# B.Sc. MICROBIOLOGY

| SEM | COURSE CODE | PART | COURSE | COURSETITLE | Ins. Hrs /Week | CREDIT | MARKS | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | CIA | ESE | |
| I | 20U1LT1/LA1/LF1 /LH1/LU1 | I | Language – I | | 6 | 3 | 25 | 75 | 100 |
| | 20UCN1LE1 | II | English - I | | 6 | 3 | 25 | 75 | 100 |
| | 20UMB1CC1 | III | **Core – I** | Introduction to Microbiology and Microbial Diversity | 5 | 5 | 25 | 75 | 100 |
| | 20UMB1CC2P | | **Core – II** | Introduction to Microbiology and Microbial Diversity Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UMB1AC1 | | **Allied –I** | General Biochemistry-I :Biomolecules | 5 | 4 | 25 | 75 | 100 |
| | 20UMB1AC2P | | **Allied –II** | General Biochemistry-I :Biomolecules Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UCN1AE1 | IV | AEC-I | Value Education | 2 | 2 | - | 100 | 100 |
| | | | **TOTAL** | | **30** | **21** | | | **700** |
| II | 20U2LT2/LA2/LF2 /LH2/LU2 | I | Language – II | | 6 | 3 | 25 | 75 | 100 |
| | 20UCN2LE2 | II | English – II | | 6 | 3 | 25 | 75 | 100 |
| | 20UMB2CC3 | III | **Core – III** | Bacteriology and Virology | 6 | 5 | 25 | 75 | 100 |
| | 20UMB2CC4P | | **Core – IV** | Bacteriology and Virology Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UMB2AC3 | | **Allied – III** | General Biochemistry-II: Bioenergetics and Enzymology | 4 | 3 | 25 | 75 | 100 |
| | 20UMB2AC4P | | **Allied –IV** | General Biochemistry-II: Bioenergetics and Enzymology Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UCN2SE1 | IV | Skill EnhancementCourse - I @ | Soft Skills Development | 2 | 2 | - | 100 | 100 |
| | | **TOTAL** | | | **30** | **20** | | | **700** |
| III | 20U3LT3/LA3/LF3 /LH3/LU3 | I | Language– III | | 6 | 3 | 25 | 75 | 100 |
| | 20UCN3LE3 | II | English – III | | 6 | 3 | 25 | 75 | 100 |
| | 20UMB3CC5 | III | **Core– V** | Microbial Physiology and Metabolism | 4 | 4 | 25 | 75 | 100 |
| | 20UMB3CC6P | | **Core– VI** | Microbial Physiology and Metabolism Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UMB3AC5 | | **Allied– V** | Immunology-I:Principles of Immunology | 4 | 3 | 25 | 75 | 100 |
| | 20UMB3AC6P | | **Allied–VI** | Immunology-I:Principles of Immunology Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UMB3GE1 | IV | Generic Elective I # | | 2 | 2 | - | 100 | 100 |
| | 20UCN3AE2 | | AEC-II | Environmental Science | 2 | 2 | - | 100 | 100 |
| | | | **TOTAL** | | **30** | **21** | | | **800** |
| IV | 20U4LT4/LA4/LF4 /LH4/LU4 | I | Language–IV | | 6 | 3 | 25 | 75 | 100 |
| | 20UCN4LE4 | II | English– IV | | 6 | 3 | 25 | 75 | 100 |
| | 20UMB4CC7 | III | **Core– VII** | Clinical Microbiology | 5 | 5 | 25 | 75 | 100 |
| | 20UMB4CC8P | | **Core - VIII** | Clinical Microbiology Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UMB4AC7 | | **Allied– VII** | Immunology-II: Immunohaematology | 5 | 3 | 25 | 75 | 100 |
| | 20UMB4AC8P | | **Allied–VIII** | Immunology-II: Immunohaematology Practical | 3 | 2 | 25 | 75 | 100 |
| | 20UMB4GE2 | IV | Generic Elective – II# | | 2 | 2 | - | 100 | 100 |
| | 20UCN4EA | V | Extension Activities | NCC, NSS, etc. | - | 1 | - | - | - |
| | | | **TOTAL** | | **30** | **21** | | | **700** |
| V | 20UMB5CC9 | III | **Core – IX** | Microbial Genetics | 6 | 5 | 25 | 75 | 100 |
| | 20UMB5CC10 | | **Core – X** | Molecular Biology and Recombinant DNA Technology | 5 | 5 | 25 | 75 | 100 |
| | 20UMB5CC11 | | **Core – XI** | Industrial Microbiology | 5 | 5 | 25 | 75 | 100 |
| | 20UMB5CC12P | | **Core - XII** | Microbial Genetics, Molecular Biology and Recombinant DNA Technology and Industrial Microbiology Practical | 5 | 5 | 25 | 75 | 100 |
| | 20UMB5DE1 | | DSE – I ** | | 5 | 4 | 25 | 75 | 100 |
| | 20UMB5SE2 | IV | Skill Enhancement Course II@ | | 2 | 2 | - | 100 | 100 |
| | 20UMB5SE3 | | Skill Enhancement Course – III@ | | 2 | 2 | - | 100 | 100 |
| | 20UMB5EC1 | | **Extra Credit Course - I** | General Intelligence for competitive Examination | - | **4*** | -- | **100*** | **100*** |
| | | **TOTAL** | | | **30** | **28** | | | **700** |
| VI | 20UMB6CC13 | III | **Core– XIII** | Food and Dairy Technology | 5 | 5 | 25 | 75 | 100 |
| | 20UMB6CC14 | | **Core– XIV** | Environmental Microbiology | 5 | 5 | 25 | 75 | 100 |
| | 20UMB6CC15 | | **Core - XV** | Soil and Agricultural Microbiology | 5 | 5 | 25 | 75 | 100 |
| | 20UMB6CC16P | | **Core - XVI** | Food and Dairy Technology Environmental Microbiology, Soil and Agricultural Microbiology Practical | 5 | 5 | 25 | 75 | 100 |
| | 20UMB6DE2 | | DSE II ** | | 5 | 4 | 25 | 75 | 100 |
| | 20UMB6DE3 | | DSE III ** | | 4 | 4 | 25 | 75 | 100 |
| | 20UCN6AE3 | IV | AEC-III | Gender Studies | 1 | 1 | - | 100 | 100 |
| | 20UMB6EC2 | | **Extra Credit Course - II** | Microbiology for competitive examinations | - | **4*** | -- | **100*** | **100*** |
| | 20UMBAECA | | **Extra Credit Course for all** | Online Course | - | **1*** | -- | - | - |
| | | | **TOTAL** | | **30** | **29** | | | **700** |
| | | | **GRAND TOTAL** | | **180** | **140** | - | - | **4300** |

Not Considered for Grant Total and CGPA.

## # Generic Electives for other major electives

| Semester | Course code | Course Title |
|---|---|---|
| III | 20UMB3GE1 | Microbial Food Products |
| IV | 20UMB4GE2 | Cosmetic Microbiology |

## @ Skill Enhancement Courses

| Semester | Course code | Course Title |
|---|---|---|
| V | 20UMB5SE2A | Biofertizers and Biopesticides |
| | 20UMB5SE2B | Analytical Techniques |
| | 20UMB5SE3A | Textile Microbiology |
| | 20UMB5SE3B | Mycology |

## **Discipline Specific Electives

| Emester | Course code | Course Title |
|---|---|---|
| V | 20UMB5DE1A | Bioinformatics and Biostatistics |
| | 20UMB5DE1B | Medical Entomology |
| VI | 20UMB6DE2A | Plant Pathology |
| | 20UMB6DE2B | Applied Phycology |
| | 20UMB6DE3A | Social and Preventive Medicine |
| | 20UMB6DE3B | Biosafety and Intellectual property rights |

| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| I | 20UMB1CC1 | Core – I | INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY | 5 | 5 | 100 | 25 | 75 |

**Course Outcomes:**

1. Explicit on historical inventions, scope of Microbiology and Principles of Microscopy.
2. Systematize the taxonomy of Microorganisms.
3. Demonstrate the bacterial growth by using various measurement techniques.
4. Illustrate the methods of sterilization, media preparation, pure culture, preservation and decontamination techniques.
5. Describe the microbial diversity and their economic importance.

**UNIT – I** **15 hours**

**Introduction-** Definition, Scope and Landmark discoveries relevant to the field of microbiology;#Germ theory of disease#, Theory of spontaneous generation.Biogenesis.Microscopy: Introduction, Principle – Bright field, dark field, phase contrast, confocal, fluorescent and electron microscope-TEM and SEM. Specimen preparation of Electron Microscopy.

**UNIT – II** **15 hours**

**Taxonomy**:Types of classification (artificial, natural, phylogenetic); #binomial nomenclature#. Haeckel's three kingdom, Whittaker's five kingdom &Eight kingdom (Cavalier Smith). Outline classification based on Bergey's manual of systemic Bacteriology($9^{th}$ edition).Difference between the prokaryotic and eukaryotic microorganisms.

**UNIT – III** **15 hours**

**Growth and Measurement:** Modes of cell Division, New cell formation. Growth curve, Synchronous growth and Continuous growth. Quantitative Measurement of Bacteria– Direct Microscopic Count, Electronic Enumeration ofCell Numbers, #Plate count method#, Membrane – Filter Count, Turbidometric methods.Anaerobic culture techniques– Wright's tube, Roll tube, McIntosh Fildes jar method.

**UNIT – IV** **15 hours**

**Methods in Microbiology**: Sterilization- Principles, Methods of Sterilization– Physical and Chemical methods. Media preparation -Solid and Liquid media – Different types of Media.Pure culture techniques - Serial dilution technique, Pour plate, Spread plate, Streak plate and #Micro manipulator#. Methods of maintenance and preservation of microbes.Safe decontamination practices.

**UNIT– V** **15 hours**

**Diversity of microbes: Fungi:** General characteristics, classification, reproduction and its economic importance. **Algae:** General characterstics and Classification basic knowledge on its reproduction and its economic importance.**Actinomycetes:** General characteristicsand their importance.**Protozoa**: General characteristics, classification, reproduction and its economic importance.

**#--- #Self studyportion**

**Text books:**

**T.B-1**. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R.Krieg, Microbiology, 5th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

**T.B-2**. Lansing M. Presscott, John P. Harley and Donald A. Klein's, Microbiology, 7th edition, McGrawHill, 2008.

**T.B-3**. Roger Y. Stainer, John L. Ingraham, Mark L, Wheelis and Page R. Painter, General Microbiology, 5thEdition, Macmillan Press Ltd, London,1992.

**T.B-4**. R.C. Dubey and D.K Maheswari, A Textbook of Microbiology (Revised edition), S. Chand and Company Ltd, New Delhi, 2012.

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|---|---|---|
| **UNIT I** | Chapter I, II &IV | **T.B-1** |
| **UNIT II** | Chapter II | **T.B-4** |
| **UNIT III** | Chapter VI | **T.B-2** |
| **UNIT IV** | Chapter II | **T.B-3** |
| **UNIT V** | Chapter XVII, XVIII, XIX | **T.B-1** |
| | Chapter II | **T.B-4** |

**Books for reference:**


1. R.Ananthanarayan and C.K.JayaramPaniker, Textbook of Microbiology, 8th edition, Universities Press (India) Private Limited, 2009.
2. Jeffrey C. Pommerville, Alcamo's Fundamentals of Microbiology, 9th edition, Jones and Bartlett publishers, Massachusetts, 2011.
3. S.S. Purohit, Microbiology- Fundamentals and Applications, 7th Edition, Agrobios (India) Jodhpur, 2008.


**Web Reference:**

1. https://www.studyandscore.com/studymaterial-detail/phylum-protozoa-general-characters-and-classification
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5205
3. https://microbeonline.com/maintenance-and-preservation-of-pure-cultures-of-bacteria/

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | | | Title of the Paper | | | Hours | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 20UMB1CC1 | | | INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY | | | 5 | | | 5 |
| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO2 | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | |
| CO3 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO4 | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | |
| CO5 | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | |
| Number of Matches= 32, Relationship : Moderate | | | | | | | | | | |

Prepared by:
Mrs.K.Vijayalakshmi

Checked by:
1.Ms.A.Fasila Begum
2. Dr.A.Khaleel Ahamed

| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| I | 20UMB1CC2P | Core – II | INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITYPRACTICAL | 3 | 2 | 100 | 25 | 75 |

**Course Outcomes:**

1. Assess the biosafety measures and aseptic techniques.
2. Illustrate the methods of sterilization, media preparation and pure culture techniques.
3. Detect the microorganisms from various samples.
4. Recapitulate the bacteria by counting methods.
5. Execute various staining techniques.

1. Laboratory practice and precautions. Antiseptics and disinfectants.
2. Cleaning and sterilization of glass wares.
3. Culture media preparation –Solid, semi-solid and liquid medium.
4. Pure culture techniques- Streak, Spread and Pour plate method.
5. Isolation of bacteria.
6. Isolation of fungi.
7. Isolation of actinomycetes.
8. Isolation of cyanobacteria.
9. Enumeration of bacteria by viable count and total count.
10. Staining of bacteria- Simple and Gram staining technique.
11. Staining of Fungi –Lacto phenol cotton blue method.

**Practical manual:**


1. James G. Cappuccino, Natalie Sherman, Microbiology – A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 1996.
2. Mackie and McCartney, Practical Medical Microbiology, Churchill Livingston, 1989.
3. K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
4. B.K. Khuntia, Basic Microbiology – An Illustrated Laboratory Manual, 2nd Edition, Daya Publishing House, New Delhi, 2013.


Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | Title of the Paper | Hours | Credits |
|---|---|---|---|---|
| I | 20UMB1CC2P | INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY PRACTICAL | 3 | 2 |

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO2 | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | |
| CO3 | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | |
| CO4 | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | |
| CO5 | ✓ | ✓ | | | | ✓ | ✓ | | | |
| Number of Matches= 32, Relationship : Moderate | | | | | | | | | | |

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2. Dr.A.Khaleel Ahamed

| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| I | 20UMB1AC1 | ALLIED - I | BIOCHEMISTRY I: BIOMOLECULES | 5 | 4 | 100 | 25 | 75 |

**Course Outcomes:**

1.Describe the structure of atoms, unit concentrations and stabilizing interactions of Biomolecules.

2. Restate the structure, classification, function and sources of Carbohydrates.

3. Explain the classification, structure, properties of Aminoacids and Proteins.

4. Comment on classification, structure and functions of Lipids.

5. Determine the Vitamins and Nucleic acids.

**UNIT - I** **15 hours**

**Biomolecules**: Structure of atoms, molecules and chemical bonds.Units of measurement of solutes in solution- Normality, molalityand molarity.Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction.).Principles of biophysical chemistry (#pH#, buffer).

**UNIT – II** **15 hours**

**Carbohydrates:** Biological significance, Occurrence,Structure, Classification and properties of carbohydrates and Stereoisomerism.Structure of glucose-Straight chain structure and #Ring structure#. Disaccharides Maltose, Lactose and Sucrose. Polysaccharides- Homo and Heteropolysaccharides.

**UNIT –III15 hours**

**Amino acids and proteins**: Structure, Classification, properties and types of amino acids. Proteins- Classification, Structure and #function#. Primary, Secondary, Tertiary and Quaternary structure- forces stabilizing the structure of proteins.

**UNIT- IV** **15 hours**

**Lipids**: Structure, classification,occurrence, properties and function of lipids.Saturated and unsaturated fatty acids- Triacylglycerols,Phospholipids,Glycolipids,Steroidsand #Amphipathic lipids#. Beta-oxidation of fatty acid.

**UNIT- V15 hours**

**Vitamins and Nucleic acid**: Definition, sourcesand functions of Fat soluble vitamins and Water soluble vitamins.Nucleic acid: Introduction- Nucleotides and #Nucleosides# and their importance – composition, structure and metabolism of nucleic acid.

**#---#Self study portion**

**Text books:**

**T.B-1**. David L. Nelson and Michael M.Cox, Lehniger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, 2005.

**T.B-2**. Eric E. Conn, Paul K. Stumpf, George Bruening and Roy H. Doi, Outlines of Biochemistry, 5thEdtion, John Wiley and Sons, New Delhi, 2006.

**T.B-3**. Ambikashanmugam, Fundamentals of Biochemistry for Medical students 7th Edition,Kartik offset Printers, Chennai, 1998.

**T.B-4**.U.Satyanarayana and U.Chakrapani, Biochemistry,4th edition, Elsevier, New Delhi, 2013.

| | | |
|---|---|---|
| **UNIT I** | Chapter I | **T.B-2** |
| **UNIT II** | Chapter VII | **T.B-1** |
| **UNIT III** | Chapter III | **T.B-1** |
| **UNIT IV** | Chapter II | **T.B-3** |
| **UNIT V** | Chapter V&VII | **T.B-4** |

**Books for reference:**


1. Dawn, B. Markus, Biochemistry, Harwal Publishing, New York, 1994.
2. Donald voet and Judith voet, Biochemistry, John Wiley and Sons, New York, 1990.
3. Jeremy M. Berg, JoghnL.Tymoczko and LubertStryer, Biochemistry, 5th Edition, W.H. Freeman and Company, New York, 1995.


**Web Reference:**

1.https://sciencenotes.org/concentration-units-for-solutions/
2. https://ww2.chemistry.gatech.edu/~lw26/structure/molecular_interactions/mol_int.html
3. https://www.mikeblaber.org/oldwine/BCH4053/Lecture10/Lecture10.htm

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | Title of the Paper | Hours | Credits |
|---|---|---|---|---|
| I | 20UMB1AC1 | BIOCHEMISTRY I: BIOMOLECULES | 5 | 4 |

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | |
| CO2 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO3 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO4 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO5 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| Number of Matches= 32, Relationship : Moderate | | | | | | | | | | |

Prepared by:
Ms.A.Fasila Begum

Checked by:
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| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| I | 20UMB1AC2P | ALLIED - II | BIOCHEMISTRY I: BIOMOLECULES PRACTICAL | 3 | 2 | 100 | 25 | 75 |

**Course Outcomes:**

1. Prepare different Buffers.
2. Perform qualitative analysis of sugars and Amino acids.
3. Demonstrate theamino acid and ascorbic acid quantitatively.
4. Predict the amount of proteins and Lipids.
5. Create an entrepreneurship in biomolecules extraction.

1. Preparation of normal, molar and percentage solutions.
2. Preparation of Buffers.
3. Qualitative Analysis of sugars.
4. Qualitative Analysis of Amino acids.
5. Estimation of glucose.
6. Estimation of amino acid
7. Estimation of ascorbic acid from biological sample - burette method.
8. Estimation of Protein by Lowry's method.
9. Estimation of Lipid.
10. Extraction of Biomolecules:
    a. Starch from potato
    b. Casein from milk.

**Practical manual:**


1. Keith Wilson and John Walker, Principles & Techniques of Practical Biochemistry,4th Edition, Cambridge University press, Britain, 1995.
2. B.A. Strolv and V.C. Makavora, Laboratory manual in Biochemistry, MIR Publisher, Moscow, 1989.


Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | Title of the Paper | Hours | Credits |
|---|---|---|---|---|
| I | 20UMB1AC2P | BIOCHEMISTRY I: BIOMOLECULES PRACTICAL | 3 | 2 |

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | | | ✓ | | ✓ | | | ✓ | |
| CO2 | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| CO3 | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| CO4 | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| CO5 | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Number of Matches= 36, Relationship : High | | | | | | | | | | |

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Checked by:
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| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| II | 20UMB2CC3 | CORE -III | BACTERIOLOGY AND VIROLOGY | 6 | 5 | 100 | 25 | 75 |

**Course Outcomes:**

1. Investigate the Ultra structure of Bacteria.
2. Comment on various bacteria and interpret staining techniques.
3. Grasp knowledge on cultivation and economic importance of bacteria.
4. Describe about general characteristics of viruses.
5.Explain the plant and animal viruses.

**UNIT – I** **18 hours**

**Structural organization of bacteria**: Size, Shape and Arrangement of Bacterial cells. Ultra structure of a bacterial cell - cell wall, cell membrane, ribosomes, capsule, flagella, spores , cysts, plasmid, mesosomes and cytoplasmic inclusions, Mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, #peroxisomes#, chloroplast, structure & function of cytoskeleton and its role in motility.

**UNIT – II:** **18 hours**

**Biology of bacteria**: *Staphylococcus, Streptococcus,E.coli, Klebsiella, Bacillus, Proteus,Salmonella, Vibrio, Pseudomonas, Mycobacterium, Spirochetes, Mycoplasma, Rickettsiae and Chlamydiae,* Archaebacteria.Staining**:**Principles and Types of staining–Simple, Differential, Capsule staining,#NuclearandFlagellastaining#.

**UNIT – III** **18 hours**

**Cultivation and Importance of Bacteria**- Nutritional requirements, Nutritional Types of bacteria- Phototrophs,Chemotrophs, Autotrophs, Heterotrophs and #Obligate parasites#. Economic importance of bacteria in Agriculture-Nitrogen fixing organisms;Ecological importance-bioremediation and biopesticides; Industrial importance- antibiotics and vaccines.

**UNIT- IV** **18 hours**

**Virology**:History#General properties of viruses#.Classification (Baltimore system) and nomenclature of viruses.Structure and replication of virus- Plant, animal and bacterial viruses-Lytic life cycle (T-Even coliphages) and Lysogenic life cycle ( #Lambda phage#). Isolation, purification, assay and cultivation of viruses.Concept ofvirions,viroids, virusoids, and Prions.

**UNIT-V** **18 hours**

**Plant and Animal viruses:**General characteristics and multiplication of Plant Viruses- Tobacco mosaic virus, Potato leaf roll virus, Bunchy top of banana. Animal viruses- Adenoviruses, Herpes viruses, Poxviruses, Rhabdo viruses, Retrovirus.

**#--- # Self study portion**

**Text books:**

**T.B-1**. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R.Krieg, Microbiology, 5th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

**T.B-2**. Lansing M. Presscott, John P. Harley and Donald A. Klein's, Microbiology, 7th edition, McGrawHill, 2008.

**T.B-3**.R.Ananthanarayan andC.K.JayaramPaniker, Textbook of Microbiology, 8th edition, Universities Press (India) Private Limited, 2009.

**T.B-4**.K.C.Sawant, Virology, Dominant Publishers and Distributors, New Delhi, 2015.

| | | |
|---|---|---|
| **UNIT I** | ChapterV | **T.B-1** |
| **UNIT II** | Part –III | **T.B-3** |
| **UNIT III** | Chapter XLIV | **T.B-2** |
| **UNIT IV** | Chapter I& II | **T.B-4** |
| **UNIT V** | Chapter XVII | **T.B-3** |

**Books for reference:**

1. Jeffrey C.Pommerville, Alcamo's Fundamentals of Microbiology, 9th edition, Jones and Bartlett publishers, Massachusetts, 2011.
2. N.J. Dimmock andS.B.Primrose, Introduction to Modern Virology,4th Edition, Blackwell Scientific Publications, Oxford, 1994.
3. A.Maharajan,Virology, Daya Publishing House, New Delhi 2015.
4. S.S. Purohit, Microbiology- Fundamentals and Applications, 7th Edition, Agrobios (India) Jodhpur, 2008.

**Web Reference:**

1.https://en.wikibooks.org/wiki/Structural_Biochemistry/Cell_Organelles/Cytoskeleton
2.https://ucmp.berkeley.edu/archaea/archaea.html
3.https://www.britannica.com/science/virion
4.https://www.khanacademy.org/science/biology/biology-of-viruses/virus-biology/a/bacteriophages

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | Title of the Paper | Hours | Credits |
|---|---|---|---|---|
| II | 20UMB2CC3 | BACTERIOLOGY AND VIROLOGY | 6 | 5 |

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | |
| CO2 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO3 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO4 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO5 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| Number of Matches= 38, Relationship : High | | | | | | | | | | |

Prepared by: Checked by:

Mrs.K.Vijayalakshmi 1.Ms.A.Fasila Begum
2. Dr.A.Khaleel Ahamed

| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| II | 20UMB2CC4P | CORE -IV | BACTERIOLOGY AND VIROLOGY-PRACTICAL | 3 | 2 | 100 | 25 | 75 |

**Course Outcomes:**

1. Examine the motility of bacteria.
2. Perform different staining techniques.
3. Determination of bacterial growth by different methods.
4. Demonstrate the isolation of bacteriophages.
5. Justify the amount of bacteriophages in sewage.

1. Temporary wet mount (TWM) technique by hay infusion broth.
2. Motility of bacteria - Hanging drop technique.
3. Acid –Fast Staining.
4. Bacterial spore (endospore) staining.
5. Capsule staining
6. Negative staining technique.
7. Determination of bacterial growth by direct count and
8. Determination of bacterial growth by turbidity measurements (Spectrophotometric method).
9. Isolation of Bacteriophage from sewage.
10. Cultivation and Enumeration of Bacteriophages.

**Practical manual:**

1. James G. Cappuccino, Natalie Sherman, Microbiology – A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 1996.
2. K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
3. B.K.Khuntia, Basic Microbiology – An Illustrated Laboratory Manual, 2nd Edition, Daya Publishing House, New Delhi, 2013.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | Title of the Paper | Hours | Credits |
|---|---|---|---|---|
| II | 20UMB2CC4P | BACTERIOLOGY AND VIROLOGY-PRACTICAL | 3 | 2 |

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO2 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO3 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO4 | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | |
| CO5 | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | |
| Number of Matches= 36, Relationship : High | | | | | | | | | | |

Prepared by: Checked by:

Mrs.K.Vijayalakshmi 1.Ms.A.Fasila Begum
2. Dr.A.Khaleel Ahamed

| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| II | 20UMB2AC3 | ALLIED - III | BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLOGY | 4 | 3 | 100 | 25 | 75 |

**Course Outcomes:**

1. Explicit the concepts of bioenergetics.
2. Acquire knowledge on energy conversions.
3. Categorize and describe enzymes.
4. State the mechanisms of enzyme action.
5. Interpret enzyme kinetics.

**UNIT- I** **12hours**

**Bioenergetics:**Laws of Thermodynamics. Definitions of Gibb's Free Energy, enthalpy, entropy and relationship among them. Standard free energy change and Energy rich compounds: Phosphoenolpyruvate, 1,3- Bisphosphoglycerate, #Thioesters#.

**UNIT- II** **12hours**

**Energy Conversions - Mitochondria:**Chemical activity of mitochondria. Sequence of electron carriers and sites of oxidative phosphorylation, ATP generation. Theories ofoxidative phosphorylation, #uncouplers# and inhibitors of energy transfer.

**UNIT - III** **12hours**

**Enzymes:** Classification of enzymes - Enzymes as biocatalysts, catalytic power, activation energy, substrate specificity and active site. Sources of enzymes – Media for enzyme production- Preparation of enzymes – Centrifugation, filtration, #Cell breakage# and Chromatography

**UNIT- IV** **12hours**

**Mechanism of Enzymes Action**: Theories of mechanisms of enzyme action -Enzyme specificity – Active site – Study of Mechanism of enzyme reaction – Pathway of enzyme catalyzed reactions. Mechanism of action of lysozyme, #chymotrypsin# and ribonuclease.

**UNIT- V** **12hours**

**Enzyme kinetics:** Importance of enzyme kinetics, factors affecting rates of enzyme mediated reactions (pH, temperature, substrate concentration, enzyme concentration and #reaction time#). Derivation of Michaelis - Menton equation and its significance in enzyme kinetic studies.

**#--- # Self study portion**

**Text books:**

**T.B-1**. David L. Nelson and Michael M.Cox, Lehniger Principles of Biochemistry, 4thEdtion, W.H. Freeman and Company, New York, 2005.

**T.B-2**.U.Satyanarayana and U.Chakrapani, Biochemistry,4th edition, Elsevier, New Delhi, 2013.

**T.B-3.** Keith Wilson and John Walker, Principles and techniques of Biochemistry and Molecular Biology,6th Edition, Cambridge University Press, New York, 2005.

**T.B-4.**AmitaSaxena, Textbook of Biochemistry, Discovery Publishing House, 2006.

**UNIT I** Chapter XIII **T.B-1**.
**UNIT II** Chapter XIX **T.B-1**.
**UNIT III** Chapter XV **T.B-3**.
**UNIT IV** Chapter VII **T.B-4**.
**UNIT V** Chapter VI **T.B-2**.

**Books for reference:**


1. Athel Cornish – Bowden. Principles of Enzyme Kinetics. - Portland press, 2004.

2. M.F. Chaplin and C. Bucke. Enzyme Technology, Cambridge University press,1990.


**Web reference:**

1. https://www.khanacademy.org/science/chemistry/thermodynamics-chemistry/gibbs-free-energy/a/gibbs-free-energy-and-spontaneity
2. https://www.britannica.com/science/metabolism/ATP-synthesis-in-mitochondria
3. http://www1.lsbu.ac.uk/water/enztech/mechan.html
4. https://en.wikipedia.org/wiki/Lysozyme

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | Title of the Paper | Hours | Credits |
|---|---|---|---|---|
| II | 20UMB2AC3 | BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLOGY | 4 | 3 |

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO2 | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | |
| CO3 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO4 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO5 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| Number of Matches= 36, Relationship : High | | | | | | | | | | |

Prepared by:
Ms.A.Fasila Begum

Checked by:
1.Mrs.K.Vijayalakshmi
2. Dr.A.Khaleel Ahamed

| Semester | Code | Course | Title of the Course | Hours | Credits | Max. marks | Internal marks | External marks |
|---|---|---|---|---|---|---|---|---|
| II | 20UMB2AC4P | ALLIED - IV | BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLOGY PRACTICAL | 3 | 2 | 100 | 25 | 75 |

**Course Outcomes:**

1. Estimate the protein by different methods.
2.Seperate the amino acids by using chromatography.
3.Determine the various influencing factors on enzymes
4. Demonstrate the method of immobilization of enzymes.
5. Perform the rate of anaerobic respiration.

1. Estimation of Proteins – Biuret andFolin method.
2. Separation of amino acids by paper chromatography.
3. Assay of enzyme activity.
4. Effect of pH on enzyme activity.
5. Effect of temperature on enzyme activity.
6. Effect of substrate enzyme activity.
7. Immobilization of enzymes by alginate beads.
8. Influence of sugar concentration on the rate of anaerobic respiration

**Practical manual:**


1. James G. Cappuccino, Natalie Sherman. Microbiology – A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 1996.
2. K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
3. JyotiSaxena, MamtaBaunthiyal,Indu Ravi, Comprehensive Laboratory Manual of Life Sciences, Scientific Publishers, 2019.


Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

| Semester | Code | Title of the Paper | Hours | Credits |
|---|---|---|---|---|
| II | 20UMB2AC4P | BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLOGY PRACTICAL | 3 | 2 |

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| CO1 | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | |
| CO2 | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| CO3 | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | |
| CO4 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| CO5 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| Number of Matches= 36, Relationship : High | | | | | | | | | | |

Prepared by: Checked by:

Ms.A.Fasila Begum

1.Mrs.K.Vijayalakshmi
2. Dr.A.Khaleel Ahamed