulphate reduction, methanogenesis and acetogenesis	Lecture	BTB303.4	Quiz & End Sem Exam
27	Fermentations, nitrogen fixation	Lecture	BTB303.4	Quiz & End Sem Exam
28	Plant microbe interactions (mycorrhizae)	Lecture	BTB303.4	Quiz & End Sem Exam
29	Archae as earliest life forms	Lecture	BTB303.5	Quiz & End Sem Exam
30	Thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles	Lecture	BTB303.5	Quiz & End Sem Exam
31	Viruses: Bacterial, animal	Lecture	BTB303.5	Quiz & End Sem Exam
32	Structure of viruses	Lecture	BTB303.5	Quiz & End Sem Exam
33	Reproduction and life cycle of RNA and DNA viruses	Lecture	BTB303.5	Quiz & End Sem Exam
34	Viroids and prions.	Lecture	BTB303.5	Quiz & End Sem Exam
35	Algae and Fungi: Classification and Reproduction	Lecture	BTB303.5	Quiz & End Sem Exam
36	Host-parasite relationship	Lecture	BTB303.6	Quiz & End Sem Exam
37	Normal micro flora of skin, oral cavity, gastrointestinal tract	Lecture	BTB303.6	Quiz & End Sem Exam
38	Respiratory infections; entry of pathogens into the host	Lecture	BTB303.6	Quiz & End Sem Exam
39	Types of toxins (Exo, endo, entro) and their mode of actions	Lecture	BTB303.6	Quiz & End Sem Exam
40	Microbial pathogenesis - Disease reservoirs	Lecture	BTB303.6	Quiz & End Sem Exam
41	Epidemiological terminologies; Infectious disease transmission	Lecture	BTB303.6	Quiz & End Sem Exam
42	Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi	Lecture	BTB303.6	Quiz & End Sem Exam
43	Chemotherapy/antibiotics	Lecture	BTB303.7	Quiz & End Sem Exam

44	Antimicrobial agents, sulfa drugs	Lecture	BTB303.7	Quiz & End Sem Exam
45	Antibiotics - Penicillin and Cephalosporins	Lecture	BTB303.7	Quiz & End Sem Exam
46	Broad spectrum antibiotics	Lecture	BTB303.7	Quiz & End Sem Exam
47	Antifungal antibiotics	Lecture	BTB303.7	Quiz & End Sem Exam
48	Mode of action of antibiotics	Lecture	BTB303.7	Quiz & End Sem Exam

J. Course Articulation Matrix (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAMME OUTCOMES												CORRELATION WITH PROGRAMME SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BTB303.1	historical perspective of microbial world, spontaneous generation, role of microbes, pure culture, microbial nutrition, culture media, and sterilization	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2
BTB303.2	prokaryotic cell, structural and functional anatomy of cell and organelles. Growth and growth curve, culture types – batch and continuous, culture collection and maintenance of	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2

	cultures															
BTB303.3	Systematics and taxonomy of bacteria, ribotyping, nomenclature and Bergey's manual	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2
BTB303.4	Metabolic Diversity among microorganisms, microbial photosynthesis, photosynthetic pigments, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2
BTB303.5	Archaea, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles. Viruses – Bacterial and Animal, their structure, reproduction. Viroids and	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2

	Prions. Algae and Fungi – their reproduction and classification															
BTB303.6	Host-parasite relationship, micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections, types of toxins (Exo, endo, entro) and their mechanism of action. Microbial pathogenesis and Sexually transmitted disease	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2
BTB303.7	Chemotherapy/ antibiotics - Antimicrobial agents, sulfa drugs, penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2

Sample Question Paper

Amity Institute of Biotechnology MID-SEMESTER (SEM –III) 2022-23
Class: B.Tech. Biotechnology III Semester

Subject Name: BTB 303 MICROBIOLOGY		Time: 1.5 Hrs			Max. Marks: 30	
Levels of the questions as per Blooms Taxonomy	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
Question Mapping	Q.1,4	Q.2,3	Q.4	Q.2,5,6		

Student will be able to
CO1: Enumerate bacterial count their isolation and development of pure culture.
CO2: Apply generation time calculation for different microbial entities.

CO Map	Question No.	Question	Marks
CO1	Q.1	Explain in brief about microbial evolution.	3
CO1	Q.2a	What do you understand by isolation of culture?	3
	Q.2b	How are prokaryotic microbes different from eukaryotic microbes?	3
CO1	Q.3	Give an account of DNA sequencing.	6
CO2	Q.4	Explain the significance of bacterial toxins.	3
CO2	Q.5a	What are the factors favoring enteric bacteria?	3
	Q.5b	Discuss the different factors affecting the growth of bacteria.	3
CO2	Q 6	Differentiate between monoauxic and diauxic bacterial growth curve.	6

Attainments		**Rubric**
Level	1	IF 60% of students secure more than 60% marks then level 1
Level	2	IF 70% of students secure more than 60% marks then level 2
Level	3	IF 80% of students secure more than 60% marks then level 3

Course outcome: Based on internal and external assessment the level of Course outcome attainment of the course **MICROBIOLOGY/BTB 303** is **level 3** for the

academic year 2022-23.

AMITY UNIVERSITY

MADHYA PRADESH

Established vide Government of Madhya Pradesh Act No. 27 of 2010

Amity Institute of Biotechnology
Course Handout
Course : Microbiology Lab
Course Code : BTB322, Credits : 01, Session : 2022-23(Odd Sem.), Class : B.Tech 2nd Year
Faculty Name : Dr. Manish Kumar

A. Introduction: To understand the basics of microbiology and different culture techniques. Preparation of culture media – liquid, slant and solid. Growth curve and different types of staining – grams, endospore and capsule staining. Isolation and identification of rhizobium from root nodules

B. Course Outcomes: At the end of the course, students will be able to:

BTB322.1. Students will learn about preparation of solid and liquid media.

BTB322.2. Students will do isolation and maintenance of organisms by plating, streaking and serial dilution.

BTB322.3. Students will know about the preparation of slant cultures.

BTB322.4. Students will learn about growth curve measurement of bacterial population by turbidometry.

BTB322.5. Students will know about measurement of bacterial population by dilution method.

BTB322.6. Students will gain knowledge of effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.

BTB322.7. Students will do microscopic examination of bacteria by gram staining.

BTB322.8. Students will learn about Endospore staining.

BTB322.9. Students will be acquainted with Capsule Staining.

BTB322.10. Students will experimentally perform isolation and identification of Rhizobium from root nodules.

C. Programme Outcomes:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science,

engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.

PO9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary

environments.

PO12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO.1: Develop knowledge base and competency in different thrust areas of cell biology, molecular biology, microbiology, biochemistry, genetics, instrumentation, chemical biology, immunology, structural biology, omic approaches, computational biology, plant and animal biotechnology, recombinant DNA technology, fundamental of biochemical engineering, bioprocess technology, biostatistics, enzymology, instrumentation, drug delivery systems, environmental and industrial biotechnology etc.

PSO.2: Achieve the scientific acumen and ability to identify research-based problems and develop suitable approach by designing protocols and their effective interpretation and implementation.

PSO.3: Develop knowledge base of applied physics, applied chemistry, applied mathematics, computer programming, electrical sciences etc. for effective multidisciplinary implementation.

PSO.4: Enhance analytical, project management, accounting and cost control, entrepreneurship skills along with effective communication and behavioural attributes.

D. Assessment Plan:

Component of Evaluation	**Description**	**Code**	**Weightage %**
Continuous Internal Evaluation	Internal Examination	CT	15%
	Seminar/Viva-Voce/Quiz/Home Assignment	S/V/Q/HA	10%
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25%	A	5%

	includes all types of leaves Including medical leaves.		
End Semester Examination	External Examination	EE	70%
Total			**100%**

E. Syllabus

Module I: Preparation of solid and liquid media.

Module II: Isolation and maintenance of organisms by plating, streaking and serial dilution.

Module III: Preparation of slant cultures.

Module IV: Growth curve measurement of bacterial population by turbidometry.

Module V: Measurement of bacterial population by dilution method.

Module VI: Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.

Module VII: Microscopic examination of bacteria by gram staining.

Module VIII: Endospore staining.

Module IX: Capsule Staining.

Module X: Isolation and identification of Rhizobium from root nodules.

F. Examination Scheme:

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

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

G. Suggested Text/Reference Books:

General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian

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

The microbes An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

The Microbial World, Roger Y. Stanier, Prentice Hall

Microbiology, Tortora, Funke and Chase, Benzamin& Cummings

Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.

Industrial Microbiology, Casida, New Age International

Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC.Brown Publisher.

H. Lecture Plan

Lecture	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Preparation of solid and liquid media	Practical	BTB322.1	Internal & External Exam
2	Learning about autoclave, laminar air flow	Practical	BTB322.1	Internal & External Exam
3	Isolation and maintenance of organisms by plating and streaking	Practical	BTB322.1	Internal & External Exam
4	Isolation and maintenance of organisms by serial dilution	Practical	BTB322.1	Internal & External Exam
5	Measurement of bacterial population by dilution	Practical	BTB322.1	Internal & External Exam
6	Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria	Practical	BTB322.1	Internal & External Exam
7	Microscopic examination of bacteria by gram staining	Practical	BTB322.1	Internal & External Exam
8	Endospore staining	Practical	BTB322.2	Internal & External Exam
9	Capsule staining	Practical	BTB322.2	Internal & External Exam
10	Collection of Root Nodules	Practical	BTB322.2	Internal & External Exam
11	Isolation of Rhizobium from root nodules	Practical	BTB322.2	Internal & External Exam
12	Identification of Rhizobium from root nodules	Practical	BTB322.2	Internal & External Exam

I. Course Articulation Matrix (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAMME OUTCOMES										CORRELATION WITH PROGRAMME SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
BTB 322.1	Preparation of solid and liquid media	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.2	Isolation and maintenance of organisms by plating, streaking and serial dilution	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.3	Preparation of slant cultures	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.4	Growth curve measurement of bacterial population by turbidometry	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.5	Measurement of bacterial population by dilution method	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.6	Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.7	Microscopic examination of bacteria by gram staining	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.8	Endospore staining	3	2	2	2	2	2	2	2	2	2	3	2	2
BTB 322.9	Capsule Staining	3	2	2	2	3	2	2	2	2	2	3	2	2
BTB 322.10	Isolation and identification of Rhizobium from root nodules	3	2	2	2	2	2	2	2	2	2	3	2	2

Sample Question Paper

Amity Institute of Biotechnology MID-SEMESTER 2021-22						
Class: B.Tech (Biotech) III Semester						
Subject Name: BTB 322 Microbiology Lab		Time: 2 Hrs			Max. Marks: 30	
Levels of the questions as per Blooms Taxonomy	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
Question Mapping	Q. 1,4	Q. 2,3	Q. 4	Q. 2,5,6		

Student will be able to
CO1: List the broad perceptive of cloud architecture and model.
CO2: Apply different cloud programming models as per need.

CO Map	Question No.	Question	Marks
CO1	Q.1	Discuss the development of pure cultures.	3
CO1	Q.2a	Differentiate between bacteria and fungi.	3
	Q.2b	Write a short note on bacterial DNA marker.	3
CO1	Q.3	Differentiate between genotype and ribotype.	6
CO2	Q.4	Explain about the capsule staining and	3

Attainments		**Rubric**
Level	1	IF 60 % of students secure more than 60 % marks then level 1
Level	2	IF 70 % of students secure more than 60 % marks then level 2
Level	3	IF 80 % of students secure more than 60 % marks then level 3

Course outcome: Based on internal and external assessment the level of Course outcome attainment of the course **MICROBIOLOGY LAB/BTB 322** is **level 2** for the academic year 2022-23.

Manish Kr

AMITY INSTITUTE OF BIOTECHNOLOGY
Course Handout
Course : **ADVANCED GENOMICS & PROTEOMICS**
Course Code : MSB 204, Crédits : 04, Session :2022-23(Even Sem.), Class : M.Sc. Ist Year
Faculty Name : Dr. MANISH KUMAR

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

B. Course Outcomes: At the end of the course, students will be able to:
MSB204.1 Understand the basic of genomics, Anatomy of genomics and human genome project
MSB204.2 Able to understand gene expression, and mapping
MSB204.3 Learn different DNA markers
MSB204.4 Understand Microarray and their applications in analysis of gene expression
MSB204.5 Develop knowledge of fundamental techniques in proteomics.
MSB204.6 Understand Post translational modification.
MSB204.7 Get detail knowledge and understanding of Protein – protein interaction.

C. Programme Outcomes:

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

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

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

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

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

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

change.

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

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

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

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

D. PROGRAM OUTCOMES OF M.Sc. BIOTECHNOLOGY

PSO.1: Develop knowledge base and competency in different thrust areas of advanced biochemistry, advanced microbial technology, biophysics and bioanalytical techniques, advanced cell biology and genetics, advanced biostatistics for biologist, advanced molecular biology, advances in genetic engineering, bioprocess technology, advanced genomics and proteomics, computational biology, environmental biotechnology, advanced immunology, enzyme technology, advanced animal biotechnology, advanced plant biotechnology, drug delivery system, etc.

PSO.2: Achieve the scientific acumen and ability to identify research-based problems and develop suitable approach by designing protocols and their effective interpretation and implementation.

PSO.3: Develop computer application skills to be applied in biotechnology.

PSO.4: Empower the students to be effective entrepreneurs and excellent researchers.

E. Assessment Plan:

Component of Evaluation	**Description**	**Code**	**Weightage %**
Continuous Internal Evaluation	Mid Term	CT	15%
	Seminar/Viva-Voce/Quiz/Home Assignment	S/V/Q/HA	10%
Attendance	A minimum of 75% Attendance is required to be maintained by a studentto be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	A	5%
End Semester Examination	End Semester Examination	EE	70%
Total			**100%**

F. Syllabus

Module I

Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genomes.

Module II
Transcriptomics and meta-transcriptomics: Introduction, method and uses. Genetic mapping

Module III
Microsatellite DNA markers, RFLP, DNA sequencing, Phylogeny

Module IV
Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V
Introduction to proteomics
Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI
Post translationalprotein modification

Module VII
Protein – protein interaction some examples

G. Examination Scheme:

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

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

H. Suggested Text/Reference Books:

Text:

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

***References*:**

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

I. Lecture Plan

Lecture	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Introduction to Genomics:	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam

2	Introduction to Genomics:	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam
3	Human Genome project	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam
4	Human Genome project	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam
5	Anatomy of prokaryotic and eucaryotic genome	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam
6	Anatomy of prokaryotic and eucaryotic genome	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam
7	repetitive DNA and RNA Contents of genoms	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam
8	repetitive DNA and RNA Contents of genoms	Lecture	MSB204.1	Mid Term-1, Quiz & End Sem Exam
9	Transcriptomics and metatranscriptomics	Lecture	MSB204.2	Mid Term-1, Quiz & End Sem Exam
10	Transcriptomics and metatranscriptomics	Lecture	MSB204.2	Mid Term-1, Quiz & End Sem Exam
11	Transcriptomics and metatranscriptomics	Lecture	MSB204.2	Mid Term-1, Quiz & End Sem Exam
12	Introduction , method and uses.genetic mapping	Lecture	MSB204.2	Mid Term-1, Quiz & End Sem Exam
13	Introduction , method and uses.genetic mapping	Lecture	MSB204.2	Mid Term-1, Quiz & End Sem Exam
14	Introduction , method and uses.genetic mapping	Lecture	MSB204.2	Mid Term-1, Quiz & End Sem Exam
15	Microsatellite DNA markers	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
16	Microsatellite DNA markers	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
17	Microsatellite DNA markers	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
18	RFLP	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam

19	RFLP	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
20	DNA sequencing, polyogemy	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
21	DNA sequencing, polyogemy	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
22	DNA sequencing, polyogemyprocedure	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
23	DNA sequencing, polyogemy	Lecture	MSB204.3	Mid Term-1, Quiz & End Sem Exam
24	Micro array	Lecture	MSB204.4	Quiz & End Sem Exam
25	Micro array	Lecture	MSB204.4	Quiz & End Sem Exam
26	Micro array	Lecture	MSB204.4	Quiz & End Sem Exam
27	DNA micro array marker, computational methods	Lecture	MSB204.4	Quiz & End Sem Exam
28	DNA micro array marker, computational methods	Lecture	MSB204.4	Quiz & End Sem Exam
29	DNA micro array marker, computational methods	Lecture	MSB204.4	Quiz & End Sem Exam
30	Introduction to proteomics	Lecture	MSB204.5	Quiz & End Sem Exam
31	Introduction to proteomics	Lecture	MSB204.5	Quiz & End Sem Exam
32	Fundamental methods used in proteomics	Lecture	MSB204.5	Quiz & End Sem Exam
33	Fundamental methods used in proteomics	Lecture	MSB204.5	Quiz & End Sem Exam
34	Fundamental methods used in proteomics	Lecture	MSB204.5	Quiz & End Sem Exam
35	2-D gel electrophoresis + mass spectroscopy	Lecture	MSB204.5	Quiz & End Sem Exam
36	2-D gel electrophoresis + mass spectroscopy	Lecture	MSB204.5	Quiz & End Sem Exam
37	2-D gel electrophoresis + mass spectroscopy 2-D gel electrophoresis + mass spectroscopy	Lecture	MSB204.5	Quiz & End Sem Exam
38	2-D gel electrophoresis + mass spectroscopy	Lecture	MSB204.5	Quiz & End Sem Exam
39	Post translationalprotein modification	Lecture	MSB204.6	Quiz & End Sem Exam
40	Post translationalprotein modification	Lecture	MSB204.6	Quiz & End Sem Exam

41	Post translationalprotein modification	Lecture	MSB204.6	Quiz & End Sem Exam
42	Post translationalprotein modification	Lecture	MSB204.6	Quiz & End Sem Exam
43	Protein – protein interaction some examples	Lecture	MSB204.7	Quiz & End Sem Exam
44	Protein – protein interaction some examples	Lecture	MSB204.7	Quiz & End Sem Exam
45	Protein – protein interaction some examples	Lecture	MSB204.7	Quiz & End Sem Exam
46	Protein – protein interaction some examples	Lecture	MSB204.7	Quiz & End Sem Exam
47	Protein – protein interaction some examples	Lecture	MSB204.7	Quiz & End Sem Exam
48	Protein – protein interaction some examples	Lecture	MSB204.7	Quiz & End Sem Exam

J. Course Articulation Matrix (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAMME OUTCOMES										CORRELATION WITH PROGRAMME SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
MSB204.1	Understand the basic of genomics, Anatomy of genomics and human genome project	3	3	1	3	1	1	1	-	2	1	3	1	-	1
MSB204.2	Able to understand gene expression, and mapping	3	3	**2**	3	1	-	-	-	2	1	3	1	-	1
MSB204.3	Learn different DNA markers	3	3	2	3	1	-	-	1	2	1	3	1	1	1

MSB204.4	Understand Microarray and their applications in analysis of gene expression	3	3	1	3	1	-	-	-	2	1	3	1	-	1
MSB204.5	Develop knowledge of fundamental techniques in proteomics.	3	3	1	3	1	-	-	-	2	1	3	1	-	1
MSB204.6	Understand Post translational modification.	3	3	1	3	1	-	-	-	2	1	3	1	1	1
MSB204.7	Get detail knowledge and understanding of Protein – protein interaction.	3	3	1	3	1	-	-	-	2	1	3	1	1	1

Amity Institute of Biotechnology I MID-SEMESTER (SEM –II) 2022-23						
Class: M.Sc Biotechnology II Semester						
Subject Name: MSB 204 Advanced Genomics & Proteomics		Time: 1.5 Hrs		Max. Marks: 30		
Levels of the questions as per Blooms Taxonomy	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
Question Mapping	Q.1,4	Q.2,3	Q.4	Q.2,5,6		
Student will be able to CO1: Understand the basics of genomics, Anatomy of genomics and human genome project. CO2: understand gene expression, and mapping.						

CO Map	Question No.	Question	Marks
CO1	Q.1	Differentiate between genomics and proteomics.	3
CO1	Q.2a	Discuss the separation processes in genomics.	3
	Q.2b	Discuss the separation processes in proteomics.	3
CO1	Q.3	Discuss physical mapping and use of restriction enzymes.	6
CO2	Q.4	Discuss linkage mapping with suitable example.	3
CO2	Q.5a	Write a short note on phylogeny.	3
	Q.5b	How genomic study is useful in the identification of	3

		genomes?	
CO2	Q 6	Discuss the role of recombination and recombinants in the linkage mapping.	6

Attainments		**Rubric**
Level	1	IF 60% of students secure more than 60% marks then level 1
Level	2	IF 70% of students secure more than 60% marks then level 2
Level	3	IF 80% of students secure more than 60% marks then level 3

Course outcome: Based on internal and external assessment the level of Course outcome attainment of the course **Advanced Genomics & Proteomics/MSB 204** is **level 3** for the academic year 2022-23.

Manish Kr


AMITY INSTITUTE OF BIOTECHNOLOGY
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AMITY UNIVERSITY
MADHYA PRADESH
Established vide Government of Madhya Pradesh Act No. 27 of 2010

Amity Institute of Biotechnology
Course Handout
Course : Advanced Microbial Technology
Course Code : MSB102, Credits : 03, Session : 2022-23(Odd Sem.), Class : M.Sc. 1st Year
Faculty Name : Dr. Manish Kumar

A. **Introduction:** To acquaint the students to understand the basic concept of microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

B. **Course Outcomes:** At the end of the course, students will be able to:

MSB102.1. Study morphology, classification, forms, of bacteria, archaebacteria, mycoplasma and PPLO. Different types of media & their preparations. Isolation of pure cultures, maintenance and preservation. Culture characteristics and Bacterial growth, growth curve, batch and continuous cultures di auxic and synchronous growth enumeration of cells by direct and indirect methods.

MSB102.2. Able to understand the Concept of sterilization and disinfection. Physical and chemical methods of control. Chemotherapeutics mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

MSB102.3. Know about the Molecular classification of microbes, microbial genetics, prokaryotic gene organization, DNA, replication, transcription and translation. Microbial regulation of gene expression: trp and lac operon. Gene Transfer and Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics and Reproductive cycles of bacteriophage, T4 phage and lambda.

MSB102.4. Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms. Applications of microbiology in effective diagnosis, treatment and prevention of infectious disease.

C. Programme Outcomes:

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

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

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

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

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

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

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

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

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

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

Programme Specific Outcomes:

PSO.1: Develop knowledge base and competency in different thrust areas of advanced biochemistry, advanced microbial technology, biophysics and bioanalytical

techniques, advanced cell biology and genetics, advanced biostatistics for biologist, advanced molecular biology, advances in genetic engineering, bioprocess technology, advanced genomics and proteomics, computational biology, environmental biotechnology, advanced immunology, enzyme technology, advanced animal biotechnology, advanced plant biotechnology, drug delivery system, etc.

PSO.2: Achieve the scientific acumen and ability to identify research-based problems and develop suitable approach by designing protocols and their effective interpretation and implementation.

PSO.3: Develop computer application skills to be applied in biotechnology.

PSO.4: Empower the students to be effective entrepreneurs and excellent researchers.

D. Assessment Plan:

Component of Evaluation	**Description**	**Code**	**Weightage %**
Continuous Internal Evaluation	Mid Term	CT	15%
	Seminar/Viva-Voce/Quiz/Home Assignment	S/V/Q/HA	10%
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves Including medical leaves.	A	5%
End Semester Examination	End Semester Examination	EE	70%
Total			**100%**

E. Syllabus

Module I: Introduction to Microbiology: Bacteria Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria nutritional requirements of microorganism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintenance and preservation of the pure cultures. Culture characteristics Bacterial growth Growth curve, batch and continuous cultures di-auxic and synchronous growth enumeration of cells by direct and indirect methods.

Module II: Control of Microorganisms: Concept of sterilization and disinfection. Physical and chemical methods of control. Chemotherapeutics mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial Genetics: Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization. The basic principles of microbial DNA, replication, transcription and translation. Microbial regulation of gene expression: the trp and lac operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical Microbiology: Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease.

F. Examination Scheme:

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

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

G. Suggested Text/Reference Books:

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

Macmillian

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

H. Lecture Plan

Lecture	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Introduction to Microbiology	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
2	Discovery of Microbial World	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
3	Spontaneous Generation	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
4	Role of microbes in disease causation	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
5	Development of Pure Culture	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
6	Methods in Microbiology	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
7	Principle of Microbial Nutrition	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
8	Culture Media Types	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
9	Theory of Sterilization	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
10	Practice of Sterilization	Lecture	MSB 102.1	Mid Term, Quiz & End Sem Exam
11	Concept of Sterilization	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam

12	Disinfection	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
13	Methods of Control	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
14	Chemotherapeutics	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
15	Mode of Action of Antibiotics	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
16	Penicillin and Ampicillin	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
17	Sulfonamide and Vanomycin	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
18	Streptomycin and Tatracycline	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
19	Chloramphenicol	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
20	Antifungals and Antivirals	Lecture	MSB 102.2	Mid Term, Quiz & End Sem Exam
21	Basics of Microbial Genetics and Prokaryotic gene organization	Lecture	MSB 102.3	Quiz & End Sem Exam
22	Principles of Microbial DNA	Lecture	MSB 102.3	Quiz & End Sem Exam
23	Replication, Transcription, Translation	Lecture	MSB 102.3	Quiz & End Sem Exam
24	Regulation of Gene Expression: Trp and Lac Operon	Lecture	MSB 102.3	Quiz & End Sem Exam
25	Transformation, Transduction, Conjugation	Lecture	MSB 102.3	Quiz & End Sem Exam
26	Plasmids and Transposons	Lecture	MSB 102.3	Quiz & End Sem Exam
27	Viral Genetics	Lecture	MSB 102.3	Quiz & End Sem Exam

28	Reproductive Cycles of Bacteriophage, T4 and Lambda	Lecture	MSB 102.3	Quiz & End Sem Exam
29	Normal Microflora of Host	Lecture	MSB 102.4	Quiz & End Sem Exam
30	Host Parasite Interactions	Lecture	MSB 102.4	Quiz & End Sem Exam
31	Mechanisms of Pathogenesis	Lecture	MSB 102.4	Quiz & End Sem Exam
32	Clinical manifestations associated to medically important pathogens	Lecture	MSB 102.4	Quiz & End Sem Exam
33	Applications of Microbiology	Lecture	MSB 102.4	Quiz & End Sem Exam
34	Diagnosis of Diseases	Lecture	MSB 102.4	Quiz & End Sem Exam
35	Treatment of different microbial diseases	Lecture	MSB 102.4	Quiz & End Sem Exam
36	Prevention of different microbial diseases	Lecture	MSB 102.4	Quiz & End Sem Exam

I. Course Articulation Matrix (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAMME OUTCOMES										CORRELATION WITH PROGRAMME SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
MSB 102.1	Study morphology, classification, forms of bacteria, archaebacteria, mycoplasma and PPLO. Different types of media & their preparations. Isolation of pure cultures, maintenance and preservation. Culture characteristics and	3	2	2	2	2	2	2	2	2	1	3	2	2	2

	Bacterial growth, growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods.														
MSB 102.2	Able to understand the Concept of sterilization and disinfection. Physical and chemical methods of control. Chemotherapeutics mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals antiviral	3	2	2	2	2	2	2	2	2	1	3	2	2	2
MSB 102.3	Know about the Molecular classification of microbes, microbial genetics, prokaryotic gene organization, DNA, replication, transcription and translation. Microbial regulation of gene expression: trp and lac operon. Gene Transfer and Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics and Reproductive cycles of bacteriophage, T4 phage and lambda.	3	2	2	2	2	2	2	2	2	1	3	2	2	2
MSB 102.4	Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations	3	2	2	2	2	2	2	2	2	1	3	2	2	2

	associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease.													

Sample Question Paper

Amity Institute of Biotechnology MID-SEMESTER 2022-23						
Class: M.Sc. (Biotech) I Semester						
Subject Name: MSB 102 Advanced Microbial Technology		Time: 2 Hrs			Max. Marks: 30	
Levels of the questions as per Blooms Taxonomy	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
Question Mapping	Q. 1,4	Q. 2,3	Q. 4	Q. 2,5,6		
Student will be able to CO1: List the broad perspective of microbiology and microbial technology. CO2: Apply the knowledge to different types of microbes (Bacteria, Virus, Algae, Fungus and Protozoa).						

CO Map	Question No.	Question	Marks
CO1	Q.1	Explain in brief the microbial nutritional requirement.	3
CO1	Q.2a	What are different sterilization techniques?	3
	Q.2b	How the mode of action of Penicillin and chloramphenicol are different from each other?	3

CO1	Q.3	How Lactose Operon works in presence and absence of Lactose as a positive or negative regulation?	6
CO2	Q.4	Explain the application of microbiology in effective diagnosis, treatment and prevention of infectious diseases.	3

Attainments		**Rubric**
Level	1	IF 60 % of students secure more than 60 % marks then level 1
Level	2	IF 70 % of students secure more than 60 % marks then level 2
Level	3	IF 80 % of students secure more than 60 % marks then level 3

Course outcome: Based on internal and external assessment the level of Course outcome attainment of the course **Advanced Microbial Technology/MSB 102** is **level 3** for the academic year 2022-23.

Manish Kr