

***RCS – 2022***

# **NEHRU ARTS AND SCIENCE COLLEGE**

An Autonomous Institution affiliated to Bharathiar University

(Reaccredited with “A” Grade by NAAC, ISO 9001:2015 & 14001:2004 Certified

Recognized by UGC with 2(f) & 12 B, Under Star College Scheme by DBT, Govt. of India)

Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105, Tamil Nadu.

## **REGULATIONS, CURRICULUM & SYLLABUS**

### **B. Sc. MICROBIOLOGY**



**Effective from 2022 – 2023**

# SYLLABUS

# SEMESTER – I

Course Code	Title		
22U3MBC101	Core Paper I – Fundamentals of Microbiology		
Semester: I	Credits: 4	CIA: 50 Marks	ESE : 50 Marks

**Course Objective:**

This subject aims to introduce the history and development of Microbiology. The contents of this course will help students understand history, biology of microorganisms, growth and control of microbes. Thus, the beginners are rightly exposed to foundation of Microbiology which would lead them towards progressive advancement of the subject.

**Course Category** : **Employability**

**Development Needs** : **Global**

**Course Description** :

Students will be able to explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations.

**Course Outcomes:**

On successful completion of this course the students will be able to

CO's		Teaching Methods	Assessment Methods
CO1	Get an idea about the historical events and diversity in Microbiology	Smart Board / PPT	Assignment / Seminar / Quiz
CO2	Understand different types and principle techniques in Microscopy	Smart Board / Demo	Assignment / Seminar / Quiz
CO3	Understand different methods of staining and culture techniques	Smart Board / Demo	Assignment / Seminar / Quiz
CO4	Acquaint with various sterilization techniques and use various method to control microbes	Smart Board / PPT	Assignment / Seminar / Quiz
CO5	Describe the Estimation, Maintenance and Preservation	Smart Board / PPT	Assignment / Seminar / Quiz

**Course Content****Instructional Hours / Week : 4**

Unit	Description	Text Book	Chapter
I	<b>History and Scope of Microbiology:</b> Spontaneous generation theory- conflict. Contribution of Leuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, John Tyndall.	1	1
<b>Suggested Learning Methods: Comics Creation</b>			
<b>Instructional Hours</b>			<b>12</b>
II	<b>Sterilization and Disinfection:</b> Principles- Methods of Sterilization – Physical methods – Dry heat- Moist heat, Filtration (Membrane & HEPA) - Radiation – Chemical Sterilization -Chemical agents Mode of action. Sterility testing. Phenol coefficient test	1	22-24
<b>Suggested Learning Methods: Demonstration</b>			

		Instructional Hours	12
III	<b>Microscopy:</b> Bright field: - Dark Field - Phase contrast and Fluorescence microscope. Electron Microscope - Specimen preparation -TEM and SEM.	3	2
<b>Suggested Learning Methods: Demonstration</b>			
		Instructional Hours	12
IV	<b>Culture media &amp; Staining techniques:</b> Media preparation: Media and its Types, Pure culture technique – Tube dilution, Pour, Spread, Streak plate. Anaerobic culture technique – Wright’s tube, Roll tube, McIntostfildes jar method. Staining Technique - Simple, Gram, Negative, Acid Fast, Endospore, LCB.	2 & 3	3 & 2, 5, 6
<b>Suggested Learning Methods: Group Learning and Experimental</b>			
		Instructional Hours	12
V	Direct Microscopic count, Turbidometric assay, TVC- Indirect Method- CO <sub>2</sub> liberation. Maintenance and Preservation - Short term – Slant, Stab, Mineral oil overlay - Long term – Lyophilization, Cryopreservation, Storage in sterile soil , Storage in silica gel.	3	6
<b>Suggested Learning Methods: Experimental</b>			
		Instructional Hours	12
		Total Hours	60

**Text Book(s):**

1. Pelczar MJ, Chan ECS and Kreig NR. **Microbiology**, 5<sup>th</sup> edition, Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi, 2012.
2. Dubey RC and Maheswari DK.A **Textbook of Microbiology**, Revised Multicolour Edition. S Chand and Company Limited, New Delhi, 1999.
3. Prescott, Harley, and Klein’s. **Microbiology**, 7<sup>th</sup>edition McGraw-Hill, 2008.

Unit I	:	Text book 1, Chapter 1: 3- 37
Unit II	:	Text book 3, Chapter 2: 17-31
Unit III	:	Text book 2 & 3, Chapter 3 & 2, 5, 6: 59-78 &25-28; 101-142;
Unit IV	:	Text book 1, Chapter 22-24: 469-510
Unit V	:	Text book 3, Chapter 6: 119-142

**Reference Book(s):**

1. Prescott, L.M., J.P. Harley and D.A. Klein. **Microbiology**, 6<sup>th</sup>edition, TATA McGraw Hill, New Delhi.2005.
2. Alcamo, E. **Fundamentals of Microbiology**, 6<sup>th</sup>edition. Jones and Bartlett Publishers, New Delhi. 2001
3. Salle, A.J. **Fundamentals and Principles of Bacteriology**, 7<sup>th</sup>edition. Tata MC Graw Hill, New Delhi.2001.
4. Brooks, G.F., E. Jawetz, J.L. Melnick and E.A. Adelberg.**Medical Microbiology**. 26<sup>th</sup>edition, New York: McGraw Hill Medical. 2013.

5. Patricia, M.T. **Bailey and Scott's Diagnostic Microbiology**, 13<sup>th</sup> Edition, Mosby, Inc. Publishers, China. 2014.
6. Harley. **Laboratory Exercises in Microbiology**, 5<sup>th</sup> Edition, McGraw – Hill, 2002.
7. <http://www.nptel.ac.in/courses/102103015/pdf/mod3.pdf>

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Seminar	Total
8	8	10	8	8	8	50

**Mapping**

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	M	M	M	M	L	H	H	H	M	L	L
CO2	H	H	M	L	H	H	L	H	H	H	M	L	L
CO3	H	H	M	L	H	H	L	H	H	H	M	L	H
CO4	H	H	L	H	L	H	L	H	H	H	H	L	L
CO5	M	H	L	H	H	L	L	H	H	H	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by
Signature of the staff	Signature of the Chairman-BoS
Dr. R. Kasimani, Department of Microbiology	Name and Bos Chairman SEAL

<b>22U3MBC102</b>	<b>Core Paper II – Cell Biology</b>		
<b>Semester: I</b>	<b>Credits: 4</b>	<b>CIA: 50 Marks</b>	<b>ESE: 50 Marks</b>

**Course Objective** : This subject aims to introduce the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, organelles, Transport mechanisms and cellular components underlying mitotic cell division.

**Course Category** : **Skill Development**

**Development Needs** : **Global**

**Course Description** : Structure, function, and biosynthesis of cellular membranes and organelles; cell growth and oncogenic transformation; transport, receptors, and cell signaling.

**Course Outcomes** :

On successful completion of this course the students will be able to know the content.

	Content	Teaching Methods	Assessment Methods
<b>CO 1</b>	Know characteristics and basic structure of prokaryotic cell.	PPT	CIA I, CIAII, CIA III, Assignment, Seminar, Quiz
<b>CO 2</b>	Understand organization and structure of eukaryotic cell.	PPT	CIA I, CIAII, CIA III, Assignment, Seminar, Quiz
<b>CO 3</b>	Distinguish transport mechanisms of cell.	PPT	CIA I, CIAII, CIA III, Assignment, Seminar, Quiz
<b>CO 4</b>	Identify concepts of cell division in bacteria.	PPT	CIA I, CIAII, CIA III, Assignment, Seminar, Quiz
<b>CO 5</b>	Explain basic concepts of cell cycle, death mechanism and stem cells.	PPT	CIA I, CIAII, CIA III, Assignment, Seminar, Quiz

### Course Content

**Instructional Hours / Week : 4**

Unit	Description	Text Book	Chapters
<b>I</b>	<b>Ultrastructure of Eubacteria:</b> Cell membrane- Extra mural layer - Slime – Capsule. Cytoplasmic inclusions – Mesosomes – Nuclear material, Reserve materials. Capsule, slime layer, flagella and pili. Ultra- structure of algae, Cyanobacteria, protozoa, fungi	1	1
<b>Instructional Hours</b>			<b>16 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
<b>II</b>	<b>Ultrastructure and functions of cells:</b> Cell wall – Cell membrane -Mitochondria – Chloroplast – Endoplasmic reticulum –Golgi complex – Nucleus –Ribosomes, Other cell inclusions and Flagella	1	5
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
<b>III</b>	<b>Transport mechanisms:</b> Diffusion - Facilitated diffusion. Active transport– Group translocation – phagocytosis–Pinocytosis Sodium Potassium and Osmosis, Regulations of cell	1	20
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			

IV	Cell division in Bacteria: Binary fission– Mitosis and Meiosis. Cell division of Eukaryotes -Mitosis and Meiosis. Cell cycle	2	4,6
<b>Instructional Hours</b>			<b>08 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
V	Cell Cycle: Eukaryotic cellcycle and its regulation. Development of cancer, causes and types Programmed cell death, Stem cells - Embryonic stem cellsinduced pluripotent stem cells	3	11
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
<b>Total Hours</b>			<b>60</b>

**Text Book(s):**

1. Pelczar MJ, Chan ECS and Kreig NR. **Microbiology**, 5<sup>th</sup> edition, Tata McGrawHill-Hill Education Pvt., Ltd., New Delhi, 2008.
2. Joanne M.Willey, Linda M. Sherwood, Christopher J.Woolverton, **Prescott, Harley and Klein's Microbiology**, 7<sup>th</sup> Edition, McGraw Hill Edition, 2008.
3. Ivan M.Roitt's& Peter J Delves. **Essential of Immunology**, 10<sup>th</sup>edition, BlackwellScience, UK, 2011.

Unit I : Text book 1, Chapter 2 (73 -97)

Unit II : Text book 1, Chapter 5 (333-389)

Unit III : Text book 1, Chapter 20(171-176)

Unit IV : Text book 2, Chapter 4(79 - 96), Chapter 6(119 - 148)

Unit V : Text book 3, Chapter 11(203 - 207)

**Reference Book(s):**

1. Stainer R.Y. Ingraham J.L. Wheelis H.H and Painter P.R., **The Microbial World**, 5<sup>th</sup>edition, Eagle Works Cliffs N.J. Prentice Hall, 1986.
2. Jain V.K. Fundamentals of Plant **Physiology**, 5<sup>th</sup> edition, S. Chand & Co Ltd., New Delhi, 2000.

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Seminar	Total
8	8	10	8	8	8	50



## Mapping

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H	H	H	M	H	H	H	H	H
CO2	H	H	M	M	H	H	H	M	H	M	H	H	H
CO3	H	H	M	H	H	M	H	M	H	M	M	H	M
CO4	H	H	M	M	H	H	L	H	H	M	M	M	H
CO5	H	H	H	H	M	H	H	M	H	L	H	M	M

H-High; M-Medium; L-Low

Course designed by	Verified by
Signature of the staff	Signature of the Chairman-BoS
Name and Department	Name and Bos Chairman SEAL

Course Code	Title		
22U3BYA101	Allied Paper I – Biochemistry I		
Semester: I	Credits: 3	CIA: 30	ESE: 45

**Course Objective** : Understand the concept of Biochemistry regarding Biomolecules - Carbohydrates, proteins, lipids, Enzymes.

**Course Category** : Skill Development / Employability

**Development Needs** : Global

**Course Description** : Study of proteins, enzymes, carbohydrates, lipids and nucleic acids in relationship to biological and metabolic processes.

**Course Outcomes** : On successful completion of this course the students will be able to

		Teaching Methods	Assessment Methods
CO 1	Know about the basic biomolecules present inside the body.	Smart board / PPT	Assignment / Seminar / Quiz
CO 2	Understand the basic structure of lipids and its importance.	Smart board / PPT	Assignment / Seminar / Quiz
CO 3	Recognize basic structure of amino acid and proteins their role in metabolic pathways.	Smart board / PPT	Assignment / Seminar / Quiz
CO 4	Gain knowledge on vitamins and vitamin deficiency diseases.	Smart board / PPT	Assignment / Seminar / Quiz
CO 5	Explain the enzymes (biochemical catalysts), and the chemistry involved in enzyme action.	Smart board / PPT	Assignment / Seminar / Quiz

### Course Content

Instructional Hours / Week : 4

Unit	Description	Text Book	Chapters
I	<b>Carbohydrates:</b> Introduction, classification, Structure and importance of monosaccharide, disaccharides, polysaccharides. Homopolysaccharides and heteropolysaccharides.	1	5-8
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
II	<b>Lipids:</b> Introduction classification physical properties, and chemical properties of fats and oils. Structure and importance of saturated and unsaturated fatty acids. Classification and Significance of lipoproteins and phospholipids.	1	12-14
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
III	<b>Amino acids and Proteins:</b> Amino acids-classification and properties. Protein – structure, classifications and properties. Denaturation and isoelectric point of proteins.	1	9-11
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
IV	<b>Vitamins:</b> Introduction, properties, functions. Deficiency diseases of fat soluble and water-soluble Vitamins	2	5

	biochemical roles, daily requirement.		
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
V	<b>Enzymes:</b> Classification of enzymes with examples, coenzymes and cofactors. Mechanism - Lock and Key model, Induced fit hypothesis. Types of inhibition of enzyme action. Chemical and industrial applications of enzymes.	2	4
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group Learning</b>			
<b>Total Hours</b>			<b>60</b>

**Text Book(s):**

1. Jain, J. L. **Fundamentals of Biochemistry**. New Delhi: S. Chand, 2004.
2. Shanmugam, A. **Ambika Shanmugam's Fundamentals of Biochemistry for Medical Students**. New Delhi: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2016.

Unit I	:	Text Book 1, Chapter 5-8: 91-163.
Unit II	:	Text Book 1, Chapter 12-14: 280-340.
Unit III	:	Text Book 1, Chapter 9-11: 164-295.
Unit IV	:	Text Book 2, Chapter 5: 97-133.
Unit V	:	Text Book 2, Chapter 4: 79-96.

**Reference Book(s):**

1. Lehninger, A. L., Nelson, D. L., & Cox, M. M. **Principles of Biochemistry**. New York: W.H. Freeman, 2013.
2. Murray, R. K. **Harper's Biochemistry**. New York: McGraw-Hill, 2003.
3. Chatterjee, M. N., & Shinde, R. **Textbook of Medical Biochemistry**. New Delhi: Jaypee Brothers Medical (P). 2013.
4. Deb, A. C. **Fundamentals of Biochemistry**. London: New Central Book Agency, 2011.

**Tools for Assessment (30 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Seminar	Total
4	4	7	5	5	5	30

## Mapping

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	M	M	H	L	L	L	H	M	M
CO2	M	H	M	H	H	H	H	M	M	L	M	H	M
CO3	H	H	H	M	M	H	L	M	H	M	M	H	L
CO4	H	M	L	M	H	H	H	M	M	H	L	H	M
CO5	M	H	H	H	H	M	L	H	H	H	H	M	L

H-High; M-Medium; L-Low

Course designed by	Verified by
Signature of the staff	Signature of the Chairman-BoS
Name and Department	Name and Bos Chairman SEAL

# SEMESTER – II

Course Code	Title		
22U3MBC203	Core Paper III – Microbial Diversity		
Semester : II	Credits : 4	CIA : 50 Marks	ESE :50 Marks

**Course Objective** : The objective of this course is to make students understand the diversity of microbial world and systematic classification systems. The course will provide insights into study of microbes and distinguishing features associated with them based on morphological, chemical, structural and metabolic characteristics.

**Course Category** : Skill Development

**Development Needs** : Global

**Course Description** : This course will study the diversity of Bacteria and Archaea in selected ecosystems at an organismal level, investigate the metabolic and enzymatic diversity in microbes that contribute to and thrive within these environments.

**Course Outcomes** :

		Teaching Methods	Assessment Methods
CO 1	Learn criteria used for bacterial classification.	Smart board / PPT	Seminar / Quiz / Assignment
CO 2	Describe classification of eubacteria and actinomycetes.	Smart board / PPT	Seminar / Quiz / Assignment
CO 3	Understand the characters and significance of eubacteria and actinomycetes.	Smart board / PPT	Seminar / Quiz / Assignment
CO 4	Know the characters and significance of fungi.	Smart board / PPT	Seminar / Quiz / Assignment
CO 5	Explain characters and significance of algae.	Smart board / PPT	Seminar / Quiz / Assignment

**Course Content**

**Instructional Hours / Week : 4**

Unit	Description	Text Book	Chapters
I	<b>Taxonomy:</b> Principles–Modern approaches–Numerical-Genetic, Serotaxonomy and Chemotaxonomy. Whittaker’s five kingdom concept.	1	19
<b>Instructional Hours</b>			<b>16 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
II	<b>Taxonomy of Eubacteria and Actinomycetes:</b> Detailed classification upto genus level with general characters of each group – Bergey’s Manual and its importance.	1	20
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
III	Eubacteria and Archaeobacteria: Taxonomy of Photosynthetic Eubacteria and Archaeobacteria- General characteristics.	1	20
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
IV	<b>Taxonomy of Fungi (Alexopolous):</b> General	2	4

	Characteristics- Life Cycles of Mucor, Neurospora, Agaricus, Dictyostelium.		
<b>Instructional Hours</b>			<b>8 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
<b>V</b>	<b>Taxonomy of Algae and Protozoa:</b> General Characters and its importance – Chlorophyta- Euglenophyta –Chrysophyta- Phaeophyta - Rhodophyta – Pyrrophyta-Taxonomy of Protozoa –General characters and its importance – Mastigophora, Rhizopoda, Ciliata, Sporozoa.	3	2
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods</b>			
<b>Total Hours</b>			<b>60 Hrs</b>

**Text Book(s):**

1. Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, **Prescott, Harley, and Klein's Microbiology**, 7<sup>th</sup> Edition, McGraw Hill Edition, 2008.
2. Sullia S.B., Shantharam S., **General Microbiology**, 2<sup>nd</sup> Edition (Revised), Oxford University Press. 2019.
3. Ashok Kumar Aswathi, Text Book of Algae, Vikas Publishing house, 2015.

Unit I	:	Text book 1, Chapter 19 (471-494)
Unit II	:	Text book 1, Chapter 20 (503-515)
Unit III	:	Text book 1, Chapter 20(516-604)
Unit IV	:	Text book 2, Chapter 4(58-67)
Unit V	:	Text book 3, Chapter 2(47-58)

**Reference Book(s):**

1. Stainer R.Y. Ingraham J.L. Wheelis H.H and Painter P.R. **The Microbial World**, 5<sup>th</sup> edition. Eagle Works Cliffs N.J. Prentice Hall, 1986.
2. Gerard J. Tortora, Berdell R. Funke, Christine L. Case, Derek Weber, Warner Bair, **Microbiology: An Introduction**, 4<sup>th</sup> edition, Pearson Education, 2019.
3. Willey, J.M., Sherwood, L and Wool Veron C.J. **Prescott's Microbiology**. 8<sup>th</sup> edition, McGraw Hill, New York, 2011.

**Tools for Assessment (50 Marks)**

CIA I	CIA II	CIA III	Assignment	Quiz	Seminar	Total
8	8	10	8	8	8	50

## Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	M	L	M	L	M	H	H	H	H	L	H
CO2	M	H	M	H	M	L	M	H	H	H	H	H	H
CO3	H	H	M	H	M	L	M	H	H	H	H	L	H
CO4	M	L	L	L	H	L	M	H	H	H	H	H	H
CO5	M	L	L	L	H	L	M	H	H	H	H	H	H

H-High; M-Medium; L-Low

Course designed by	Verified by
Signature of the staff	Signature of the Chairman-BoS
Name and Department	Name and Bos Chairman SEAL



Course Code	Title		
22U3BYA202	Allied Paper II – Biochemistry II		
Semester: II	Credits: 3	CIA: 30 Marks	ESE: 45 Marks

**Course Objective** : The fate of dietary components after digestion and absorption constitutes intermediary metabolism. Knowledge of metabolism in the normal human being is a prerequisite to a sound understanding of abnormal metabolism underlying many diseases

**Course Category** : Skill Development

**Development Needs** : Global

**Course Description** : Study of biological processes at the molecular level with emphases on analytical techniques concepts of centrifugation and the chemistry of biological molecules, including carbohydrates, lipids, and nucleic acids.

**Course Outcomes** :

		Teaching Methods	Assessment Methods
CO 1	Know about the fundamentals of pH and buffer preparation.	Smart board / PPT	Seminar / Quiz / Assignment
CO 2	Acquire the basic knowledge about analytic techniques.	Smart board / PPT	Seminar / Quiz / Assignment
CO 3	Learn the basic functions, principles and concepts of centrifugations.	Smart board / Demo	Seminar / Quiz / Assignment
CO 4	Explain on various metabolic pathways.	Smart board / PPT	Seminar / Quiz / Assignment
CO 5	Describe on interrelationship of carbohydrates, fat and protein metabolism.	Smart board / PPT	Seminar / Quiz / Assignment

### Course Content

Instructional Hours / Week : 4

Unit	Description	Text Book	Chapters
I	<b>Buffers:</b> Concept of acid base indicators, buffer systems of blood and body fluids. Components of the pH meter and the concept of pH. Basic principles and laws of thermodynamics	1	3
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
II	<b>Electrophoresis techniques:</b> Principles technique AGE, SDS-PAGE. <b>Chromatography:</b> Paper, TLC, molecular sieve and affinity chromatography: their applications.	1	40
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
III	<b>Centrifugation techniques:</b> Basic principles of sedimentation, types of centrifugation, types of centrifuges. <b>Colometric and spectroscopic techniques:</b> Beer - Lambert's	1	35

	law, light absorption and its transmittance.		
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
<b>IV</b>	<b>Nucleic acid metabolism:</b> Purine Metabolism Pyrimidine Metabolism RNA Synthesis DNA Synthesis.	2	6
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
<b>V</b>	<b>Amino acid and Protein metabolism:</b> Protein Catabolism Amino Acid Metabolism Urea Cycle Protein Synthesis Protein Metabolism and Nitrogen Economy. Amino acid metabolism – Deamination, transamination and decarboxylation.	2	21-22
<b>Instructional Hours</b>			<b>12 Hrs</b>
<b>Suggested Learning Methods: Group learning</b>			
<b>Total Hours</b>			<b>60 Hrs</b>

**Text Book(s):**

1. Jain, J. L. **Fundamentals of Biochemistry**. New Delhi: S. Chand, 2004.
2. Gareja, H.P., Patel SV., Golakiya BA. **Fundamentals of Biochemistry**.  
A textbook International Book Distributing Co., 2008.

Unit I	:	Text Book 1, Chapter 3: 47-63
Unit II	:	Text Book 1, Chapter 40: 1381-1424
Unit III	:	Text Book 1, Chapter 35: 1027-1048
Unit IV	:	Text Book 2, Chapter 6: 134-158
Unit V	:	Text Book 2, Chapter 21-22: 384-442

**Reference Book(s):**

1. Lehninger, A. L., Nelson, D. L., & Cox, M. M. **Principles of Biochemistry**. New York: W.H.Freeman, 2013.
2. Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelley, P. Antony Weil, **Harpers Biochemistry**. 31<sup>st</sup> Edition, New York: McGraw-Hill, 2018.
3. Chatterjee, M. N., & Shinde, R. **Textbook of Medical Biochemistry**. Jaypee Brothers Medical (P), New Delhi, 2013.
4. Deb, A. C. **Fundamentals of Biochemistry**. London: New Central Book Agency, 2011.

## Tools for Assessment (30Marks)

CIA I	CIA II	CIA III	Assignment	Quiz	Seminar	Total
4	4	7	5	5	5	30

## Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	L	L	M	M	L	H	M	L	H	L	L
CO2	H	M	M	H	M	L	L	H	H	M	H	L	L
CO3	H	H	M	L	M	L	L	H	M	L	M	L	L
CO4	H	M	L	H	M	L	L	H	L	H	L	L	M
CO5	M	H	M	H	M	L	M	H	H	H	L	L	L

H-High ;M-Medium; L-Low.

Course designed by	Verified by
Signature of the staff	Signature of the Chairman-BoS
Name and Department	Name and Bos Chairman SEAL

Course Code	Title		
22U3BYP203	Allied Paper III – Lab in Biochemistry		
Semester: II	Credits: 2	CIA: 25 Marks	ESE : 25 Marks

**Course Objective** : The lab aims to develop the skills in biochemical analysis and to develop the skills of the students in Qualitative and Quantitative Analysis of biomolecules. The student is able to quantify the biochemical molecules. The students equip themselves with the basic biochemical tools and standard operation procedures.

**Course Category** : Skill Development / Employability

**Development Needs** : Global

**Course Description** : This course provides familiarization with protein and enzyme techniques in the laboratory, and properties of amino acids and sugars. There is some material dealing with DNA and very basic molecular biology.

**Course Outcomes** :

On successful completion of this course the students will be able to

		Teaching Methods	Assessment Methods
CO 1	Determine the absorption Maxima of different molecules and verify Beer's law.	Practical	Lab experiments
CO 2	Identify carbohydrates and amino acids present in the given unknown sample.	Practical	Lab experiments
CO 3	Asses DNA and Proteins in the specified sample.	Practical	Lab experiments
CO 4	Familiarize paper and thin layer chromatography techniques.	Practical	Lab experiments
CO 5	Separate macromolecules using column chromatography.	Practical	Lab experiments

**Offered by** : Microbiology

**Course Content**

**Instructional Hours / Week** : 2 & 4 (I Sem & II Sem)

S. No.	Experiment
1.	Determination of absorption maxima ( $\lambda$ max) of small molecules and macromolecules
2.	Verification of Beer's Law
3.	Calculation, preparation of normal, molar and percentage solutions
4.	Determination of Acid number
5.	Determination of Iodine number
6.	Determination of molar extinction coefficient.
7.	Qualitative analysis of carbohydrates
8.	Qualitative analysis of amino acids
9.	Colorimetric estimation DNA by diphenylamine method
10.	Colorimetric estimation of proteins by Biuret/Lowry method
11.	Paper chromatographic separation of amino acids
12.	Thin layer chromatographic separation of amino acids
13.	Column Chromatography
<b>Total hours 90</b>	

**Text Book(s):**

1. SadasivamS., Manickam A. **Biochemical Methods**, New Age International Pvt. Ltd., 2018.
2. Jayaraman J. **Laboratory Manual in Biochemistry**, New Age International Pvt. Ltd.,2011.

**Reference Book(s):**

1. David Plummer. **An Introduction to Practical Biochemistry**, 3<sup>rd</sup> edition, McGrawHill Education, 2017.
2. Sharma DC., Manminder Riyat, **Practical Medical Biochemistry**, Wolters Kluwer India Pvt. Ltd. 2018.

**Tools for Assessment (25 Marks)**

Laboratory Performance			Test I (Mid sem)	Test II (Model)	Observation note book	Total
Level of engagement in lab	Preparation	Result				
4	4	4	5	5	3	25

**Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	L	L	L	L	L	H	L	L	M	L	L
CO2	H	M	L	L	M	M	L	M	L	M	L	L	L
CO3	H	H	L	H	L	M	L	H	H	H	L	L	M
CO4	M	L	L	L	L	L	L	M	L	M	L	L	L
CO5	H	H	M	L	M	M	M	H	L	L	L	L	L

H-High; M-Medium; L-Low.

Course designed by	Verified by
Signature of the staff	Signature of the Chairman-BoS
Name and Department	Name and Bos Chairman SEAL

