SEMESTER I

Core Course 2

MICROBIAL BIOCHEMISTRY & BIOINSTRUMENTATION

Code : P26/MIC/DSC/102
Credits : 4
Total hours : 60
Hours/week: 4

Module I: BIOMOLECULES 1

Module II: BIOMOLECULES 2

Module III: ENZYMES

Module IV: BIOINSTRUMENTATION

SEMESTER - I
MICROBIAL BIOCHEMISTRY & BIOINSTRUMENTATION - THEORY

1. **Course Description:**
Programme: M.Sc.
Course Code: P26/MIC/DSC/102
Course Type: DSC
No. of credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. **Course Objectives:**
- To make students understand its application to living systems pertaining to both macro and microorganisms.
- To provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis.

3. **Course Outcomes:**

CO1: Understand the concepts of pH, buffers, biological buffer systems, entropy their importance, principles of bioenergetics, biological oxidation, reduction and biosynthesis and degradation of amino acids and proteins enzyme catalysis. (L II)

CO2: Understand, remember, and analyze the monomeric units and structural significance of polymeric biomolecules carbohydrates and lipids. (L II , IV)

CO3: Understand the biosynthesis structure of nucleic acids and the degradation pathways of the nucleotides and evaluate the conceptual knowledge of properties, structure, function kinetics, regulation of enzymes and apply the concept in engineering enzymes for large scale industrial processes (L II, III, V)

CO4: Understand the knowledge of different electrophoresis techniques, apply to know the molecular weight of biomolecules and understand the principle and working of various radiation detectors. (L II, III)

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4. Course Content:

MODULE I - BIOMOLECULES 1 **(15 Hrs)**

pH and its biological relevance, Determination of pH, preparation of buffers, Concept of entropy, free energy high energy compounds. Equilibrium constants, Biological oxidation and reduction, Electron transport, oxidative phosphorylation. Proteins and amino acids: Properties of amino acids, structure, conformation and properties of proteins, metabolism of amino acids, biosynthesis and degradation- an overview

MODULE II - BIOMOLECULES 2 **(15 Hrs)**

Classification, basic chemical structure, monosaccharides, aldoses, and ketoses, Cyclic structure of Mono, Oligo and Polysaccharides, stereoisomerism, anomers and epimers. Sugar derivatives, deoxy sugars, amino sugars, and sugar acids. Lipids: Definition, major classes of storage, structural lipids. Fatty acids structure & function, essential fatty acids. Bacterial lipids, Prostaglandins, structure, function, Major steroids of biological importance. various approaches for characterization of biomolecules

MODULE III - ENZYMES **(15 Hrs)**

Introduction to Enzymes -Definition and characteristics of enzymes, Nature and properties of enzymes, Coenzymes and cofactor catalysis. Enzyme Nomenclature and Classification-(IUB system), Isolation and Purification of Enzymes, Determination of Enzyme Activity, Enzyme Kinetics-Basic concept of enzyme kinetics, Michaelis–Menten equation, Lineweaver–Burk plot, Factors Affecting Enzyme Activity- Effect of substrate concentration, Effect of pH, Effect of temperature, Effect of inhibitors. Mechanism of Enzyme Action - Lock and Key hypothesis, Induced Fit hypothesis, Transition state theory. Mechanism with Examples- Hydrolases – Esterases, Oxidases – Glucose oxidase, Reductases- 5-alpha reductase, Enzyme Inhibition-Competitive inhibition, Non-competitive inhibition, Isoenzymes, Control of enzymes in metabolism, Allosteric Regulation- Allosteric enzymes, Aspartate transcarbamoylase (ATCase) Feedback Regulation-Feedback inhibition mechanisms

MODULE IV – BIOINSTRUMENTATION **(15 Hrs)**

Centrifugation: preparative and analytical centrifuges and rotors, Differential Centrifugation, Density gradient centrifugation, spectrometry: colorimetry and spectrophotometry, fluorimetry, Fluorescence in situ hybridization (FISH), NMR, ESR spectroscopy, Mass spectrometry: MALDI-TOF. Agarose gel electrophoresis, NATIVE-PAGE, SDS-PAGE (sodium dodecyl sulfate polyacrylamide gel electrophoresis), two-dimensional, Gel retardation assay (GRA), pulse field, capillary, Blotting techniques, Radio isotopes: Detection and measurement of radioactivity: Geiger Muller counter, Scintillation counters: Solid and Liquid, autoradiography.

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5. Resources:

Text books:

1. Lehninger, 2004, Principles of Biochemistry, W. H. Freeman Publishers.
2. U. Satyanarayana, U.Chakrapani. 2003, Text book of Biochemistry, Elsevier Publishers
3. Voet & Voet (2004), Biochemistry, Wiley publishers.
4. Davidson, (2010), The Biochemistry of Nucleic acids, 8th edition, Academic Press.

Reference Books:

1. Cohn & Stumph, (2009), Outlines of Biochemistry, Wiley Publishers.
2. Methods in Enzymology, Elsevier series.
3. Jeremy. M. Berg, John.L, Stryer (2002), Biochemistry, W. H. Freeman Publishers.
4. Gopal Reddy et al, (2008) Laboratory experiments in Microbiology, 3rd edition, Himalaya Publishing house.
5. J. Jayaraman, (2011), Laboratory manual in Biochemistry, 2nd edition, New Age International Pvt. Ltd. Publishers

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6. Syllabus Focus:

a) Relevance to Local, Regional, National and Global Development Needs

Module	Local / Regional/ National/Global Development Needs	Relevance
Module I	Global	By advancing knowledge in Biological Chemistry and microbiology, regions can stimulate growth in biotechnology, pharmaceuticals, and other knowledge-intensive sectors. This creates high-value jobs, contributing to national prosperity and stability.
Module II	Global	Understanding these molecules helps in fields like medicine, biotechnology, nutrition, and biological research. Techniques for characterization of biomolecules are important for identifying and studying biological compounds in laboratories.
Module III	Global	Studying enzyme kinetics, inhibition, and regulation helps understand how metabolic reactions are controlled. Knowledge of enzymes is important in medicine, biotechnology, diagnostics, and drug development. Understanding enzyme activity also helps in industrial processes and biochemical research.
Module IV	Global	Understanding and applying knowledge on tools and techniques used for biological research, medical diagnosis, and biotechnology applications.

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b) Components on Skill Development/Entrepreneurship Development/Employability

Skill Development/ Entrepreneurship Development/ Employability	Syllabus Content	Description of Activity
Employability NSQEF Level 5, 6	Module III	Skills in biological chemistry are in high demand in R&D departments within the pharmaceutical, biotechnology, and food industries, where understanding the chemical basis of biological systems are crucial for developing new products and technologies.

c. SDG Components

Aligned with SDG 3 (Good health and wellbeing) and SDG 9 (Industry and innovation).

7. Pedagogy:

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Scientific experiments	Experiential learning
2.	Interactive classroom sessions/ Presentations	Participative learning
3.	Case studies	Problem solving

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8. Course Assessment Plan:

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Max. Marks : 20 M		Max.marks : 20 M	
CIA - 1	**CIA - 2**	**Skill Based Test -1(10M)**	**Skill Based Test -2 (10M)**
Section A:1X10=10M Essay question 2 questions given. Answer ONE **Section B: 2X5=10M** Short questions 3 questions given. Answer TWO	**Section A: 1X10=10M** Essay question 2 questions given. Answer ONE **Section B: 2X5=10M** Short questions 3 questions given. Answer TWO	Assignment	Model Presentation Poster Presentation etc (Discretion of Faculty)
Average of two IA's will be considered			

EXTERNAL QP PATTERN		
4 CREDITS 4 MODULES (CORE)	SECTION A - Internal choice	**4 Q X 10 M = 40 M**
	SECTION B- Answer any five questions out of 8	**5Q X 4 M= 20 M**

c) Aligning COs with Continuous Internal Assessments

COs	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1 & CO2	CIA-1	End Semester examination
CO3 & CO4	CIA II	
CO1	Assignment	
CO2, CO3, CO4	Skill Based- Model Presentation	

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C) Model Question Paper - End Semester Exam

MICROBIAL BIOCHEMISTRY & BIOINSTRUMENTATION
MODEL QUESTION PAPER – THEORY

Course Code : P26/MIC/DSC/102 Max. Marks: 60
Credits :4 Time: 2 ½ Hrs

SECTION A - INTERNAL CHOICE				4 Q X 10 M = 40 M
Q.No	Question	Module	CO	BTL
1	Question	Module I	CO 1	II
OR				
2	Question	Module I	CO 1	II
3	Question	Module II	CO 2	II
OR				
4	Question	Module II	CO 2	IV
5	Question	Module III	CO 3	II
OR				
6	Question	Module III	CO 4	IV
7	Question	Module IV	CO 4	II
OR				
8	Question	Module IV	CO 4	III

SECTION B - ANSWER ANY 5 OUT OF 8				5 Q X 4 M = 20 M
Q.No	Question	Module	CO	BTL
9	Question	Module I	CO 1	I
10	Question	Module I	CO 1	I
11	Question	Module II	CO 2	II
12	Question	Module II	CO 2	II
13	Question	Module III	CO 3	II
14	Question	Module III	CO 3	II
15	Question	Module IV	CO 4	II
16	Question	Module IV	CO 4	II

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SECTION A - INTERNAL CHOICE			4Q X 10 M = 40 M	
Question Number	Module	Question	CO	BTL (Blooms Taxonomy Level)
1	Module I	Describe in detail the biological oxidation and reduction process.	CO 1	Level II
2	Module I	Explain in detail the properties, structure and biological importance of amino acids.	CO 1	Level II
3	Module II	Describe in detail the process of metabolism of purines.	CO 2	Level II
4	Module II	Describe the classification of carbohydrates and their biological importance in industry.	CO 2	Level IV
5	Module III	Explain in detail regulation of enzyme activity by AspartateTranscarbomylase and its applications	CO 3	Level II
6	Module III	What methodologies are employed in the isolation and purification of enzymes, and how do these techniques contribute to the comprehensive understanding and application of enzymes in biochemical research and industrial processes?	CO 3	Level V
7	Module IV	Narrate the principle and types of Mass Spectrometry	CO 4	Level II
8	Module IV	Describe SDS Page electrophoresis technique and its application	CO 4	Level III
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have **ONE** question from **each** module)			5Q X 4M = 20M	
9	Module I	What is pH	CO 1	Level I
10	Module I	Explain Properties of proteins	CO 1	Level I
11	Module II	Describe Amino sugars	CO 2	Level II
12	Module II	Explain Bacterial lipids	CO 2	Level II
13	Module III	Describe Isoenzymes	CO 3	Level II
14	Module III	Explain Feedback inhibition	CO 3	Level II
15	Module IV	Explain Gieger Muller counter	CO4	Level II
16	Module IV	Explain the principle of colorimeter	CO4	Level II

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a. Question Paper Blueprint:

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	10	2	4
2	15	CO-2	2	10	2	4
3	15	CO-3	2	10	2	4
4	15	CO-4	2	10	2	4
1,2,3,4		CO-1,2,3,4				4

9. CO - PO Mapping:

CO	PO	Cognitive Level	Classroom sessions (Hrs)
1	1	Understand	15
2	1, 2	Understand & Apply	15
3	1, 2	Understand & Apply	15
4	1, 2	Understand & Apply	15

10. CO-PO Mapping: (H-High, M-Medium, L-low)

CO / PO	PO1	PO2
1	M	
2	M	M
3	M	H
4	M	H

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SEMESTER - I
MICROBIAL BIOCHEMISTRY & BIOINSTRUMENTATION – PRACTICAL

1. Course Description:

Course Code: P26/MIC/DSC/102/P | **Max. Hours: 60**
Type of course: DSC | **Hours per week: 4**
No. of credits: 2 | **Max. Marks: 50**

2. Course Objectives:

- To give practical exposure to qualitative and quantitative analysis of biomolecules.
- To analyze the application of SDS-PAGE and HPLC.

3. Course Outcomes:

CO1: Prepare buffers, determine its pH and apply it to various biochemical analysis

CO2: Identify biomolecules qualitatively & estimate their concentration in unknown samples

CO3: Isolate, purify, concentrate and analyze the parameters affecting enzyme activity

List of Practicals

1. Preparation of buffers and adjustment of pH
2. Qualitative tests for carbohydrates and analysis of unknown
3. Qualitative tests for amino acids and analysis of unknown
4. Tests for lipids(qualitative)
5. Quantitative estimation of fructose
6. Determination of saponification value and iodine number of fats
7. Partial purification of enzymes (B-amylase)
8. Effect of substrate concentration, pH, time and temperature on enzyme activity
9. Calculation of Km for partially purified enzyme
10. Separation of proteins by electrophoresis (SDS-PAGE)
11. Demonstration of HPLC

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]MODEL QUESTION PAPER – PRACTICAL

Course Code: P26/MIC/DSC/102/P **Max Marks: 50**
Credits: 2 **Time: 3 Hrs**

I. MAJOR	**20 M**
II. MINOR	**10 M**
III. Identify the given spots A-E and write few significant points	**10 M**
IV. Record	**5 M**
V. VIVA	**5 M**

Prepared by Faculty	Checked & verified by HoD	Approved by the Principal
Dr.P.Roselin	Dr.P.Roselin	Prof.Uma Joseph

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SEMESTER I

Core Course 1

MICROBIAL BIOENERGETICS

Code : P26/MIC/DSC/101
Credits : 4
Total hours : 60
Hours/week: 4

Module I: MICROBIAL CULTIVATION AND NUTRITION

Module II: MICROBIAL GROWTH AND SOLUTE TRANSPORT

Module III: METABOLIC PATHWAYS

Module IV: BIOENERGETICS

SEMESTER – I

MICROBIAL BIOENERGETICS - THEORY

1. Course Description:

Programme: M.Sc
Course Code: P26/MIC/DSC/101
Course Type: DSC
No. of credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. Course Objectives:

- To impart fundamental knowledge of microbial growth, nutrition and solute transport.
- To give an insight on various metabolic pathways in bacteria

3. Course Outcomes:

CO1: Understand the various types of culture media, nutritional groups of bacteria and apply it in cultivation of bacteria, fungi and algae. (L II, III)

CO2: Understand & attain knowledge about methods of measuring microbial growth, derivation of generation time, factors affecting the growth and analyze the role of biological membranes in solute transport. (L II, IV)

CO3: Understand & analyze the metabolic pathways, different modes of fermentations in microbes. (L II, IV)

CO4: Understand the concepts of Bioenergetics and analyze the significance of bacteriorhodopsin and quorum sensing techniques. (L II, IV)

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4.Course Content:

MODULE I - MICROBIAL CULTIVATION AND NUTRITION **(15 Hrs)**

Microbiological media: Types of Culture media & their significance, Defined synthetic media, Minimal media, Complex media, Basal media, Enriched media, Enrichment media, Selective media, Differential media, transport media. Media for cultivation of fungi, protozoa and algae. Cultivation methods of bacteria, Isolation of pure cultures, Aerobic and anaerobic culturing methods- Anaerobic GasPak, McIntosh & Fildes Anaerobic jar, Pyrogallol method, Isolation of Microaerophiles by Candle Jar Method.

Principles of bacterial taxonomy and classification. Overview of Microbial methods of identification: Morphological, cultural, ecological, biochemical and molecular methods (16srRNA typing). Nutritional requirements, Nutritional groups of bacteria-photo autotrophy, Photo heterotrophy, Chemolithoautotrophy and Chemoorganoheterotrophy, Prototroph, Auxotroph and Isolation of auxotrophic mutants by Replica Plating Technique, Culture Collection Centers-Examples.

MODULE II - MICROBIAL GROWTH AND SOLUTE TRANSPORT **(15 Hrs)**

Definition of growth, Generation time, Growth curve, Growth phases of bacteria. Types of growth - Synchronous cultures – methods of synchronous culturing, Continuous culturing methods, Catabolite repression & Diauxic Growth, Factors effecting growth.

Nutrient Uptake in Bacteria. Solute transport: Role of membrane in solute transport, Mechanism for uptake of solutes-Passive diffusion, Facilitated diffusion, Active transport (Uniport, Antiport, Symport), PEP Group translocation, Other examples of solute transport- Iron transport, Concept of Siderophores

MODULE III - METABOLIC PATHWAYS **(15 Hrs)**

Aerobic: Amphibolic pathways: EMP pathway: reaction and key enzymes, ED pathway: key enzymes and energy yield comparison with EMP pathway, TCA cycle: steps, key enzymes, energy yield, anaplerotic reactions. Glyoxylate bypass: significance in bacteria and plants.,

Electron transport chain in Prokaryotes: components, complexes and functions. Bioenergetics and Significance of the pathways.

Anaerobic Metabolism: Modes of fermentations in microorganisms: Introduction to anaerobic metabolism, Acetate fermentation: representative organisms, Industrial and ecological significance.

Mixed acid Fermentation; Definition, characteristics, representative organisms, enzymes involved, Methyl red Test. Mixed Acid Fermentation & Lactic acid in Traditional Foods. Eg; Curd Propionic acid pathway: Methyl malonyl COA pathway, representative organisms, applications. Industrial Applications of Fermentation pathways.

MODULE IV: BIOENERGETICS **(15Hrs)**

Bacteriorhodopsin: Source, Introduction, Structure of bacteriorhodopsin, Photo cycle & significance.

Quorum Sensing History, General Mechanism, Ex: Bioluminescence: Quorum sensing in gram negative bacteria, Introduction, Role of LUX Operon, luciferase activity, Significance /Application.ATP Synthase enzyme-Structure of bacterial ATP synthase & Mitochondrial ATP synthase, Mechanism by Rotational catalysis.

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5. Resources:

5.a Text books:

1. Pelczar's Text Book of Microbiology, 7th Edition (2025) by Micheal J Pelczar Jr
2. Brock Biology of Microorganisms 16th Edition (2023) by Michael T. Madigan, Kelly S. Bender, Daniel H Buckley, W. Matthew Sattley, David A Stahl
3. S. Ram Reddy, S.M Reddy, (2008) Microbial Physiology, Scientific Publishers. Company.
4. Prescott's Microbiology 11th Edition (2020) by Joanne Willey, Kathleen Sandman, Chris Woolverton.
5. Nelson, D, Cox, M, (2005), Principles of biochemistry, 4thedition, W.H. Freeman and Company
6. White, D. (2011), The physiology and biochemistry of prokaryotes, 4th edition, Oxford University Press.
7. Powar, C. B., & Daginawala, H. F. (1995). General microbiology Vol. 2, Himalaya Publishers
8. Stanier, R.Y., Ingrahm, J.L., Wheelis, M.L. and Painter, R.R,.(1987), General Microbiology, 5thedition, The Macmillan press Ltd
9. Microbiology Practical manual 3rd edition (2024) by Shukla Das

5.b. Reference books:

1. Voet, D &Voet, J. G., (2004), Biochemistry, 3rdedition, John Wiley& Sons Inc.
2. Zubey, G. L (1996), Principles of Biochemistry, Wm. C. Brown publishers
3. Conn, Stump, P. K., Bruening, G. R. H. (1987), Outlines of Biochemistry, 5th Edition, John Wiley & Sons.
4. Gottschalk, G., (1985), Bacterial Metabolism, 2nd edition, Springer Verlag
5. White, D., (1995), The Physiology and Biochemistry of Prokaryotes, 3rd Edition, Oxford University Press.
6. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
7. Moat, A.G. and Foster, J. W., (2002), Microbial Physiology. 4th Edition. John Wiley & Sons.

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6. **Syllabus Focus:**

a) Relevance to Local, Regional, National and Global Development Needs

Module	Local /Regional/National / Global Development Needs	Relevance
Module I	Local & Regional	The module is designed to understand the culturing and cultivation methods of bacteria, fungi
Module II	Local	The module is designed to attain knowledge about growth parameters and solute transport in bacteria.
Module III	National	This module is designed to understand the metabolic pathways and analyze the role of microbes in fermentation
Module IV	Local & National	This module is designed to understand the concepts of Bioenergetics

b) Components on Skill Development/Entrepreneurship Development/Employability

Skill Development/ Entrepreneurship Development/ Employability	**Syllabus Content**	**Description of Activity**
Skill Development	Module I & III	Assignment, Hands on Experience on Culturing techniques, Model Presentations

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c. IKS & SDG Components

IKS	Syllabus Content	Module
IKS	Mixed Acid fermentation & lactic acid Fermentation in traditional foods.	III

Aligned with SDG 4 (Quality Education)

7. Pedagogy:

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Interactive Presentations	Participative learning
2.	Biological Animations	Participative learning
3.	Science Experiments	Experiential Learning

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8. Course Assessment Plan:

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination:

Max. Marks : 20 M		Max.marks : 20 M	
CIA - 1	**CIA - 2**	**Skill Based Test -1(10M)**	**Skill Based Test -2 (10M)**
Section A:1X10=10M Essay question 2 questions given. Answer ONE **Section B: 2X5=10M** Short questions 3 questions given. Answer TWO	**Section A: 1X10=10M** Essay question 2 questions given. Answer ONE **Section B: 2X5=10M** Short questions 3 questions given. Answer TWO	Assignment	Model Presentation Poster Presentation etc (Discretion of Faculty)
Average of two IA's will be considered			

EXTERNAL QP PATTERN		
4 CREDITS 4 MODULES (CORE)	SECTION A - Internal choice	**4 Q X 10 M = 40 M**
	SECTION B- Answer any five questions out of 8	**5Q X 4 M= 20 M**

b) Aligning COs with Continuous Internal Assessments

COs	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1 & CO2	CIA-1	End Semester examination
CO3 & CO4	CIA II	
CO1	Assignment	
CO2, CO3, CO4	Skill Based- Model Presentation	

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c. Model Question Paper - End Semester Exam

MICROBIAL BIOENERGETICS
MODEL QUESTION PAPER - THEORY

Course Code: P26/MIC/DSC/101
Credits: 4

Max Marks: 60
Time: 2 ½ Hrs

SECTION A - INTERNAL CHOICE		4 Q X 10 M = 40 M		
Q.No	Question	Module	CO	BTL
1	Question	Module I	CO 1	II
	OR			
2	Question	Module I	CO 1	II
3	Question	Module II	CO 2	II
	OR			
4	Question	Module II	CO 2	IV
5	Question	Module III	CO 3	II
	OR			
6	Question	Module III	CO 4	IV
7	Question	Module IV	CO 4	III
	OR			
8	Question	Module IV	CO 4	IV

SECTION B - ANSWER ANY 5 OUT OF 8		5 Q X 4 M = 20 M		
Q.No	Question	Module	CO	BTL
9	Question	Module I	CO 1	II
10	Question	Module I	CO 1	II
11	Question	Module II	CO 2	III
12	Question	Module II	CO 2	II
13	Question	Module III	CO 3	II
14	Question	Module III	CO 3	II
15	Question	Module IV	CO 4	II
16	Question	Module IV	CO 4	IV

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SECTION A - INTERNAL CHOICE				4Q X 10M = 40 M
Question Number	Module	Question	CO	BTL (Blooms Taxonomy Level)
1	Module I	Explain various methods of cultivation Bacteria.	CO 1	II
2	Module I	Explain in detail, Chemolithoautotrophy and chemoorganotrophy in Bacteria	CO 1	II
3	Module II	Define Growth curve and describe different growth phases of bacteria.	CO 2	II
4	Module II	Describe & analyze different types of solute transport mechanisms in bacteria and outline the role of membrane in solute transport.	CO 2	IV
5	Module III	Write in detail about TCA and anaplerotic reactions of TCA.	CO 3	II
6	Module III	Explain and analyze how six carbon glucose is converted to three carbon pyruvate, which further is converted to two carbon acetyl groups that can be funneled to Krebs cycle	CO 3	IV
7	Module IV	Explain the concept of Bioluminescence and highlight its significance	CO4	III
8	Module IV	Explain the structure of Bacteriorhodopsin and analyze its role in acting as a proton pump	CO4	IV
SECTION B - ANSWER ANY 5 OUT OF 8				5Q X 4M = 20M
9	Module I	What is Enriched media, give examples and explain the significance	CO 1	II
10	Module I	Describe the Cultivation of Fungi	CO 1	II
11	Module II	How can we obtain Synchronous cultures	CO 2	III
12	Module II	Describe Diauxic growth	CO 2	II
13	Module III	Explain the Mixed acid Fermentation Pathway	CO 3	II
14	Module III	ED Pathway	CO 3	II
15	Module IV	Structure of bacterial ATP synthase	CO4	II
16	Module IV	Significance of Quorum sensing	CO4	IV

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c. Question Paper Blueprint:

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	10	2	4
2	15	CO-2	2	10	2	4
3	15	CO-3	2	10	2	4
4	15	CO-4	2	10	2	4
1,2,3,4		CO-1,2,3,4				4

9. CO - PO Mapping:

CO	PO	Cognitive Level	Classroom sessions (Hrs)
1	1	Understand	15
2	1, 2	Undersand & Analyze	15
3	1, 2	Understand & Analyse	15
4	1, 2	Understand & Evaluate	15

10. CO-PO Mapping: (H-High, M-Medium, L-low)

CO / PO	PO1	PO2
1	M	
2	M	M
3	M	H
4	M	H

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SEMESTER – I
MICROBIAL BIOENERGETICS - PRACTICAL

Course Code: P26/MIC/DSC/101/P
Course Type: DSC
No. of Credits: 2

Max. Hours: 60
Hours per week: 4
Max. Marks: 50

Course Objectives:

- To provide hands on experience in culturing & cultivation of microbes
- To study the factors affecting bacterial growth and studying the biochemical pathways in bacteria.

Course Outcomes:

CO1: Attain hands on experience on culturing methods of bacteria and understand the significance and application of the microbiological medias

CO2: Perform and analyze anaerobic cultivation methods of bacteria.

CO3: Identify the phases of growth in bacteria, evaluate the factors effecting the growth and analyze the phenomenon of catabolite repression by performing diauxic growth curve.

List of Practicals

1. General Instructions: Microbiology Laboratory and its Discipline
2. Preparation of microbiological media. Minimal media, Basal media, Enriched media, Enrichment media, Differential media, Selective media.
3. Isolation and culturing of fungi
4. Isolation and culturing of algae
5. Culturing methods of microbes- slant, stab culture, tube culture, flask cultures.
6. Anaerobic culturing methods of microbes- Candle Jar and use, thioglycolate media, culturing, Anaerobic Gas Pak and its application.
7. Enumeration of bacteria by Breed's count (Direct Microscopic Count).
8. Study of bacterial growth curve
9. Study of catabolite repression by diauxic growth curve
10. Factors effecting the microbial growth (pH, temperature & salt concentration)
11. Isolation of bioluminescent bacteria from fish

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MODEL QUESTION PAPER - PRACTICAL

Course Code: P26/MIC/DSC/101/P
Credits: 2

Max Marks: 50
Time: 3 Hrs

I. MAJOR	**20 M**
II. MINOR	**10M**
III. Identify the given spots (A – E) and write few significant points	**10 M**
IV. Record	**5 M**
IV. Viva	**5 M**

Prepared by Faculty	Checked and Verified by HoD	Approved by the Principal
Dr. Anitha Thomas	**Dr. P.Roselin**	**Prof. Uma Joseph**

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SEMESTER I

Core Course 4

MOLECULAR BIOLOGY & MICROBIAL GENETICS

Code : P26/MIC/DSC/104
Credits : 4
Total hours : 60
Hours/week: 4

Module I: DNA STRUCTURE, PROPERTIES & ITS BIOSYNTHESIS

Module II: RNA STRUCTURE, BIOSYNTHESIS & GENE REGULATION

Module III: GENE TRANSFER METHODS

Module IV: CLONING STRATERGIES, DNA DAMAGE AND REPAIR

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SEMESTER - I

MOLECULAR BIOLOGY & MICROBIAL GENETICS - THEORY

1. **Course Description:**

Programme: M.Sc **Max. Hours: 60**
Course Code: P26/MIC/DSC/104 **Hours per week: 4**
Course Type: DSC **Max. Marks: 100**
No. of credits: 4

2. **Course Objectives:**

- To Understand the structure, types, replication, damage & repair of DNA, Mutagenesis, transcription, genetic code, Protein synthesis and gene regulation.
- Enable the student to acquire knowledge on Transposons, cloning procedures, Plasmids, vectors, artificial chromosomes and construction of cDNA libraries and gene transformation methods.

3. **Course Outcomes:**

CO1: Understand the structure, properties, replication of DNA, organization of prokaryotic and eukaryotic Genomes and extra chromosomal elements. (L II)

CO2: Understand and Analyze the structure of RNA, Transcription, Protein synthesis, Genetic code, Concept of Gene, Gene regulation in Prokaryotes and Eukaryotes. (L II, IV)

CO3: Apply the conceptual knowledge of molecular mechanisms of Gene transfer to Mapping and Genome analysis. (L III, IV)

CO4: Understand the properties of vectors, cloning process, DNA libraries, Concepts of mutagenesis and apply the conceptual knowledge of DNA damage, repair mechanisms to metabolic diseases in humans (L II, III, IV)

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4. Course Content:

MODULE I - DNA STRUCTURE, PROPERTIES AND ITS BIOSYNTHESIS (15 Hrs)

Structure of DNA and its biosynthesis – detailed structure of DNA, Variation from Watson and Crick model, Z-DNA, A&B DNA, Denaturation and melting curves. Over view of Purine & Pyrimidine synthesis. Genome organization in prokaryotes and eukaryotes. Replication Mechanism: enzymes involved in replication, step by step process. Eukaryotic telomere replication. Extrachromosomal elements plasmids, types, isolation, identification and detection.

MODULE II - RNA STRUCTURE, BIOSYNTHESIS AND GENE REGULATION (15Hrs)

RNA structure and biosynthesis. Prokaryotic and eukaryotic transcription. Processing of t- RNA, r- RNA, m -RNA splicing. Concept of Ribozyme. Genetic code and Wobble hypothesis. Contribution of Indian scientists towards discovery of genetic code. Protein synthesis- Translation in prokaryotes and Eukaryotes. Post translational modification. Concept of Gene: Fine structure, Gene regulation and expression – lac operon, arabinose and tryptophan operons. Gene regulation in eukaryotic systems, role of promoters, enhancer elements.

MODULE III - GENE TRANSFER METHODS (15Hrs)

Bacterial transformation and recombination- discovery, detection, molecular mechanisms of transformation. Bacterial conjugation- sex factor in bacteria, F and HFr transfer, mechanism of transfer, linkage mapping, mechanism of recombination. Bacterial transduction- transduction phenomenon, methods of transduction, co- transduction, generalized, specialized and abortive transduction, sexduction and their applications. Transposable elements -Definition, detection of transposition in bacteria, types of bacterial transposons and application of transposons. Giant extrachromosomal elements (ECEs) - Inocles and their significance.

MODULE IV - CLONING STRATEGIES, DNA DAMAGE AND REPAIR (15Hrs)

Cloning and expression vectors based on plasmids, phagemids and cosmids, phages. Viruses, artificial chromosomes(YAC's), shuttle vectors. Restriction enzymes. Principle and applications. Construction and screening of genomic, cDNA libraries. Mutagenesis - types of mutagens, molecular basis of mutations, site directed mutagenesis, reverse genetics. DNA damage and repair mechanism. Mutagenicity testing using microbial systems.

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5. Resources:

a) Textbooks:

1. James D. Watson Tania A. Baker, Stephen P. Bell Alexander Gann, Michael Levine, Richard Losick (2013). 7th Edition, Molecular Biology of the Gene, Pearson Edu Publishers.
2. Roger Y. Stanier, Edward A. Adelberg, John L. Ingraham (1977). 5th edition. General Microbiology, London Macmillan.
3. David Freifelder (1986). 3rd edition, Molecular Biology. Jones & Bartlett Publishers
4. T.A. Brown (2025). 9thedition. Gene cloning and DNA analysis- An Introduction, John Wiley & Sons.
5. Bernard R. Glick and Jack. J. Pasternak (2010). 4th edition. Molecular Biotechnology. ASM Press.
6. Bruce Alberts (2014). 6th Edition. Molecular Biology of the Cell. W. W. Norton & Company.

b) References Books:

1. Robert Weaver (2025), 4thedition, Molecular Biology, Mc Graw-Hill publication.
2. David Latchman, Taylor &Francis (2025). 3rd edition, Gene Control, Taylor and Francis group publication.
3. David Freifelder, Stanley R. Maloy, John E. Cronan, (1994). 2nd edition, Microbial genetics Jones and Bartlett Publishers.
4. Joseph Sambrook, David William Russel (2006). The Condensed Protocols from Molecular Cloning: a Laboratory Manual, Cold spring harbor laboratory press.
5. Davidson JN, (1972), 7th edition, The Biochemistry of nucleic acids, Academic Press, New York
6. Sandy B. Primrose, Richard Twyman (2006). 8th edition, Principles of Gene Manipulation and Genomics. Wiley publishers.
7. Mark Schena, (2007) DNA Microarrays: Methods Express Series, revised edition, Scion Publishing.

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8. Keith Wilson, John Walker (2018). 8th Edition. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
9. Genes X II (201 7). 12th edition. Benjamin Lewin. Jones & Bartlett Publishers, Inc.
10. Avinash Upadhyay, Kakoli Upadhyay (2023). MolBio (Fundamentals of Molecular Biology). Himalaya Publishing House.
11. Basic Molecular Biology (2010). Avinash Upadhyay, Kakoli Upadhyay. Himalaya Publishing House.
12. Sushi I Kumar Upadhyay. Harendra k ri war Gaur. Cytology, Genetics and Molecular Biology. Kalyani Publishers.
13. Carolyn D. Bustamante, Jan Vaughan (2024). 3rd Edition. Molecular Biology Techniques: A Classroom Laboratory Manual. Academic Press.
14. S. K. Gakhar, Monika M iglani, A shwani Kumar (2013). Molecular Biology: A Laboratory Manual. I.K. International Publishing House Pvt. Ltd.
15. J Saxena, M. Baunthiyal, I. (2015). Laboratory Manual of Microbiology, Biochemistry and Molecular Biology. Ravi. Scientific Publishers.

6. Syllabus Focus:

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National / Global Development Needs	Relevance
Global	In recent decades, advances in methods in molecular biology and genetics have revolutionized multiple areas of the life and health sciences. It remains as a global need for the development of more refined and effective methods across these fields of research. The current course presents articles related to novel molecular biology and genetics techniques developed by scientists from around the world.

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b) Components on Skill Development/Entrepreneurship Development/Employability

Skill Development / Entrepreneurship Development / Employability	Syllabus Content	Description of Activity
Skill Development **(NSQF Level 8)**	Module IV	Presentations & Practical Demonstrations

c) IKS components

IKS	Syllabus Content	Module
IKS	Contribution of Indian scientists to Genetic code	II

d) Aligned with SDG 4 (Quality Education).

7. Pedagogy:

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Seminar Presentation	Participative Learning
2.	Designing your experiment	Experiential Learning
3.	Case studies	Problem solving

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8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Maximum Marks: 20M		Maximum Marks: 20M	
CIA 1 **Subjective**	**CIA 1** **Subjective**	**CIA 2** **Skill Based Test: 10M**	**CIA 2** **Assignment: 10M**
Section A: 1x10=10M Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	**Section A: 1x10=10M** Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	Discretion of the faculty	Discretion of the faculty

External QP Pattern		
4 Credits 4 Modules (CORE)	SECTION A - Internal Choice	**4 Q X 10 M = 40M**
	SECTION B – Answer any 5 out of 8 (To compulsorily have ONE question from each module)	**5 Q X 4 M = 20M**

d) Aligning COs with Continuous Internal Assessments

Cos	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Practical Demonstration	
CO4	CIA-2 Assignment	

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e) Question Paper Pattern:

MOLECULAR BIOLOGY AND MICROBIAL GENETICS
Model Question Paper – Theory

Subject Code: P26 /MIC/DSC/104
Time: 2½ h **Max marks: 60**

SECTION A - INTERNAL CHOICE		4 Q X 10 M = 40 M		
Q.No	Question	Module	CO	BTL
1	Question	Module I	CO 1	II
	OR			
2	Question	Module I	CO 1	II
3	Question	Module II	CO 2	II
	OR			
4	Question	Module II	CO 2	IV
5	Question	Module III	CO 3	II
	OR			
6	Question	Module III	CO 4	IV
7	Question	Module IV	CO 4	III
	OR			
8	Question	Module IV	CO 4	IV

SECTION B - ANSWER ANY 5 OUT OF 8		5 Q X 4 M = 20 M		
Q.No	Question	Module	CO	BTL
9	Question	Module I	CO 1	II
10	Question	Module I	CO 1	II
11	Question	Module II	CO 2	III
12	Question	Module II	CO 2	II
13	Question	Module III	CO 3	II
14	Question	Module III	CO 3	II
15	Question	Module IV	CO 4	II
16	Question	Module IV	CO 4	IV

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SECTION A - INTERNAL CHOICE			4 Q X 10M = 40 M	
Question Number	**Module**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module I	Discuss the structure and forms of DNA in detail.	CO 1	Level II
2	Module I	Discuss in detail the mechanism of replication of DNA and various enzymes involved in the process	CO 1	Level II
3	Module II	Describe in detail the process of gene expression and regulation in prokaryotes with reference to Lac operon.	CO 2	Level II
4	Module II	Write notes of Prokaryotic Transcription mechanism.	CO 2	Level II
5	Module III	Discuss in detail the concept of transposable elements. Add notes on Giant extrachromosomal elements.	CO 3	Level III
6	Module III	Explain in detail the process of conjugation. Add notes on application of conjugation in linkage mapping.	CO 3	Level IV
7	Module IV	Write notes on Cloning and Expression vectors with examples.	CO4	Level IV
8	Module IV	Give an account of mutagenesis with special reference to types of mutagens and molecular mechanisms of mutation.	CO4	Level IV
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have **ONE** question from **each** module)			5 Q X 4M = 20M	
9	Module I	Write notes on Prokaryotic genome organization.	CO 1	Level II
10	Module I	Identification & detection of Plasmids.	CO 1	Level II
11	Module II	Types of RNA	CO 2	Level II
12	Module II	Concept of Gene	CO 2	Level II
13	Module III	Explain Bacterial transformation	CO 3	Level III
14	Module III	Write notes on specialized transduction	CO 3	Level III
15	Module IV	DNA damage and repair	CO4	Level IV
16	Module IV	Restriction Enzymes	CO4	Level IV

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9a. Question Paper Blueprint:

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	10	2	4
2	15	CO-2	2	10	2	4
3	15	CO-3	2	10	2	4
4	15	CO-4	2	10	2	4
1,2,3,4		CO - 1,2,3,4				4

9b. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (Hrs)
1	1	Understand	15
2	1, 2	Understand	15
3	1, 2	Understand, Analyze	15
4	1, 2	Understand, Analyze Apply	15

10.CO-PO Mapping: (H-High, M-Medium, L-low)

CO / PO	PO1	PO2
1	M	
2	M	M
3	M	H
4	M	H

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SEMESTER – I
MOLECULAR BIOLOGY & MICROBIAL GENETICS - PRACTICAL

1. Course Description:

Course Code: P26/MIC/DSC/104/P
Course Type: DSC
No. of Credits: 2

Max. Hours: 60
Hours per week: 4
Max. Marks: 50

2.Course Objectives:

- To give hands on experience to isolate DNA, RNA and Plasmids
- To isolate mutants and carry out the process of screening.

3.Course Outcomes:

CO1: Extract, purify and determine the molecular weight of DNA, RNA and Plasmid

CO2: Isolate screen and identify mutants

CO3: Carryout the process of conjugation and protoplast fusion in Bacteria

List of Practicals

1. Extraction and isolation of genomic DNA from *E. Coli.*
2. Estimation of DNA.
3. Estimation of RNA.
4. Determination of molecular weight of DNA, resolved on agarose gel electrophoresis.
5. Screening and isolation of mutants by replica plating technique.
6. Conjugation in bacteria.
7. Protoplast isolation and preparation.
8. Protoplast fusion and regeneration.
9. Isolation of genomic DNA from Spring onions.
10. Isolation of genomic DNA from Goat liver.

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11. Induction of Lac operon and observation of lac operon concept in *E. coli*
12. Induction of mutations by physical mutagens (UV)
13. Induction of mutations by chemical mutagens

MODEL QUESTION PAPER - PRACTICAL

Course Code: P26/MIC/DSC/104 /P **Max Marks: 50**

Credits: 2 **Time: 3 Hrs**

I. Major	**20 M**
II. Minor	**10M**
IV. Identify the given spots (A-E) and write few significant points	**10 M**
V. Record	**5 M**
VI. Viva	**5 M**

Prepared by Faculty	Checked & verified by HoD	Approved by the Principal
Dr. D. Sunita	Dr. P. Roselin	Prof. Uma Joseph

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SEMESTER –I

VIROLOGY

1. Course Description:

Programme: M.Sc **Max. Hours: 60**

Course Code: P26/MIC/DSC/103 **Hours per week:4**

Course Type: DSC **Max. Marks: 100**

No. of credits: 4

2. Course objectives:

- To develop a strong foundation in fundamental and advanced virology, including viral structure, classification, taxonomy, replication strategies, virus–host interactions, cellular responses, cytopathic effects, and representative viruses of different genome types, along with emerging viral diseases.
- To provide applied and molecular insights into virology, covering viral diseases of plants, animals, and humans; diagnostic and control strategies; traditional medicine approaches; and applications of viral genetics, interferons, antiviral agents, vaccines, and viral vectors in biotechnology and research.

3. Course outcomes:

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

CO1: Understand the diversity, classification, taxonomy, structure, detection, and significance of viruses, including emerging and re-emerging viral pathogens (LII).

CO2: Understand and apply viral replication mechanisms, virus–host interactions, cellular responses and cytopathic effects with reference to representative DNA and RNA viruses (L II, III).

CO3: Analyze the pathogenesis, laboratory diagnosis, prevention, and control of viral diseases in plants, animals, and humans, including zoonotic and sexually transmitted viral infections (LIV).

CO4: Apply knowledge of viral genetics, antiviral strategies, vaccines, interferons, and viral vectors in molecular biology, biotechnology, and disease control (LIII, LV).

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4. **Course content:**

MODULE I: VIRUS CLASSIFICATION, STRUCTURE AND DETECTION (15h)

History of Virology (Latest Scientific Investigations), Viral Classification: Baltimore. Recent changes to Virus Taxonomy, ICTV-Virosphere and Hierarchical Ranks. Viral Metadata Resource. Viral Metagenomics-Virome. Virus Structure and Morphology. Detection of Viruses: Physical. Biological, Serological and Molecular methods. Cultivation and Quantification of bacteriophages. plant and animal viruses. Significance of Emerging Viruses: Ebola, Nipah, Hantavirus, Zika virus. General idea about Cyanophages, Actinophages and Mycophages. Sub-Viral Particles: Satellites Virus, Viroids and Prions.

MODULEII: VIRUS–HOST INTERACTIONSANDREPLICATION (15h)

Viral replication Strategies. Cellular interactions - Clathrin Coated Pits, Endocvtosis and Virus Uncoating mechanisms. Host response to viral Infection-Apoptosis, Necrosis. Cellular basis of transformation, Types of Cytopathic Effects. Structure, Characteristics and Replication strategies of T4 and Lambda, ds/ssDNA virus: ds DNA viruses: Adenoviridae - Adenovirus; ss DNA: Nanoviridae- BBTV; ds RNA viruses: Reoviridae - Rota virus; (+) ssRNA virus: Coronaviridae - SARS-CoV-2; Virgaviridae: Tobacco Mosaic Virus (TMV); (—) ssRNA virus: Paramyxoviridae - Measles virus: ssRNA-RT virus: Retroviridae- HIV; dsDNA-RT virus: Hepadnaviridae - Hepatitis B virus.

MODULE III VIRAL PATHOGENESIS AND CONTROL (15h)

Introduction to traditional medicine; role of spices used in Indian foods for prevention and treatment of Viral Infections. Pathogenicity, Lab Diagnostics, Prevention and Control of Plant viruses: Cauliflower Mosaic Virus, Gemini viruses.

Pathogenicity, Lab Diagnostics, Prevention and Control of Animal viruses: Air borne viral infections: Influenza, Rubella, Mumps; Water borne viral infections - Hepatitis (HAV). Polio myelitis. Zoonotic viral infections - Rabies, Dengue. Sexually transmitted viral diseases — Herpes (Herpes Simplex Virus) Hepatitis B viruses, HIV-acquired immunodeficiency syndrome (AIDS)

MODULE IV: VIRAL GENETICS AND THERAPEUTIC STRATEGIES (15h)

Recombination in Phages, Multiplicity Reactivation and Phenotypic Mixing.

General account of Tumor virus (RNA and DNA). Viral Interference and Interferons. Classification of Interferons. Antiviral agents (chemical) and their mode of actions.

Different types of Viral Vaccines, Viral Vectors used for Cloning and Sequencing: X phage. M13. Retro viruses, Use of Baculoviruses and CaMV 35S promoter and its applications.

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5. Resources:

5a. Textbooks:

1. Fields Virology 7th Edition (2023) by Peter M. Howley, David M. Knipe
2. Molecular and Cellular Biology of Viruses 2nd Edition (2024) by Phoebe Lostroh
3. Virology: Principles and Applications 2nd Edition (2013) by John Carter, Venetia Saunders
4. Principles of Virology 5th Edition (2020) by S. Jane Flint, Vincent R. Racaniello, Glenn F.Rall, Theodora Hatziioannou, Anna Marie Skalka
5. Molecular Biology of the Gene 7th Edition (2013) by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick
6. Molecular Virology of Human Pathogenic Viruses by Wang-Shick Ryu
7. Textbook of Medical Virology 2nd Edition (2025) Baijayanti Mala Mishra
8. Recent Advances in Animal Virology (2019) Yashpal Singh Malik
9. Essentials of Virology (2007) by S. Ram Reddy, S.M. Reddy
10. Alfred Brown and Heidi Smith, 2017, Bensons Microbiological application: A laboratory manual in General Microbiology, Indian Edition, Mc.Graw Hill (13e)
11. Laboratory manual of Microbiology and Biotechnology by K.R. Aneja. 2014

5b. Reference books:

- Edward K. Wagner and Martinez J. Hewlett. (2004). Basic Virology. 2nd ed. Blackwell Science.
- Biswas SB and Amita Biswas. (1996). An introduction to viruses. 4th ed. Vikas Publishing House.
- Michael T. Madigan. (2014). Brock Biology of Microorganisms: International Edition. 14 th Edition.
- White D.E and Frank J. Fenner. (1994). Medical Virology. 4 th Edition. Academic Press.
- Jane Flint S, Lynn W. Enquist, Vincent R. Racaniello and Anna Marie Skalka. (2008).
- Principles of Virology. 3 rd Edition. ASM Press.
- Charles H Cunningham. (1977). A Laboratgory Guide in Virology. 7 th Edition. Burgess Publishing Co.
- Basic Lab Procedures in Diagnostic Virology by Marty Cristensen. CBS publishers.
- Steven C. Specter, Richard L. Hodinka, Danny L.Wiedbrauk and Stephen A.Young. (2009). Clinical Virology Manual. 4 th Edition. ASM Press.

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6. **Syllabus Focus:**

a. Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National / Global Development Needs	Relevance
Global	Support healthcare improvements, economic stability, agricultural productivity, environmental sustainability, and international cooperation, thereby contributing to the overall well-being and development of the nation.

b. Components on Skill Development/Entrepreneurship Development/Employability

Skill Development / Entrepreneurship Development / Employability	**Syllabus Content**	**Description of Activity**
Entrepreneurship Development (NSQF Level 3 or 4)	Module II and III	Hands on practicals and field visits

c. IKS components

IKS	**Syllabus Content**	**Module**
IKS	Introduction to traditional medicine; role of spices used in Indian foods for prevention and treatment of Viral Infections	III

Aligned with SDG 3 (Good Health and well- being) and SDG 4 (Quality Education).

7. **Pedagogy**

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Interactive Classroom quiz	Experiential learning
2.	Presentation	Participative learning

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8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Maximum Marks: 20M		Maximum Marks: 20M	
CIA 1 **Subjective**	**CIA 1** **Subjective**	**CIA 2** **Skill Based Test: 10M**	**CIA 2** **Assignment: 10M**
Section A: 1x10=10M Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	**Section A: 1x10=10M** Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	Discretion of the faculty	Discretion of the faculty

External QP Pattern		
4 Credits 4 Modules **(CORE)**	SECTION A - Internal Choice	**4 Q X 10 M = 40M**
	SECTION B – Answer any 5 out of 8 (To compulsorily have ONE question from each module)	**5 Q X 4 M = 20M**

b) Aligning COs with Continuous Internal Assessments

COs	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1 & CO2	CIA-1	End Semester examination
CO3 & CO4	CIA II	
CO1	Assignment	
CO2, CO3, CO4	Skill Based- Model Presentation	

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a. Question Paper Pattern:

VIROLOGY
Model Question Paper – Theory

Subject Code: P26 /MIC/DSC/202/L
Time: 2½ h Max marks: 60

SECTION A - INTERNAL CHOICE		4 Q X 10 M = 40 M		
Q.No	Question	Module	CO	BTL
1	Question	Module I	CO 1	II
	OR			
2	Question	Module I	CO 1	II
3	Question	Module II	CO 2	II
	OR			
4	Question	Module II	CO 2	IV
5	Question	Module III	CO 3	II
	OR			
6	Question	Module III	CO 4	IV
7	Question	Module IV	CO 4	III
	OR			
8	Question	Module IV	CO 4	IV

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SECTION B - ANSWER ANY 5 OUT OF 8				5 Q X 4 M = 20 M
Q.No	Question	Module	CO	BTL
9	Question	Module I	CO 1	II
10	Question	Module I	CO 1	IV
11	Question	Module II	CO 2	II
12	Question	Module II	CO 2	IV
13	Question	Module III	CO 3	II
14	Question	Module III	CO 3	IV
15	Question	Module IV	CO 4	II
16	Question	Module IV	CO 4	IV

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SECTION A - INTERNAL CHOICE			4Q X 10 M = 40M	
Question Number	**Module**	**Question (Model Questions)**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module I	Describe the role of the International Committee on Taxonomy of Viruses (ICTV) in virus classification	CO1	Level II
2	Module 1	Differentiate between serological and molecular diagnostic methods.	CO1	Level IV
3	Module II	Explain cellular basis of transformation and types of Cytopathic effects by viral replication	CO2	Level II
4	Module II	Compare and contrast the replication strategies of T4 and Lambda phages.	CO2	Level IV
5	Module III	Explain the pathogenesis and diagnosis of CaMV and Gemini viruses in plants.	CO3	Level II
6	Module III	Compare the transmission routes and pathogenesis of Rabies and Dengue.	CO3	Level IV
7	Module IV	Explain the mechanism of recombination in phages	CO4	Level II
8	Module IV	Differentiate between bacteriophage vectors and animal viral vectors for sequencing applications.	CO4	Level IV
SECTION B - ANSWER ANY 5 OUT OF 6 (To compulsorily have **ONE** question from **each** module)			5 Q X 4M = 20M	
9	Module I	Define sub viral particles	CO 1	Level I
10	Module I	Describe the significance of Emerging Viruses	CO 1	Level II
11	Module II	Explain viral replication strategies	CO 2	Level II
12	Module II	Describe the replication strategy of Hepatitis B virus.	CO 2	Level II
13	Module III	Describe the role of spices used in Indian foods for prevention of Viral Infections	CO 3	Level II
14	Module III	Explain how contaminated water plays a role in the transmission of poliomyelitis.	CO 3	Level II
15	Module IV	Differentiate between RNA and DNA tumor viruses	CO4	Level IV
16	Module IV	Explain the mode of action of antiviral agents.	CO4	Level II

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8. Question Paper Blueprint:

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	10	2	4
2	15	CO-2	2	10	2	4
3	15	CO-3	2	10	2	4
4	15	CO-4	2	10	2	4
1,2,3,4		CO-1,2,3,4				4

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (Hrs)
1	1	Understand & Analyze	15
2	1, 2	Understand & Analyze	15
3	1, 2	Apply	15
4	1, 2	Apply	15

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10. CO-PO Mapping: (H-High, M-Medium, L-low)

CO / PO	PO1	PO2
1	M	
2	M	M
3	M	H
4	M	H

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SEMESTER – I
VIROLOGY – PRACTICAL

1. Course Description:

Course Code: P26/MIC/DSC/103/P
Type of course: DSC
No. of credits: 2

Max. Hours: 60
Hours per week: 4
Max. Marks: 50

Course Objectives

- To provide hands-on training in virology laboratory practices, including biosafety, Good Laboratory Practices (GLP), isolation, cultivation, quantification, and preservation of bacteriophages, plant viruses, and animal viruses.
- To familiarize students with applied virology techniques and public health relevance, such as immunodiagnostic assays, viral disease diagnosis, vaccination awareness, and epidemiological survey-based studies.

Course Outcomes

CO1: Demonstrate GLP and biosafety level (BSL) practices and perform standard laboratory procedures safely while handling viral and bacteriophage samples.

CO2: Isolate, cultivate, quantify and preserve bacteriophages from environmental and food samples, and interpret phage growth characteristics such as one-step growth curve, burst size, and induction.

CO3: Identify plant and animal viral infections, demonstrate virus cultivation and cytopathological changes, and apply immunodiagnostic and epidemiological methods for viral disease detection while understanding viral biocontrol and vaccination strategies.

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List of practicals

1. GLP and BSL facilities demonstration for virology lab
2. Isolation of E. coli and specific phage from soil
3. Isolation of E. coli and specific phage from sewage
4. Isolation of phages from contaminated food samples
5. Demonstration for the application of bacteriophages as food preservatives
6. Demonstration of one step growth curve, burst size and phage induction
7. Quantification and preservation of phages
8. Demonstration of plant viral infections using different samples
9. Cultivation of animal viruses in egg allantoic, amniotic and CAM (dye insertion method)
10. Demonstration of cytopathological changes of animal virus
11. lmmunodiagnostics — Tridot test for HIV
12. Diagnosis of Dengue by detection of IgG and IgM antibody and NS1 antigen
13. Demonstration of NPV production and its role as biopesticide.
14. Awareness and participation in vaccination programs (extension activity).
15. Survey bases studies on viral epidemics, pandemics and vaccine drive

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MODEL QUESTION PAPER – PRACTICAL

Course Code: P26/MIC/DSC/102/P **Max Marks: 50**
Credits: 2 **Time: 3 Hrs**

I. MAJOR	**20 M**
II. MINOR	**10 M**
III. Identify the given spots A-E and write few significant points	**10 M**
IV. Record	**5 M**
V. VIVA	**5 M**

Prepared by Faculty	Checked & verified by HoD	Approved by the Principal
Dr.P.Roselin	Dr.P.Roselin	Prof.Uma Joseph

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