SEMESTER - I

BIOINSTRUMENTATION - THEORY

1. Course Description :

Programme: M.Sc.
Course Code: P24/MIC/DSC/104
Course Type: DSC
No. of credits: 3

Max. Hours: 45
Hours per week: 3
Max. Marks: 100

2. Course Objectives :

- To impart the knowledge of qualitative and quantitative methods of measurement of biomolecules.
- To analyze and correlate the methods involved in study of biomolecules.

3. Course Outcomes :

CO1: Understand, remember the concentration methods of biomolecules and apply different centrifugation methods. Understand the chromatographic methods and analyze the application of cell disruption Methods (L II , IV)

CO2: Understand the application of optical methods in quantitation of biomolecules and analyze the structural features of biomolecules by optical methods. (L II , IV)

CO3: Understand the knowledge of different electrophoresis techniques, apply to know the molecular weight of biomolecule and understand the principle and working of various radiation detectors. (L II, III)

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4. Course Content :

MODULE I- SEPARATION METHODS : (15 Hrs)

Introduction and various approaches for characterization of biomolecules. Centrifugation: preparative and analytical centrifuges and rotors, Differential Centrifugation, Density gradient centrifugation: Principle, media types and their applications – Isolation of cells, sub cellular organelles, viruses and macromolecules. Chromatographic techniques: paper, thin layer, ion exchange: cation and anion, gel filtration, affinity: His Tag, GST-Tag; adsorption, reverse phase, counter current distribution, GLC, HPLC, cell disruption methods, cell free extracts and their use in metabolic studies.

MODULE II - OPTICAL METHODS – PRINCIPLE AND APPLICATION : (15 Hrs)

Elementary treatment of biochemical methods, colorimetry and spectrophotometry, fluorimetry, Fluorescence in situ hybridization (FISH), Scanning electron microscope (SEM), Transmission Electron Microscope (TEM), optical rotation, Birefringence, Circular dichroism, NMR, ESR spectroscopy, X-ray diffraction, Mass spectrometry: Different types, MALDI-TOF.

MODULE III - ELECTROPHORESIS & RADIO ISOTOPES : (15 Hrs)

Paper, Gel (starch, acrylamide and agrarose), NATIVE-PAGE, SDS-PAGE (sodium dodecyl sulfate polyacrylamide gel electrophoresis), horizontal, gradient, two dimensional, Isoelectric focusing, Gel retardation assay (GRA), pulse field, capillary, Blotting techniques, PAGE staining techniques: Coomassie blue & Silver staining, Radio isotopes: Detection and measurement of radioactivity: Geiger Muller counter, Scintillation counters: Solid and Liquid, autoradiography, Radioisotopes and stable isotopes: General method of study of intermediary metabolism, Uses of mutants in study of metabolism.

5. Resources:

Text books:

1. P. Asokan. (2003). Analytical Biochemistry (Biochemical Techniques). 1st Edition. China Publications.
2. Upadhyay and Upadhyay. (1993). Biophysical chemistry. 3rd Edition, Himalaya Publishers.
3. Dinesh Puri. (2014). Textbook of Medical Biochemistry. 3rd Edition. Elsevier India.
4. *Lehninger*, Nelson & Cox. (2004). Principles of Biochemistry. 4th Edition. W. H. Freeman.

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5. Brock T.D. (1983). Membrane filtration: A User's Guide and Reference Manual. Science Tech Publishers.
6. Joanne M.Willey, Linda M.Sherwood, Christopher J.Woolverton. (2011). Prescott's Microbiology. 8th Edition. Mc Graw. Hill International Edition.
7. Michael J. Pelczar, Chan E.C.S, Noel R. Krieg. (2013). Microbiology. 5th Edition. McGraw Hill Education (India) Private Limited.
8. P.Asokan. (2003). Analytical Biochemistry (Biochemical Techniques). 1st Edition. China Publications.

Reference books:

1. Wilson K & Walker J. (2000). Principles and Techniques of Practical Biochemistry. 5th Edition. Cambridge Univ. Press.
2. Bryan L. Williams & Keith Wilson (2010). Principles and Techniques of practical biochemistry. Cambridge Cambridge University Press.
3. David Freifelder. (1983). Physical Biochemistry: Applications to Biochemistry and Molecular Biology. 2nd Edition. W. H. Freeman.
4. Rodney F. Boyer. (1993). Modern Experimental Biochemistry. 3rd Edition. Benjamin-Cummings Pub.
5. S. K. Sawhney and Randhir Singh. (2000). Introductory Practical biochemistry. 2nd Edition. Narosa Publisher.
6. Saroj Dua and Neera Garg. (2013). Biochemical Methods of Analysis: Theory and Applications. 1st Edition. Alpha Science Intl Ltd.
7. John F. Robyt and Bernard J. White. (1987). Biochemical Techniques: Theory and Practice. 1st Edition. CBS *Publishers.*
8. R.O. Okotore. (1998) Basic Separation Techniques in Biochemistry Paperback. 1st Edition. Professional *Book Publishers.*

6. Syllabus Focus:

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

Local /Regional/National /Global Development Needs	Relevance
Global	Lead to innovations in pharmaceuticals, biofuels, and bioremediation technologies. In improving laboratory services to implement nationwide health monitoring and response systems.

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Employability	Module III	The skills acquired are applicable in various sectors, including healthcare, pharmaceuticals, agriculture, environmental science, and academia, thus broadening employment opportunities.

7. Pedagogy :

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

8. Course Assessment Plan :

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

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA-1	End Semester examination
CO2	CIA-2 Poster presentation	
CO3	CIA-2 Assignment	

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b) Question Paper Pattern :

BIOINSTRUMENTATION
MODEL QUESTION PAPER – THEORY

Course Code : P24/MIC/DSC/104
Credits: 3

Max. Marks: 60
Time: 2 ½ Hrs

SECTION – A

I. Answer the following: **3 x 12 = 36 M**

1. Discuss the principle, methodology and applications of density gradient centrifugation.

OR

2. Describe the concept of thin layer chromatography and its application for amino acid analysis.

3. Distinguish between the principle, components and application of colorimeter and spectrophotometer.

OR

4. Describe the principle and applications of mass spectrophotometry.

5. How does the principle of SDS-PAGE facilitate protein separation, and what Specific functions do SDS, urea, and β-mercaptoethanol serve within this context?

OR

6. Describe the measurement of radioactivity by liquid scintillation counters.

SECTION – B

Answer any FOUR : **4 x 6 M = 24 M**

7. What is Dialysis
8. Define Adsorption chromatography
9. Explain FISH
10. Describe TEM
11. Explain GRA
12. What are Stable isotopes

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SECTION A - INTERNAL CHOICE			3Q X 12 M = 36 M	
Question Number	**Module**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain the principle, methodology and applications of density gradient centrifugation.	CO 1	Level II
2	Module 1	Describe the concept of thin layer chromatography and its application for amino acid analysis.	CO 1	Level II
3	Module 2	Distinguish between the principle, components and application of colorimeter and spectrophotometer.	CO 2	Level IV
4	Module 2	Describe the principle and applications of mass spectrophotometry	CO 2	Level II
5	Module 3	How does the principle of SDS-PAGE facilitate protein separation, and what Specific functions do SDS, urea, and β-mercaptoethanol serve within this context?	CO 3	Level III
6	Module 3	Describe the measurement of radioactivity by liquid scintillation counters	CO 3	Level II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have **ONE** question from **each** module)			4 Q X 6M = 24M	
7	Module 1	What is Dialysis	CO 1	Level I
8	Module 1	Define Adsorption chromatography	CO 1	Level I
9	Module 2	Explain FISH	CO 2	Level II
10	Module 2	Describe TEM	CO 2	Level II
11	Module 3	Explain GRA	CO 3	Level II
12	Module 3	What are Stable isotopes	CO 3	Level I

SEMESTER - I
BIOINSTRUMENTATION – PRACTICAL

1. Course Description:

Course Code: P24/MIC/DSC/104/P **Max. Hours: 60**
Type of course: DSC **Hours per week: 4**
No. of credits: 2 **Max. Marks: 50**

2. Course Objectives:

- To impart the knowledge of practical aspects of concentration methods of biomolecules.
- To analyze the application of column chromatography, SDS-PAGE and HPLC.

3. Course Outcomes:

CO1: Understand the concentration methods of biomolecules.

CO2: Analyze the quantification method of protein.

CO3: Understand the application of chromatographic methods.

List of Practicals

1. Isolation of biomolecule - amylase
2. Concentration of biomolecules: Salting out with ammonium sulphate
3. Dialysis
4. Estimation of proteins by Folin Lowry method
5. Separation and purification of proteins by column chromatography
6. Separation of amino acids by paper chromatography
7. Separation of lipids by thin layer chromatography
8. Separation of proteins by electrophoresis (SDS-PAGE)
9. Demonstration of HPLC

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MODEL QUESTION PAPER – PRACTICAL

Course Code : P24/MIC/DSC/104/P **Max. Marks: 50**
Credits: 2 **Time: 3 Hrs**

I. MAJOR **20 M**

1. Determine the concentration of protein in the given plant extract by Lowry method.

   Std. Concentration of protein = 100 µg/ml

2. Estimate the amount of protein in the given sample.

II. MINOR **10M**

1. Calculate the amount of protein content in the given plant extract.

OR

2. Observe and identify the components

III. Identify the given spots (A-E) and write few significant points **5x2=10 M**

IV. Record **5M**

V. Viva **5M**

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

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SEMESTER - I
BIOLOGICAL CHEMISTRY- THEORY

1. **Course Description:**
Programme: M.Sc.
Course Code: P24/MIC/DSC/102
Course Type: DSC
No. of credits: 3

Max. Hours: 45
Hours per week: 3
Max. Marks: 100

2. **Course Objectives:**
- To make student 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)

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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.

MODULE III - NUCLEIC ACIDS & ENZYMES **(15 Hrs)**

Conformation of nucleic acids (DNA and RNA). Metabolism of purines and Pyrimidines (an overview) Enzymes: nomenclature, classification methods for determination of enzyme activity. Isolation and purification of enzymes. Enzyme kinetics: Effect of pH, substrate concentration, temperature and inhibitors. Control of enzymes. Mechanism of enzyme action – Action of Hydrolases- Esterases, Oxidases – Glucose oxidase, and Reductases-5-alpha reductases, Coenzyme catalysis. Isoenzymes. Competitive and non-competitive inhibition. Regulation of enzyme activity: allosteric enzyme - Aspartate trans carbamoylase and feedback mechanisms.

5. Resources:

Text books:

1. Lehninger, 2004, Principles of Biochemistry, W. H. Freeman Publishers.
2. U. Satyanarayana, U.Chakrapani. 2003, Text book of Biochemistry, ElsevierPublishers
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.

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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

6. Syllabus Focus:

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

Local /Regional/National /Global Development Needs	Relevance
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.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Employability	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 is crucial for developing new products and technologies.

7. Pedagogy :

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Scientific experiments	Experiential learning
2.	Interactive class room 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

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA-1	End semester examination
CO2	CIA-2 (Poster presentation)	
CO3	CIA-2 (Assignment)	

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b) Model Question Paper - End Semester Exam

BIOLOGICAL CHEMISTRY
MODEL QUESTION PAPER – THEORY

Course Code : P24/MIC/DSC/102 **Max. Marks: 60**
Credits :3 **Time: 2 ½ Hrs**

SECTION – A

I . Answer the following: **3 x 12 = 36M**

1. Describe in detail the biological oxidation and reduction process.

OR

2. Explain in detail the properties, structure and biological importance of amino acids.

3. Describe the classification carbohydrates and their biological importance in industry.

OR

4. Describe in detail the process of metabolism of purines.

5. 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?

OR

6. Explain in detail regulation of enzyme activity by AspartateTranscarbomylase and its applications

SECTION – B

II. Answer any four **4 x 6 = 24 M**

7. What is pH
8. Explain Properties of proteins
9. Describe Amino sugars
10. Explain Bacterial lipids
11. Describe Isoenzymes
12. Explain Feedback inhibition

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SECTION A - INTERNAL CHOICE			3Q X 12 M = 36 M	
Question Number	**Module**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Describe in detail the biological oxidation and reduction process.	CO 1	Level II
2	Module 1	Explain in detail the properties, structure and biological importance of amino acids.	CO 1	Level II
3	Module 2	Describe the classification carbohydrates and their biological importance in industry.	CO 2	Level IV
4	Module 2	Describe in detail the process of metabolism of purines.	CO 2	Level II
5	Module 3	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
6	Module 3	Explain in detail regulation of enzyme activity by AspartateTranscarbomylase and its applications	CO 3	Level II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have **ONE** question from **each** module)			**4 Q X 6M = 24M**	
7	Module 1	What is pH	CO 1	Level I
8	Module 1	Explain Properties of proteins	CO 1	Level I
9	Module 2	Describe Amino sugars	CO 2	Level II
10	Module 2	Explain Bacterial lipids	CO 2	Level II
11	Module 3	Describe Isoenzymes	CO 3	Level II
12	Module 3	Explain Feedback inhibition	CO 3	Level I

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9. CO-PO Mapping:

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 5	Understand	15
2	1	Understand, Apply	15
3	1, 2, 7, 8	Understand, Apply,	15

SEMESTER - I
BIOLOGICAL CHEMISTRY – PRACTICAL

1. Course Description :

Course Code: P24/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.

3. Course Outcomes:

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

CO2: Identify biomolecules qualitatively & estimate their concentrationin unknown samples

CO3: Isolate, purify, concentrate and analyse the parameters effecting the 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

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9. Calculation of Km for partially purified enzyme

MODEL QUESTION PAPER – PRACTICAL

Course Code : P24/MIC/DSC/102/P **Max Marks: 50**
Credits: 2 **Time: 3 Hrs**

I. MAJOR **20 M**

Estimate the concentration of fructose in the given unknown sample

- Plot the graph
- Do the calculations

II. MINOR **10 M**

1. Identify the carbohydrates in a given sample

(or)

2. Identify the amino acid in a given sample

III. Identify the given spots A-E and write few significant points **5 x 2 = 10 M**
IV. Record **5 M**
V. VIVA **5 M**

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

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SEMESTER - I

CELL AND MOLECULAR IMMUNOLOGY- THEORY

1. **Course Description :**
   Programme: M.Sc
   Course Code: P24/MIC/DSC/103
   Course Type: DSC
   No. of credits: 3

   Max. Hours: 45
   Hours per week: 3
   Max. Marks: 100

2. **Course Objectives :**

   - To understand the various components of the host immune system as well as the structure, organization and functions of immunological organs and cells.
   - To emphasize the immune mechanisms involved in allergy, cancers and organ transplantation.

3. **Course Outcomes :**

CO1: Understand various structural concepts like cells, organs, antigens, elucidate the genetic basis of antibodies and apply the concept of antigen – antibody reactions in immunodiagnosis. (L II, III, IV)

CO2: Analyze the aspects of different types immunity in the body and analyze the important immune effector mechanisms of hypersensitivity and MHC restriction. (L IV)

CO3: Apply the knowledge of clinical immunology in diagnosis of cancer, autoimmune diseases and production of vaccines. (L III, IV)

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4. Course Content :

MODULE I - BASICS OF IMMUNOLOGY AND IMMUNE REACTIONS: **(15 Hrs)**

Immunological cells: Hematopoiesis, Stem cells, Lymphoid cells, Mononuclear cells, Granulocytes, Mast cells, Dendritic cells. Lymphoid organs: Primary and secondary lymphoid organs, MALT. Antigens: Nature and Types. Antibodies: Structure and function of different types of immunoglobulins, Organization and expression of immunoglobulin gene. Monoclonal antibodies. Antigen antibody reactions: Principle and applications of Precipitation tests, Neutralization, Agglutination tests, CFT Labelled antibody test- RIA, IF, FACS, ELISA, Immuno electron microscopy.

MODULE II – TYPES OF IMMUNITY: **(15 Hrs)**

Innate immunity: Phagocytosis, Opsonization, Fever, Inflammation, Acute phase proteins, NK cells, ADCC, Mechanical barriers, TLR Cytokines, Complement: Activation, biological consequences. T-cell, TCR, T cell coreceptors. B-cell, BCR, B cell coreceptors. Cell mediated immunity- cell mediated cytotoxicity. Antibody mediated immunity -T dependent & T-Independent. Primary and secondary immune responses. MHC- MHC molecules and genes, Immune responsiveness, Self MHC restriction of T cells, Ag processing and presentation.

MODULE III-IMMUNE EFFECTOR MECHANISMS AND CLINICALIMMUNOLOGY:(15Hrs)

Hypersensitivity- Classification & Types-Anaphylaxis, Antibody mediated, immune complex mediated, Delayed type Hypersensitivity. Transplantation- Immunological basis of graft rejection; clinical manifestations of graft rejection, Immune suppressive therapy for transplantation. Autoimmunity-Tolerance, Organ specific and Systemic auto immune diseases. Tumor immunology -Tumor antigens; mechanism of tumor cell destruction by the immune system, immuno therapy of cancer. Types of Vaccines - Live, Attenuated, Subunit, DNA, recombinant.

5. Resources:

Text books:

1. Kindt, Goldsby, Osborne (2007) Kuby Immunology, 6th edition, W.H. Freeman and company, New York.
2. Stewart Sell, Edward Max (2001) Immunology, Immunopathology, and immunity, 6th edition, ASM press Washington, DC.
3. Roitt I.M. Essential Immunology. (2012). 11th edition. Wiley Blackwell publications
4. Ananthanarayan and Paniker's Textbook of Microbiology. C.K. Jayaram Paniker, R. Ananthanarayan. Universities Press (India) Pvt. Ltd., Orient Longman Limited. 2009.

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Reference Books:

1. David Male, Immunology- an illustrated outline. Churchill Living Stone.
2. Abul K. Abbas, Andrew Lichtman, Shivpillai. (2011). Cellular and Molecular Immunology,7th edition. Elsevier, Philadelphia.
3. Ian Todd, Gavin Spickett. (2010). Immunology lecture notes, 6th edition, Wiley Blackwell publications.
4. Sudha Gangal, Shubhangi Sontakke (2013) Text Book of basic and Clinal Immunology University press.
5. Immunobiology: The immune system in health and disease by Janeway CA, Travers P, Walport M, Shlomchik MJ: 6th edition. New York. Garland Science Publishing; 2005.
6. Medical Microbiology and Immunology by Levinson W, Jawetz E: Lange publication; 2001.
7. Essentials of Clinical Immunology, 5th Edition. Helen Chapel, Mansel Haeney, Siraj Misbah, Neil Snowden. May 2006, Wiley-Blackwell.
8. Fundamental immunology. Seventh Edition. William E. Paul. 2012.

6.Syllabus Focus:

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

Local /Regional/National /Global Development Needs	Relevance
Global	The course on cell and molecular immunology helps to develop understanding on human health, particularly in light of the threat from infectious diseases and the ability to harness the immune system to treat cancer, autoimmune diseases, and allergies. The course Provides opportunities to explore the field of immunology, relevant to postgraduate students interested in pursuing careers in health professions and biomedical research.

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b) **Components on Skill Development/Entrepreneurship Development/Employability**

SD/ED/EMP	Syllabus Content	Description of Activity
Employability	Module III	Presentations on Immune effector mechanisms and clinical immunology. This would help the students to acquire understanding on Immunological mechanisms like hypersensitivity, Transplantations, Autoimmune diseases, Tumor immunity and Vaccine production.

7.Pedagogy:

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Presentations	Participative Learning
2.	Biological Animations	Participative Learning
3.	Case studies	Problem solving

8.Course Assessment Plan :

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

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1 -Written Exam	End semester exam
CO2	CIA 2 - Assignment	
CO3	CIA 2 - Presentations	

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b. Question Paper Pattern

CELL AND MOLECULAR IMMUNOLOGY

MODEL QUESTION PAPER – THEORY

Course Code: P24/MIC/DSC/103 **Max Marks: 60**
Credits: 3 **Time: 2 ½ Hrs**

SECTION – A

I Answer the following: **3 x 12 = 36 M**

1. Write notes on mechanisms of precipitation and agglutination. Add notes on their applications.

OR

2. Explain the Organization and expression of Immunoglobulin genes.

3. What are class 1 and class 2 MHC. Write in detail about the prominence of MHC in immune response

OR

4. Explain different innate immunity mechanisms of human body.

5. Explain the mechanism of vaccines and their types.

OR

6.What is tumor? Write about tumor antigens and mechanism of tumor cell destruction by the immune system.

SECTION – B

II Answer any Four: **4 x 6 = 24 M**

7. Write notes on Thymus.
8. Describe about ELISA.
9. Explain about Complement proteins.
10. Write notes on T Cell receptors
11. Describe IgE mediated hypersensitivity.
12. Write notes on Immunotolerance

SECTION A - INTERNAL CHOICE				3Q X 12 M = 36 M
Question Number	**Module**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Write notes on mechanisms of precipitation and agglutination. Add notes on their applications.	CO 1	Level III
2	Module 1	Explain the Organization and expression of Immunoglobulin genes.	CO 1	Level II
3	Module 2	What are class 1 and class 2 MHC. Write in detail about the prominence of MHC in immune response	CO 2	Level II
4	Module 2	Explain different innate immunity mechanisms of human body.	CO 2	Level II
5	Module 3	Explain the mechanism of vaccines and their types	CO 3	Level II
6	Module 3	What is tumor? Write about tumor antigens and mechanism of tumor cell destruction by the immune system	CO 3	Level IV
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have **ONE** question from **each** module)				4 Q X 6M = 24M
7	Module 1	Write notes on Thymus	CO 1	Level I
8	Module 1	Describe about ELISA	CO 1	Level II
9	Module 2	Explain about Complement proteins	CO 2	Level II
10	Module 2	Write notes on T Cell receptors	CO 2	Level II
11	Module 3	Describe IgE mediated hypersensitivity.	CO 3	Level II
12	Module 3	Write notes on Immunotolerance	CO 3	Level II

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CELL AND MOLECULAR IMMUNOLOGY – PRACTICAL

1.Course Description :

Course Code: P24/MIC/DSC/103/P **Max. Hours: 60**
Course Type: DSC **Hours per week: 4**
No. of Credits: 2 **Max. Marks: 50**

2.Course Objectives:

- To familiarize students with the various immunological techniques that include antigen-antibody interactions.
- To understand concepts in quantitation of antigens, antibody and agglutination reactions.

3.Course Outcomes:

CO1: Perform and interpret immunodiffusion for estimation of unknown amount of antigen

CO2: Perform and interpret different agglutination reactions

CO3: Perform Total Count and DLC.

List of Practicals

1. Separate serum and Plasma from the blood sample.
2. Radial Immunodiffusion (RID) by Mancini's technique.
3. Double Immunodiffusion (DID) by using Ouchterlony method.
4. Hemagglutination -ABO blood group typing determination of and Rh factor.
5. Differential leucocyte count by Leishman's staining.
6. Total count of RBC & WBC.
7. Latex agglutination test for CRP.
8. Latex agglutination test for RA.
9. Latex agglutination test for ASO.
10. To perform tube agglutination test of widal.
11. Isolation of lymphocytes from peripheral blood by ficoll method and check the viability. of isolated lymphocytes by trypan blue staining.

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MODEL QUESTION PAPER - PRACTICAL

Course Code: P24/MIC/DSC/ 103/P **Max Marks: 50**

Credits: 2 **Time: 3 Hrs**

I. Write down the principles involved in major and minor experiments 5 + 5 = 10 M

II. Major: 15M

Perform Total RBC Count/ WBC Count of the Blood sample.

III. Minor: 5M

WIDAL slide method / tube method has been performed on a patient's serum sample.

Analyze and interpret the results provided.

IV. Spots 5x2=10M

V. Record 5M

VI. Viva 5M

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SEMESTER-V

CRITICAL HEALTH CARE MANAGEMENT

1. Course Description:

Programme: B.Sc
Course Code: U24/MIC/GE/501
Course Type: GE
No.of credits: 4

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

2. Course Objectives:

- To understand fundamental concepts in healthcare, including medical emergencies and patient care.
- To develop practical skills in healthcare , communication, and decision making for effective healthcare management.

3. Course Outcomes:

CO1: Understand key terminology related to critical care practices. (L II)

CO2:Demonstrate an understanding of the ethical dilemmas in critical health situations.(L III)

CO3: Apply critical thinking skills to assess and prioritize patient needs in emergency situations.(L III)

CO4:Analyze the effectiveness of critical care protocols and interventions.(L IV)

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4. Course Content:

MODULE I - MEDICAL CATASTROPHE: **(15 Hrs)**

Introduction to Natural Medical disasters.

What is medical catastrophe? How to cope with it.

Blood Pressure levels and blood sugar levels.

Heart attacks, strokes and bone fractures.

MODULE II - GENERAL HEALTH CONDITIONS: **(15 Hrs)**

Drowning, snake bites, animal bites.

Burns, fire accidents, accidents, sudden attacks, Migraine, Thyroidism.

Conditions like dizziness, epilepsy.

Case studies related to each of the above conditions.

MODULE III -WOMEN'S HEALTH AND MANAGEMENT: **(15 Hrs)**

Menstrual Hygeine.

Pregnancy care and Actions to reduce maternal mortality.

Post partum physical health care.

Breast cancer, cervical cancer, PCOS.

Case studies related to each of the above conditions.

MODULE IV- CHILD HEALTH: **(15 Hrs)**

High fever, nose bleeding, sun stroke.

Indigestion Problems – abdominal pain.

Asthma attacks, Chocking.

Case studies related to each of the above conditions.

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5. References

1.Textbook of Critical Care, 8th Edition, Jean-Louis Vincent, Frederick A. Moore,Rinaldo Bellomo and John J. Marini

2. Textbook of Health Management , S C Mohapatra, Meghkanta Mohapatra, Vishwakant Mohapatra, 2023, IP Publications.

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SEMESTER – I

MICROBIAL BIOENERGETICS - THEORY

1.Course Description:

Programme: M.Sc
Course Code: P24/MIC/DSC/101
Course Type: DSC
No. of credits: 3

Max. Hours: 45
Hours per week: 3
Max. Marks: 100

2.Course Objectives:

- To impart fundamental knowledge of microbial growth and nutrition.
- 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, III, IV)

CO3: Understand & analyze the metabolic pathways, different modes of fermentations in microbes and evaluate the significance of bacteriorhodopsin and quorum sensing techniques. (L II, III)

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4. Course Content:

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

Microbiological media and their significance, Media for cultivation of fungi, protozoa and algae. Cultivation methods of bacteria, Aerobic and anaerobic culturing methods- Anaerobic Gas Pak, Anaerobic Glove Box ,Isolation of Microaerophiles by Candle Jar Method.
Nutritional requirements, Nutritional groups of bacteria-Photoautotrophy, Photoheterotrophy, Chemolithoautotrophy and Chemo organoheterotrophy, Prototrophs, Auxotrophs and Isolation of auxotrophic mutants by Replica Plating Technique, Culture Collection Centers- Examples.

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

Generation time, Definition of growth, 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 & BIOENERGETICS: **(15 Hrs)**

Aerobic: Amphibolic pathways: role of EMP, HMP, ED pathway, TCA cycle- anaplerotic reactions, glyoxylate bypass. Electron transport chain: components, complexes and functions of Prokaryotic ETC.
Anaerobic: Modes of fermentations in microorganisms: acetate, mixed acid, propionic acid pathway.
Bacteriorhodopsin: Photo cycle & significance. Quorum Sensing Ex: Bioluminescence: Introduction, luciferase activity, Significance, /Application.
ATP Synthase enzyme-Structure of bacterial ATP synthase & Mitochodrial ATP synthase, Mechanism by Rotational catalysis.

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5. Resources:

Text books:

1. S. Ram Reddy, S.M Reddy, (2008) Microbial Physiology, Scientific Publishers. Company.
2. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., (1998), Microbiology, Tata McGraw-Hill Education.
3. Nelson, D, Cox, M, (2005), Principles of biochemistry, 4th edition, W.H. Freeman and Company
4. White, D. (2011), The physiology and biochemistry of prokaryotes, 4th edition, Oxford University Press.
5. Stanier, R.Y., Ingrahm, J.L., Wheelis, M.L. and Painter, R.R,.(1987), General Microbiology, 5th edition, The Macmillan press Ltd

Reference books:

1. Voet, D &Voet, J. G., (2004), Biochemistry, 3rd edition, John Wiley& Sons Inc.
2. Zubey, G. L (1996), Biochemistry, 4th edition, Wm. C. Brown publishers
3. Zubey, G. L (1996), Principles of Biochemistry, Wm. C. Brown publishers
4. Conn, Stmpf, P. K., Bruening, G. R. H. (1987), Outlines of Biochemistry, 5th Edition, John Wiley & sons.
5. Gottschalk, G., (1985), Bacterial Metabolism, 2nd edition, Springer Verlag
6. White, D., (1995), The Physiology and Biochemistry of Prokaryotes, 3rd Edition, Oxford University Press.
7. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
8. 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

Local /Regional/National /Global Development Needs	Relevance
National	The classical approach in Microbial Bioenergetics has been to culture, cultivate microbes, analyze the metabolic pathways, fermentations and understand the role of microorganisms in fundamental research and in industrial applications.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	**Description of Activity**
Skill Development	**Module 1**	**Skill Development Content -** Attain the skill of cultivating aerobic, anaerobic bacteria, fungi, algae, understand the significance of various types of culture media, solute transport mechanisms and the metabolic pathways in bacteria. Activity: To attain skills in cultivation methods of bacteria, Poster presentations.

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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

8.Course Assessment Plan:

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

COs	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Poster presentations / Models Assignments	

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b. Question Paper Pattern:

MICROBIAL BIOENERGETICS
MODEL QUESTION PAPER - THEORY

Course Code: P24/MIC/DSC/101 **Max Marks: 60**
Credits: 3 **Time: 2 ½ Hrs**

SECTION – A

I. Answer the following: **3 x 12 = 36M**

1. Explain various cultivation methods of Bacteria.

OR

2. Explain in detail, Chemolithoautotrophy and chemoorganotrophy in Bacteria.

3. Define Growth curve and describe different growth phases of bacteria.

OR

4. Describe & analyze different types of solute transport mechanisms in bacteria and outline the role of membrane in solute transport.

5. Explain and analyze how six carbon glucose is converted to three carbon pyruvate which further is converted to two carbo acetyl groups that can be funneled into Krebs cycle.

OR

6. Explain the concept of Bioluminescence and highlight its significance.

SECTION – B

II. Answer any FOUR: **4x 6 = 24M**

7. What is application of Enriched media and give examples
8. Describe the Cultivation methods of Fungi
9. How can we obtain Synchronous cultures
10. Describe Diauxic growth
11. Explain the Mixed acid Fermentation Pathway
12. Describe the structure of Bacteriorhodopsin

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SECTION A - INTERNAL CHOICE			3Q X 12 M = 36 M	
Question Number	**Module**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain various cultivation methods of Bacteria.	CO 1	II
2	Module 1	Explain in detail, Chemolithoautotrophy and chemoorganotrophy in Bacteria	CO 1	II
3	Module 2	Define Growth curve and describe different growth phases of bacteria.	CO 2	I
4	Module 2	Describe & analyze different types of solute transport mechanisms in bacteria and outline the role of membrane in solute transport.	CO 2	IV
5	Module 3	Explain and analyze how six carbon glucose is converted to three carbon pyruvate which further is converted to two carbo acetyl groups that can be funneled into Krebs cycle.	CO 3	IV
6	Module 3	Explain the concept of Bioluminescence and highlight its significance.	CO 3	II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have **ONE** question from **each** module)			**4 Q X 6M = 24M**	
7	Module 1	What is application of Enriched media and give examples	CO 1	II
8	Module 1	Describe the Cultivation of Fungi	CO 1	II
9	Module 2	How can we obtain Synchronous cultures	CO 2	III
10	Module 2	Describe Diauxic growth	CO 2	II
11	Module 3	Explain the Mixed acid Fermentation Pathway	CO 3	II
12	Module 3	Describe the structure of Bacteriorhodopsin	CO 3	I

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SEMESTER – I
MICROBIAL BIOENERGETICS - PRACTICAL

1. Course Description:

Course Code: P24/MIC/DSC/101/P **Max. Hours: 60**
Course Type: DSC **Hours per week: 4**
No. of Credits: 2 **Max. Marks: 50**

2. Course Objectives:

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

3. Course Outcomes:

CO1: Attain hands on experience on culturing methods of bacteria and remember the significance of all the microbiological medias

CO2: Perform and analyse 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. Preparation of microbiological media. Minimal media, Basal media, Enriched media, Enrichment media, Differential media, Selective media.
2. Isolation and culturing of fungi and algae
3. Culturing methods of microbes- slant and stab culture, flask culture
4. Anaerobic culturing methods of microbes- Candle Jar and use, thioglycolate media, culturing, Anaerobic Gas Pak and its application.
5. Enumeration of bacteria by Breed's count (Direct Microscopic Count).
6. Study of bacterial growth curve
7. Study of catabolite repression by diauxic growth
8. Factors effecting the microbial growth (pH, temperature & salt concentration)
9. Isolation of bioluminescent bacteria from fish

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MODEL QUESTION PAPER - PRACTICAL

Course Code: P24/MIC/DSC/101/P **Max Marks: 50**
Credits: 2 **Time: 3 Hrs**

I. Write down the principles involved in major and minor experiments **5 + 5= 10M**

II. MAJOR **15 M**

1. An *E.coli* culture has been inoculated into Nutrient Broth. Determine the phases of growth you observe and comment on it.

(or)

2. Enumerate the cells in given milk sample by Breeds Method and comment on the results observed. Calculate the number of microbes in 1 ml of the milk sample.

III. MINOR **5M**

3. The given bacterial sample has been subjected to 4C, 25C, 37C and 47C keeping the pH constant, and the growth observed under these conditions. . Plot a graph and comment on the result.

(or)

4. Nutrient broth sample with pH 2, 5, 7 and 10 was prepared and *E.coli* was inoculated & incubated at 37C. Plot a graph and comment on your result.

IV. Identify the given spots (A – E) and write few significant points **5x2=10 M**
V. Record **5 M**
VI. Viva **5 M**

Prepared by Faculty	Checked and Verified by HoD	Approved by the Principal
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