

# College of Computer, Science & Information Technology - Junagadh

AFFILIATED TO BHAKTA KAVI NARSINH MEHTA UNIVERSITY



◆ Syllabus ◆

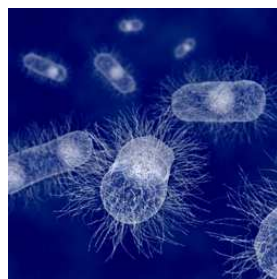
Bachelor of Science

[ Microbiology, Biotechnology, Chemistry ]

[ Semester – I & II ]

Academic Year : 2020 – 21

( Effective from June – 2018 )



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| <b>(SEMESTER-I)</b>  |  |               |                    |                   |                    |
|----------------------|--|---------------|--------------------|-------------------|--------------------|
| <b>Subject code</b>  | <b>Subject Name</b>                          | <b>Credit</b> | <b>Int. Marks</b>  | <b>Ext. Marks</b> | <b>Total Marks</b> |
| MB-101               | Basics and Scopes                            | 4             | 30                 | 70 (14x5)         | 100                |
| MB-101               | Basics and Scopes                            | 2             | 15                 | 35                | 50                 |
| BT-101               | Introduction to Biotechnology & Cell Biology | 4             | 30                 | 70 (14x5)         | 100                |
| BT-101               | Introduction to Biotechnology & Cell Biology | 2             | 15                 | 35                | 50                 |
| C-101                | Chemistry                                    | 4             | 30                 | 70 (14x5)         | 100                |
| C-101                | Chemistry Practical                          | 2             | 15                 | 35                | 50                 |
| English              | Compulsory English                           | 3             | 30                 | 70 (14x5)         | 100                |
| <b>Total Credits</b> |  | <b>21</b>     | <b>Total Marks</b> |                   | <b>550</b>         |

| <b>(SEMESTER-II)</b> |  |               |                    |                   |                    |
|----------------------|--|---------------|--------------------|-------------------|--------------------|
| <b>Subject code</b>  | <b>Subject Name</b>  | <b>Credit</b> | <b>Int. Marks</b>  | <b>Ext. Marks</b> | <b>Total Marks</b> |
| MB-201               | Microbial Physiology   | 4             | 30                 | 70 (14x5)         | 100                |
| MB-201               | Microbial Physiology Practical                                       | 2             | 15                 | 35                | 50                 |
| BT-201               | Fundamentals of Biochemistry, Biocomputing & Biostatistics           | 4             | 30                 | 70 (14x5)         | 100                |
| BT-201               | Fundamentals of Biochemistry, Biocomputing & Biostatistics Practical | 2             | 15                 | 35                | 50                 |
| CH-201               | Chemistry  | 4             | 30                 | 70 (14x5)         | 100                |
| CH-201               | Chemistry Practical  | 2             | 15                 | 35                | 50                 |
| English              | Compulsory English   | 3             | 30                 | 70 (14x5)         | 100                |
| <b>Total Credits</b> |  | <b>21</b>     | <b>Total Marks</b> |                   | <b>550</b>         |

**General Instructions:**

1. Time duration of each theory paper will be of Two and Half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be five questions.
4. All questions are compulsory.

**Instructions to the candidates for Practical Examination:-**

1. Practical Exam. would be conducted for 1 ½ days, All the students have to remain present at the examination center 15 minutes before the scheduled time for examination.
2. Students have to carry with them certified Journal, I – card, Examination Receipt, and other necessary requirements for examination.
3. Student should not leave the laboratory without the permission of examiner.
4. Use of calculator is allowed but the use of mobile phones is strictly prohibited.
5. The candidate has to leave the laboratory only after the submission of all the answer sheets of the exercises performed.

# Syllabus of B.Sc. Semester – I

## MB-101 : BASICS AND SCOPES (THEORY)

### **UNIT 1**

**(TEACHING HOURS-12, MARKS-14)**

#### **MICROBIOLOGY : SCOPE AND HISTORY**

- 1.1 Microbiology as a field of Biology
- 1.2 The Place of Microorganisms in the living world
- 1.3 Introduction to Groups of Microorganisms
- 1.4 Distribution of Microorganisms in Nature
- 1.5 Applied areas of Microbiology
- 1.6 Spontaneous generation versus Biogenesis
- 1.7 Germ Theory of disease
- 1.8 Eminent scientists of Microbiology

### **UNIT 2**

**(TEACHING HOURS-12, MARKS-14)**

#### **MICROSCOPY AND SPECIMEN PREPARATION**

- 2.1 Bright field Microscopy – Principle, Construction and Working
- 2.2 Dark field Microscopy - Principle, Construction and Working
- 2.3 Fluorescent Microscopy - Principle, Construction and Working
- 2.4 Phase Contrast Microscopy - Principle, Construction and Working
- 2.5 Electron Microscopy – Types, working and Limitations
- 2.6 Introduction to Confocal Microscopy
- 2.7 Introduction to Stains, Mordents, Decolorizers and Fixatives
- 2.8 Preparations for Light Microscope Examinations

### **UNIT 3**

**(TEACHING HOURS-12, MARKS-14)**

#### **PROKARYOTIC CELL: STRUCTURE AND FUNCTION**

- 3.1 Size, Shape and Arrangement of Bacteria
- 3.2 Bacterial Structures – External to Cell Wall : Capsule, Flagella, Pili, Prostheca, Sheath & Stalk
- 3.3 The cell wall of Bacteria – Structure and chemical composition of Gram negative and Gram positive Bacterial cell wall
- 3.4 Bacterial Structures – Internal to Cell Wall : Cell Membrane, Protoplast, Spheroplast, Membranous intrusions and intracellularembrane system, Cytoplasm, Cytoplasmic inclusions and Vacuoles, Nuclear Material
- 3.5 Bacterial Spores and Cyst – Types of spore, Structure and formation of Endospores (Sporogenesis).

### **UNIT 4**

**(TEACHING HOURS-12, MARKS-14)**

#### **MICROBIAL NUTRITION**

- 4.1 Nutritional requirements of bacteria
- 4.2 Nutritional types of Bacteria
- 4.3 Bacteriological Media
- 4.4 Physical conditions required for growth
- 4.5 Gaseous requirements and oxygen toxicity
- 4.6 Selective methods
- 4.7 Cultural characteristics

### **UNIT 5**

**(TEACHING HOURS-12, MARKS-14)**

#### **MICROBIAL GROWTH**

- 5.1 Reproduction of Bacteria : Modes of cell division and new cell formation
- 5.2 Growth of Bacteria : Generation time, Growth rate
- 5.3 Bacterial Growth Curve
- 5.4 Synchronous growth and Continuous culture of Bacteria

#### **REFERENCE BOOKS:**

1. Prescott L.M., Microbiology 7th Edition, The McGraw–Hill Companies,
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Modi, H.A. Elementary Microbiology - Vol -I & II, Akta Prakashan, Nadiyad.

4. Powar and Dagainawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
6. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.
7. Stanier, R.Y., Iningraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5 Edition. MacMillan Press Ltd., London.
8. Frobisher M., Hinsdill, Crabtree and Goodherat Fundamentals of Microbiology, 9<sup>th</sup> Edition. W.B Saunders Co. USA.
9. Mani, A., Selwaraj, A.M., Narayanan L.M., and Arumngam, N., Microbiology, Saras Publication, Delhi

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### **MB-101 : BASICS AND SCOPES (PRACTICAL)**

1. Principles, working and uses of the following laboratory instruments :
  - a) Microscope
  - b) Incubator
  - c) pH meter
  - d) Refrigerator
  - e) Colorimeter
  - f) Colony counter
2. Principles, working and uses of the following sterilizers:
  - a) Autoclave
  - b) Hot air oven
  - c) Steam sterilizer
  - d) Inspissator
  - e) Bacteriological filters.
3. Preparation of glassware for sterilization and disposal of laboratory media and cultures.
4. Preparation of Stains and Staining Reagents.
5. Study of Permanent Slides of Bacteria, Fungi, Algae and Protozoa.
6. Study of bacterial motility by hanging drop method.
7. Monochrome Staining:
  - a) Negative Staining
  - b) Positive Staining
8. Differential Staining : Gram's Staining
9. Special staining of bacteria:
  - a) Capsule staining – Hiss's method
  - b) Cell wall staining – Webb's method
  - c) Spore staining – Schaeffer's method
  - d) Metachromatic granule staining – Albert's method
  - e) Spirochete staining – Harrie's method
10. Isolation of bacteria by streak plate/pour plate and spread plate technique
11. Study of liquid/solidified culture media

#### **REFERENCE BOOKS : (SEMESTER 1 PRACTICALS)**

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma, Manual of Microbiology – Tools and Techniques , Ane books, Delhi

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### **BT-101 : INTRODUCTION TO BIOTECHNOLOGY AND CELL BIOLOGY(Theory)**

#### **UNIT-1: INTRODUCTION AND SCOPE OF BIOTECHNOLOGY**

- 1.1 Historical perspective and Definitions of Biotechnology
- 1.2 Current Status of Biotechnology and Future of Biotechnology in Developing World.
- 1.3 Recombinant DNA Technology
- 1.4 Applications of Biotechnology- Agriculture, Medicine & Environment
- 1.5 Ethical and Social Impacts

#### **UNIT-2: BASIC CONCEPT AND UNDERSTANDING OF CELL**

- 2.1 Concept of Life, Origin and Evolution of Cell and Cell Theory
- 2.2 Cell Structure (organization of plant and animal cell, chemical composition of cell, comparison of plant, animal and prokaryotic cell)
- 2.3 Diversity of Cell Size and Shape
- 2.4 Ultrastructure and Function of Prokaryotic cell and Virus
- 2.5 Microscopic Techniques for Study of Cell

#### **UNIT-3: STRUCTURE AND FUNCTION OF CELL ORGANELLES**

- 3.1 Cell Wall and Plasma Membrane
- 3.2 Mitochondria and Chloroplast

- 3.3 Endoplasmic Reticulum and Golgi Bodies
- 3.4 Lysosomes, Glyoxisomes and Peroxisomes
- 3.5 Ribosomes

#### **UNIT-4 : NUCLEUS, CELL CYCLE AND CELL DIVISION**

- 4.1 Nucleus
- 4.2 Structure and Ultrastructure of chromosomes
- 4.3 overview of cell cycle
- 4.4 Mitosis and Meiosis
- 4.5 Regulation of cell cycle

#### **UNIT-5: ADVANCE STUDIES IN CELL BIOLOGY**

- 5.1 Cytoskeleton
- 5.2 Cell Locomotion – Amoeboid, Flagella, Cilia, Cytoplasmic Streaming
- 5.3 Cell – Cell Interaction
- 5.4 Overview of Stem cells
- 5.5 Cancer biology

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### **BT-101 : INTRODUCTION TO BIOTECHNOLOGY AND CELL BIOLOGY(Theory)**

#### **LIST OF PRACTICALS :-**

- Exp.1. Introduction to LAB and lab environment
- Exp.2. Preparation of solution
- Exp.3. Staining techniques (Simple and Differential)
- Exp.4. Calibration of stage and ocular micrometer and measurement of given biological samples
- Exp.5. Cytology and histology of various organs (Permanent slides or fresh preparation)
- Exp.6. Preparation of slides showing different stages of cell division – Mitosis and meiosis
- Exp.7. Human Karyotyping
- Exp.8. Preparation of slide of Polytene and Lampbrush chromosomes from drosophila Larvae
- Exp.9. Isolation of chloroplast and microscopic observation
- Exp.10. Observation of bacterial motility by performing hanging drop method
- Exp.11. One day Field visit

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### **C-101 : Chemistry(Theory)**

#### **Unit-1 : Inorganic Chemistry**

**[20 Hours]**

#### **Chapter-1 : Atomic structure and Periodic properties**

**[08 hours]**

Basic concept of Wave particle duality of electron, De-Broglie's equation, Heisenberg's uncertainty principle, Schrödinger's wave equation and significance of  $\psi$  and  $\psi^2$ ,

Quantum numbers, Shapes of orbital, Aufbau rule, Pauli's Principle, and Hund's rule for electron configuration,

Periodicity in atomic properties and its causes, Magic number, explanation of general trends of periodic properties: atomic radii (covalent, metallic and van der Waals radii), Ionic radii, ionization potential, electron affinity, electronegativity,

Calculation of Ionic radii by Pauling method and calculation of Electronegativity by Mullikan and Pauling method, Example based on de-Broglie's equation, Heisenberg's uncertainty principle, Ionic radii (Pauling method and Electronegativity),

Special characteristics such as metallic character, polarizing power, hydration energy, Inert pair effect, relative stability of different oxidation state, complex formation tendency of s and p-block elements, diagonal relationship of (1) lithium with magnesium (2) boron with silicon and (3) beryllium with aluminum, anomalous behavior of Li, Be and B, Catenation.

## Chapter-2 : Chemical bonding

[12 hours]

Basics of Ionic bond, Covalent bond, Co-ordinate covalent bond and H- bond, Valence Bond Theory; Covalent bond: Valence bond theory and its limitations, Concept of hybridization:  $sp$  ( $C_2H_2$  and  $BeCl_2$ ),  $sp^2$  ( $BF_3$ ,  $C_2H_4$ ),  $sp^3$  ( $CH_4$ ),  $sp^3d$  ( $PCl_5$ ) and  $sp^3d^2$  ( $SF_6$ ), Hybridization of elements involving  $\pi$ -bonds ( $SO_2$ ,  $SO_3$ ,  $XeO_3$ ) Stereochemistry of inorganic molecules: Sidgwick Powell rule and VSEPR theory, Calculation of total electron pair, lone pair, bond pair in  $SnCl_2$ ,  $SO_4^{2-}$ ,  $I_3^-$ ,  $CO_3^{2-}$  (with Structure), Basic concept of MO theory, Bonding and anti-bonding molecular orbital, gerade and ungerade molecular orbital,  $\sigma$ - molecular orbital and  $\sigma^*$ -molecular orbital,  $\pi$ - molecular orbital and  $\pi^*$ - molecular orbital, Conditions for effective combinations of atomic orbitals, Energy level diagrams of  $B_2$ ,  $C_2$ ,  $N_2$ ,  $O_2$ ,  $F_2$ ,  $CO$ , and  $NO$  with calculation of bond order and magnetic moment, Comparison of MO theory and VB theory, Intermolecular forces; H-bonds, Types and application of H-bond

## UNIT – 2 : ORGANIC CHEMISTRY

[20 hours]

### Chapter-3 : Basic Organic Chemistry and introduction to stereochemistry

[12 hours]

Nomenclature of organic compounds (Acyclic and cyclic - IUPAC-1993) Electronic displacements: Inductive effect, electromeric effect, mesomeric effect and hyper conjugation, Applications of inductive effect to bond length, dipole-moment, reactivity of alkyl halides, relative strength of acid, basicity of amines. Homolytic and heterolytic fission, curly arrow rules, Reaction intermediates: Carbocation, carbanion, free radical, carbenes and benzyne (Formation by cleavage type, structure, relative stabilities, generation) Types of organic reagents: Nucleophiles and electrophiles. Types of organic reactions: Substitution, addition, elimination and rearrangement. Introduction to Stereochemistry: Projection formulae and their interconversion: Fisher, sawhorse and Newmann, Definition of Configuration, Homomers, enantiomers and diastereomers, Geometrical isomerism: cis-trans, syn-anti, E/Z notations using CIP rules.

### Chapter-4 : Aliphatic Hydrocarbons-I and alkyl halides

[08 hours]

Alkanes: Formation of alkanes by Wurtz reaction, Wurtz-Fittig reaction. Free radical substitutions reactions, Relative reactivity and selectivity in Halogenation and alkylhalides. Reactions of alkylhalides: Nucleophilic substitution reaction mechanism ( $SN^1$  &  $SN^2$ ) for alkyl halides Hydrocarbons containing Carbon-Carbon  $\pi$  bonds: I Formation of alkene by Elimination reactions, dehydration of alcohol, dehydrohalogenation of alkyl halide, dehalogenation of vicinal and geminal dihalides, Mechanism of  $E1$ ,  $E2$ ,  $E1c_b$  reactions, Saytzeff and Hofmann eliminations, Electrophilic addition reaction and its mechanism (Markownikov/ Anti Markownikovrule).

## UNIT – 3 : PHYSICAL CHEMISTRY

[20 hours]

### Chapter-5 Chemical Kinetics

[12 hours]

Concept of chemical kinetic: rate of chemical reaction, concentration dependence of reaction rate specific reaction rate constant, order and molecularity of the reaction, Factors affecting rate of the reaction. Definition, derivation of integrated rate equations for zero, first and second (same and different reactants) order reactions, their characteristics and half-life periods. Determination of the order of reaction: (1) Hit and trial method (Integration method) and its limitations (2) Oswald's isolation method (3) Half-life period method (4) Graph method and (5) van't Hoff differential method, Concept of activation energy, Derivation of Arrhenius equation and determination of activation energy by integrated equation and methods, Theories of Reaction Rates: Collision theory and absolute reaction rate theory of bimolecular reactions and qualitative comparison and Numerical.

## Chapter-6 : Adsorption

[04 hours]

Introduction, types of adsorption (physical and chemical), characteristics and factors affecting adsorption. Adsorption isotherm and Freundlich equation, Langmuir theory of adsorption: assumptions, derivation, modification in equation at very low and high pressure and applications of adsorption.

## Chapter-7 : Catalysis

[04 hours]

Introduction, types of catalysis (homogeneous and heterogeneous), Characteristics of catalysis, auto-catalysis, negative catalysis (Inhibitor), promoters, and catalytic poisoning, Activation energy and catalysis, Theories of catalysis: (1) Intermediate compound formation and (2) adsorption theory, active centers, Enzyme catalysis and its characteristics.

### Reference books:

1. UGC Inorganic Chemistry - H. C. Khera ( PragatiPrakashan)
2. Inorganic Chemistry - J. N. Gurtu & H. C. Khera
3. Principles of Inorganic chemistry- B. R. Puri, L. R. Sharma and K. C. Kalia; Vallabh publications, Delhi.
4. Concise Inorganic Chemistry - J. D. Lee
5. Basic Inorganic Chemistry - Gurdeep & Chatwal.
6. Advanced Inorganic Chemistry - Raymond Chang
7. Advanced Inorganic Chemistry- Cotton and Wilkinson
8. Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L. D.S. Yadav, PragatiPrakashan, 8<sup>th</sup> edition-2013
9. Organic Reaction Mechanism, including Reaction Intermediates, V. K. Ahluwalia, Ane's Chemistry active series.
10. Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd.
11. Organic Chemistry by Morrison and Boyd.
12. Organic Chemistry by Clayden.
13. March's Advanced Organic Chemistry Reactions, Mechanism and Structure by Michael B Smith and Jerry March.
14. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co. New Delhi.
15. Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
16. Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
17. Chemical Kinetics, G. R. Chatwal and Harish Mishra, Goel Publication House. Meerut.
18. A text book of Physical Chemistry by Samuel Glasstone
19. Elements of Physical Chemistry by Samuel Glasstone and D Lewis

## C-101 : CHEMISTRY PRACTICALS

50 Marks

### 1. Organic Qualitative Analysis

[20 Marks]

Compounds containing one functional group such as phenolic, carboxylic acid, ester, amide, nitro, amine, aldehyde, ketone, alcohol, halogen, anilide, carbohydrate and hydrocarbon. For example; Benzoic acid, cinnamic acid, phenol,  $\alpha$ -naphthol,  $\beta$ -naphthol, acetone, ethyl methyl ketone, methyl acetate, ethyl acetate, naphthalene, anthracene, aniline, nitrobenzene, benzamide, urea, thiourea, chloroform, acetanilide, carbon tetra chloride, chloro benzene, bromo benzene.

### 2. Volumetric Analysis

[15 Marks]

#### Part-1 : Acid-base titration

- a. To prepare a solution by dissolving 'x' g  $\text{NaHCO}_3 / \text{Na}_2\text{CO}_3$  in 100 ml solution and determine its concentration in terms of normality and molarity using 0.1 N HCl solution.
- b. To determine the normality, molarity and g/lit of NaOH and HCl using 0.1 N  $\text{Na}_2\text{CO}_3$  solution.
- c. To determine the normality, molarity and g/lit of each component in a given mixture of  $\text{NaHCO}_3$  and  $\text{Na}_2\text{CO}_3$  using 0.1N HCl solution.

### Part-2 : Redox Titration

- d. To determine the normality, molarity and g/lit of each component in a mixture of  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$  and  $\text{H}_2\text{SO}_4$  using 0.1 N  $\text{KMnO}_4$  and 0.1N  $\text{NaOH}$  solution.
- e. To determine the normality, molarity and g/lit of each component in a mixture of  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$  and  $\text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$  using 0.1N  $\text{NaOH}$  and 0.1 N  $\text{KMnO}_4$  solution
- f. To determine the normality, molarity and g/lit of  $\text{KMnO}_4$  and  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  solution using 0.1N  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$  solution.
- g. To determine the normality, molarity and g/lit of  $\text{FeSO}_4$   $(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  solutions using 0.1 N  $\text{KMnO}_4$  solution.

### 3. Continuous Internal Assessment

[15 Marks]

## Compulsory English(Theory)

|                     |   |                             |
|---------------------|---|-----------------------------|
| Teaching Hours      | : | 45 Hours per semester       |
| Total marks         | : | 100 Marks                   |
| Semester End Exam   | : | 70 Marks                    |
| Internal assessment | : | 30 Marks Course objectives: |

### Learning Objectives:

- To enhances the knowledge of the subject particularly from non-urban areas.
- To make students proficient in English language and subject related terminology.
- To make them able to master in grammar.
- To make them develop the power of understanding the passage critically.

### Detailed Syllabus:

| Unit                        | Item   | Marks | Hours     |
|-----------------------------|--|-------|-----------|
| 1                           | Text : Ignited Minds by APJ Abdul Kalam Chapters 1,2 and 3   | 28    | 18        |
| 2                           | <b>Grammar:</b> <ul style="list-style-type: none"><li>• Parts of Speech</li><li>• Transformation of Sentences: Assertive/Declarative to Interrogative, affirmative to negative, exclamatory to assertive and vice-versa</li></ul> (Note : The original meaning of the sentence should not be changed while transforming affirmative into negative or vice versa) | 14    | 09        |
| 3                           | <b>Composition:</b> Formal Letter Writing (Letters for purchasing the goods, Letters asking for hotel reservation/cancellation of reservation/ asking for tariff/facilities etc.   | 14    | 09        |
| 4                           | Interpretation of mobile text messages and composing short messages  | 14    | 09        |
| <b>Total Teaching Hours</b> |  |       | <b>45</b> |





# Syllabus of B.Sc. Semester – II

## MB-201 : MICROBIAL PHYSIOLOGY(THEORY)

### **UNIT-1 : CHEMISTRY FOR THE MICROBIOLOGIST**

**(TEACHING HOURS-12, MARKS-14)**

- 1.1 Chemicals, Elements and structure of Atoms
- 1.2 Molecules and Chemical bonds
- 1.3 Chemical reactions
- 1.4 Water and pH
- 1.5 The essence of biochemistry for microbiologist

### **UNIT-2 : INTRODUCTION TO BIOMOLECULES**

**(TEACHING HOURS-12, MARKS-14)**

- 2.1 Classification, Structures and Biological function of Carbohydrates
- 2.2 Classification, Structures and Biological function of Lipids
- 2.3 Classification, Structures and Biological function of Proteins
- 2.4 Classification, Structures and Biological function of Nucleic acids

### **UNIT-3 : ENZYMES**

**(TEACHING HOURS-12, MARKS-14)**

- 3.1 Characteristics of Enzymes, Chemical & Physical Properties of Enzymes
- 3.2 Classification and Nomenclature of Enzymes
- 3.3 Enzyme activity: Nature & Mechanism of enzyme activity, Inhibition of enzymes
- 3.4 Mechanism and Regulation of Enzymes Activity
- 3.5 Mechanism and Regulation of Enzymes Synthesis
- 3.6 Differences between Prokaryotic & Eukaryotic Enzyme Regulation

### **UNIT-4 : CONTROL OF MICROORGANISMS BY PHYSICAL AND CHEMICAL AGENTS**

**(TEACHING HOURS-12, MARKS-14)**

- 4.1 Fundamentals of Microbial Control  
Principle and Types, Definition of Sterilization, Disinfectant, Antiseptic, Sanitizer, Germicide, Bactericide and Bacteriostasis.
- 4.2 Characteristics, Evaluation and Selection of Ideal antimicrobial agent
- 4.3 Physical Agents of Microbial Control –  
High Temperature, Low temperature, Desiccation, Osmotic Pressure, Radiation, Ultraviolet lights, X-rays, Gamma rays, Cathode rays, surface tension and interfacial tension, filtration.
- 4.4 Chemical Agents of Microbial Control –  
Phenol and phenolic compound, Alcohol, Halogen, Heavy metals and their compounds, Dyes, Detergents, Quaternary ammonium compounds, Aldehydes, Gaseous sterilization
- 4.5 Phenol Coefficient Method for the evaluation of chemical antimicrobial agents.

### **UNIT-5 : ANTIBIOTICS AND THEIR MODE OF ACTION**

**(TEACHING HOURS-12, MARKS-14)**

- 5.1 Chemotherapeutic agents and Chemotherapy
- 5.2 Characteristics of ideal chemotherapeutic agent
- 5.3 Antibiotics and their mode of action: Inhibition of cell wall synthesis, Damage to cytoplasmic membrane, Inhibition of nucleic acid and protein synthesis, Inhibition of specific enzyme system
- 5.4 Antifungal, antiviral and antitumor chemotherapeutic agents
- 5.5 Microbiological assay of antibiotics 5.6 Nonmedical uses of antibiotics

### **REFERENCE BOOKS (SEMESTER-2)**

1. Atlas. R.M., Microbiology, 2 nd Edition. Wm. C. Brown Publishers
2. Satyanarayana. U., Biochemistry, Books and allied Pvt. Ltd.
3. Prescott L.M., Microbiology 7th Edition, The McGraw–Hill Companies,
4. Mathew, Van Holde & Ahern, Biochemistry,3 rd Edition. Pearson Education (Singapore) Pte. Ltd. India Branch, New Delhi
5. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
6. Powar and Dagainawala, General Microbiology Vol-I. Himalaya Publishing House, Mumbai.
7. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
8. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi

## **MB-201 : MICROBIAL PHYSIOLOGY(PRACTICAL)**

**Practical Hours – 3hrs/day for 2 days/Week Total Credit – 3 = Total 6 hours/Week**

1. Qualitative analysis of Amino acids and Proteins
2. Qualitative analysis of Carbohydrates
3. Colorimetric estimation of Protein by Folin and Lowry's method
4. Titrimetric estimation of reducing Sugars by Cole's method
5. Colorimetric estimation of reducing sugar by DNSA method
6. Assay of Alpha – Amylase by iodometric method
7. Effect of Chemicals on growth of bacteria
8. Effect of Antibiotics on growth of bacteria : Agar ditch method and Agar cup Method.
9. Enumeration of bacterial number by viable count technique.
10. Growth curve of Bacteria by colorimetric method and determination of Generation time and Growth rate of *E. coli* by colorimetric method.

### **REFERENCE BOOKS : (SEMESTER-2 PRACTICAL)**

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma., manual of Microbiology – Tools & Techniques, Ane Books, Delhi.

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## **BT-201 : Fundamentals of Biochemistry, Biocomputing & Biostatistics** **(Theory)**

### **UNIT-1 :- Chemistry of Life: An Introduction**

- 1.1 The Properties of Water
- 1.2 The Properties of Biomolecules
- 1.3 Chemical Bonds/Interactions : Ionic, Covalent, Nonpolar, Polar, Hydrogen Bonds, Hydrophobic Interactions, Vander Wall's Attractive Force
- 1.4 pH, pKa, Acids, Bases and Buffers
- 1.5 Thermodynamics of Biological System : The First Law, The Second Law, The Third Law, Free Energy, ATP and other High Energy Compounds

### **UNIT-2 :- The Molecules of Life - I (Carbohydrates)**

- 2.1 Chemistry of Carbohydrates: Functions And Classifications, Monosaccharides: Configuration and Conformation,
- 2.2 Reactions of Monosaccharides and Sugar Derivatives
- 2.3 Disaccharides
- 2.4 Polysaccharides: Classifications and Functions
- 2.5 Glycoconjugates: Proteoglycans, Glycoproteins and Glycolipids.

### **UNIT-3 :- The Molecules of Life – II (Proteins)**

- 3.1 Amino Acids: Structures, General Properties, Classifications, Nomenclature, Nonstandard Amino Acid (Amino Acid Derivatives)
- 3.2 Proteins: An Overview of Four Levels of Structures in Proteins, Classifications of Proteins, Properties of Proteins, Biologically Important Peptides
- 3.3 Protein folding
- 3.4 DNA-protein and Protein-Protein Interactions
- 3.5 Protein sequencing

### **UNIT-4 :- The Molecules of Life – III (Nucleic acids)**

- 4.1 Basic Understanding of Nucleotides, Structure and Properties of Nitrogen Basis, Functions of Nucleotides. Nucleotide Analogs
- 4.2 Nucleic Acids: Historical aspects of DNA as Genetic Material, Semi Conservative Nature of DNA, Chargaff's Rule
- 4.3 Watson and Crick DNA Double Helix Structure, other Types of DNA Structure, Denaturation and Renaturation of DNA
- 4.4 Types of RNA and their Functions, Catalytic RNAs (Ribozymes)
- 4.5 Nucleic acid sequencing

## UNIT-5 :- The Molecules of Life – IV (Lipids and vitamins)

- 5.1 Lipids : Classifications of Lipids and Functions of Lipids
- 5.2 Structure of Fatty Acids, Triacylglycerols, Phospholipids and Steroids
- 5.3 Functions of Fatty Acids, Triacylglycerols, Phospholipids and Steroids
- 5.4 Vitamins : Classification, Functions and Sources
- 5.5 Vitamins : Deficiency Disorders

## **BT-201 : Fundamentals of Biochemistry, Biocomputing & Biostatistics** **(PRACTICAL)**

### **List of Practical's :-**

- Exp.1 Operation of pH meter.
- Exp.2 Preparation of buffer
- Exp.3 Qualitative tests for carbohydrates
- Exp.4 Qualitative tests for Amino acids
- Exp.5 Titration curve of amino acids and determination of pI, pK1 and pK2.
- Exp.6 Qualitative test for Lipids
- Exp.7 Qualitative test for Nucleic acids
- Exp.8 Estimation of reducing and non-reducing sugars
- Exp.9 Titrimetric analysis of Ascorbic acid
- Exp.10 Estimation of Saponification value of Lipids
- Exp.11 One day Field visit

### **Reference Books :-**

1. Lehninger. Principles of Biochemistry, Nelson & Cox, 4th Edition.
2. Stryer – Biochemistry. W.H.Freeman & Co.
3. Plummer. An introduction to practical Biochemistry, 3rd Edition
4. J.Jayaraman. Lab Manual in Biochemistry.
5. Cohn and Stumph. Outline of Biochemistry. Wiley eastern.
6. Zube's Biochemistry. 4th Edition Macmillan.
7. Voet & Voet Donald. 3rd Edition. Fundamentals of Biochemistry, J/W.
8. Seidman and Moore. 2000. Basic laboratory methods for biotechnology. Lovgman
9. Boyer. 1999. Concepts in biochemistry. Thomson
10. A Text book of Biochemistry, A.V.S.S. Rama Rao, UBS Publisher
11. Switzer and Garrity. Experimental Biochemistry WH Freeman. 2nd Edition
12. Hames and Hooper. 2000. Instant notes in Biochemistry. BIOS Sci. Publ.
13. Smith G. 1996. Biotechnology. Cambridge Univ. Press.
14. Geoffrey Cooper. 2000. The cell with CD- Rom. Sinauer Asso. Incorp.
15. Elliott & Elliot. 3rd Edition Biochemistry and molecular biology.

## **C-201 : Chemistry(Theory)**

### **UNIT – I : INORGANIC CHEMISTRY**

**[20 hours]**

#### **Chapter-1 : Chemistry of Some Special Compounds of p block elements**

**[12 hours]**

Oxides and its Properties, Classification of oxides based on their chemical behavior and based on their oxygen content, Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses; Borax, Boric acid, Boron nitrides, Borohydrides (diborane), Boron halide and Aluminum halide acidity comparison, Oxides of nitrogen ( $N_2O$ ,  $NO$ ,  $N_2O_3$ ,  $NO_2$ ,  $N_2O_4$ ,  $N_2O_5$ ), Oxo acids of nitrogen ( $H_2N_2O_2$ ,  $HNO_2$ ,  $HNO_3$ ), Oxo acids of Phosphorus ( $H_3PO_2$ ,  $H_3PO_3$ ,  $H_3PO_4$ ,  $H_3PO_5$ ,  $H_4P_2O_7$ ,  $H_4P_2O_8$ ,  $H_4P_2O_5$ ,  $H_4P_2O_6$ ,  $HPO_3$ ,  $(HPO_3)_3$  and  $(HPO_3)_n$ ), Oxo acids of Sulphur (Sulphurous acid series, Sulphuric acid series, Thionic acid series, Peroxy acid series, Oxo acids of halogen, Oxides of chlorine ( $Cl_2O$ ,  $ClO_2$ ,  $Cl_2O_6$ ,  $Cl_2O_7$ ) and oxide of iodine ( $I_2O_5$ ), Inter-halogen compounds and Polyhalide ions, Valence bond and VSEPR approach of following xenon compounds; Oxides of xenon ( $XeO_3$ ,  $XeO_4$ ), Fluorides of xenon ( $XeF_2$ ,  $XeF_4$ ,  $XeF_6$ ), Oxy-fluorides of xenon ( $XeOF_4$ ,  $XeO_2F_2$ ,  $XeOF_2$ )

## Chapter-2 : Ionic solids

[8 hours]

Introduction, characteristics of ionic solids, Born Haber cycle and its application, Lattice and Solvation energy and their importance in the context of stability and solubility of ionic compounds, Max Born equation, limiting radius ratio, Relation between radius ratio, co-ordination number and crystal structure, Derivation of  $r^+/r^-$  ratio in triangular planar, square planar, body centered and tetrahedral crystal lattice, Defects in ionic crystal lattice (stoichiometric and non-stoichiometric), study of N & P type of semi-conductor.

## UNIT – II : ORGANIC CHEMISTRY

[20 hours]

### Chapter-3 : Aliphatic Hydrocarbons-II [06 Hours]

Reactions of alkenes: Oxymercuration-demercuration, Hydroboration oxidation, Ozonolysis, Reduction (catalytic), Syn and anti-hydroxylation (oxidation), 1, 2- and 1,4 -addition reactions in conjugated dienes, Diels-Alder reaction.

Formation of alkynes: Dehydrohalogenation of vicinal and geminal dihalides, Dehalogenation of tetrahalides Reactions of alkynes: Acidity, electrophilic addition reactions like halogenation, hydrohalogenation, hydration, hydroboration, addition of carbene and catalytic hydrogenation. Nucleophilic addition with hydrogen cyanide and alcohol, hydration to form carbonyl compounds, alkylation of terminal alkynes.

### Chapter-4 : Alicyclic compounds and conformations

[06 Hours]

Introduction and classification of ring systems (Based on number of rings, size, number of carbon atom common between the two rings).

IUPAC nomenclature of cycloalkanes (including simple spiro compounds, fused ring and bridged ring systems-bicyclic only) Method of preparation of small ring cycloalkanes:

Intra-molecular Wurtz' reaction, Simmons-Smith, Diels-Alder reaction.

Chemical Properties of Cycloalkanes: Substitution Reactions, Addition Reactions, Baeyer's Strain Theory and its limitations (puckering).

Definition of conformations and factors affecting its stability, Conformation of ethane, propane and butane.

### Chapter-5 : Aromatic Hydrocarbons

[08 Hours]

Aromaticity: Criteria for aromatic, non-aromatic and antiaromatic compounds, applications of Huckel's rule to simple annulene, cyclic carbocation/anion.

Electrophilic aromatic substitution reactions of benzene with mechanisms, theory of effect of substituents on reactivity and orientation (with resonating structures for activating and deactivating groups).

Electrophilic aromatic substitution reactions with mechanisms: Halogenation, nitration, sulphonation, Friedel-Crafts alkylation, Friedel-Crafts acylation.

## UNIT – III: PHYSICAL CHEMISTRY

### Chapter-6 : Ionic Equilibrium

[12 Hours]

Types of electrolytes, degree of dissociation and factors affecting degree of dissociation, Ionic product of water, dissociation constants of weak acids and bases, Common ion effect and calculation of concentrations of  $\text{OH}^-$  ions ( $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$ ) and  $\text{H}^+$  ions ( $\text{H}_2\text{S} + \text{HCl}$ ), Solubility and solubility products of sparingly soluble salts, Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis) Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases, Relation among  $K_h$ ,  $K_a$ , or  $K_b$  and  $K_w$ , Degree of hydrolysis and pH of the solution of salts of weak acids and strong bases, salts of weak bases and strong acids and salts of weak bases and weak acids.

Buffer solutions: Definition and types of buffer solutions, Buffer action, Derivation of Henderson-Hasselbalch equation, Numerical

### Chapter-7 : Solid State

[8 Hours]

Introduction, Crystalline and amorphous solid, Forms of solids (molecular, ionic, metallic and network solid) unit cells, crystal systems, Bravais lattices,

Laws of crystallography: (1) Law of Symmetry, (2) Law of constancy of interfacial angles and (3) law of rational indices, Miller and Weiss indices.

Bragg's law, X-Ray diffraction methods: Rotating crystal method and Powder method. Structures of NaCl and KCl, Density of unit cell, Numerical based on Bragg's law, Miller indices and density.

**Reference books:**

1. UGC Inorganic Chemistry - H. C. Khera ( PragatiPrakashan)
2. Inorganic Chemistry - J. N. Gurtu & H. C. Khera
3. Principles of Inorganic chemistry- B. R. Puri, L. R. Sharma and K. C. Kalia; Vallabh publications, Delhi.
4. Concise Inorganic Chemistry - J. D. Lee
5. Basic Inorganic Chemistry – Gurdeep & Chatwal.
6. Advanced Inorganic Chemistry - Raymond Chang
7. Advanced Inorganic Chemistry- Cotton and Wilkinson
8. Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L. D.S. Yadav, PragatiPrakashan, 8th edition-2013
9. Organic Reaction Mechanism, including Reaction Intermediates, V. K. Ahluwalia, Ane's Chemistry active series.
10. Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd.
11. Organic Chemistry by Morrison and Boyd.
12. Organic Chemistry by Clayden.
13. March's Advanced Organic Chemistry Reactions, Mechanism and Structure by Michael B Smith and Jerry March.
14. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co. New Delhi.
15. Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
16. Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
17. A text book of Physical Chemistry by Samuel Glasstone
18. Elements of Physical Chemistry by Samuel Glasstone and D Lewis

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**C-202 : CHEMISTRY PRACTICALS**

1. **Qualitative analysis of inorganic salts:** [20 Marks]  
**(Minimum 12 salts-containing two radicals)**  
Inorganic salts containing anion (chloride, bromide iodide, nitrate, nitrite, sulphate, sulphite, sulphide, carbonate, phosphate (soluble & insoluble), oxide, chromate, and dichromate).
2. **Inorganic volumetric analysis** [15 Marks]  
**(Standard solution should be given)**
  - 1) Quantitative estimation of  $\text{Cu}^{2+}$  in a given  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  solution using 0.01M EDTA solution.
  - 2) Quantitative estimation of  $\text{Ni}^{2+}$  in a given  $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$  solution using 0.01M EDTA solution.
  - 3) Quantitative estimation of  $\text{Zn}^{2+}$  in a given  $\text{ZnCl}_2$  solution using 0.01M EDTA solution.
  - 4) Determination of total hardness of water by EDTA.
  - 5) Determination of acetic acid in a commercial vinegar using 0.1M NaOH solution.
  - 6) Determination of alkali in antacid using 0.1M HCl solution.
  - 7) Quantitative estimation of  $\text{Fe}^{2+}$  by dichromate method (Internal indicator method).
3. **Continuous internal assessment** [15 Marks]

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**Compulsory English(Theory)**

|                            |   |                                    |
|----------------------------|---|------------------------------------|
| <b>Teaching Hours</b>      | : | <b>45 Hours per semester</b>       |
| <b>Total marks</b>         | : | <b>100 Marks</b>                   |
| <b>Semester End Exam</b>   | : | <b>70 Marks</b>                    |
| <b>Internal assessment</b> | : | <b>30 Marks Course objectives:</b> |

**Learning Objectives:**

- To enhance the knowledge of the subject particularly from non-urban areas.
- To make students proficient in English language and subject related terminology.
- To make them able to master in grammar.
- To make them develop the power of understanding the passage critically.

## Detailed Syllabus:

| Unit                        | Item  | Marks | Hours     |
|-----------------------------|---|-------|-----------|
| 1 & 2                       | Text : Stories for India – Edited by D. S. Mishra & R. Jadeja<br>Publisher : Macmillan India Limited<br><b>Chapters:</b><br>1. Karma by Khushwant Singh<br>2. The case for the Defence by Graham Green<br>3. 'The Shroud' by Prem Chand<br>4. 'Mason's Life' by Kingsley Amis<br>5. 'The Long Exile' by Leo Tolstoy | 28    | 18        |
| 3                           | <b>Grammar:</b><br>• Tenses – 07 Marks<br>• Concord – 07 Marks  | 14    | 09        |
| 4                           | <b>Comprehension:</b><br>1. Comprehension of an Unseen Passage – 07 Marks<br>2. Reshaping of a story – 07   | 14    | 09        |
| 5                           | <b>Composition :</b><br>1. Application writing for a Job – 07 Marks<br>2. Paragraph Writing – 07 Marks  | 14    | 09        |
| <b>Total Teaching Hours</b> |   |       | <b>45</b> |



### Lab Practices and Safety Rules :-

1. Wash your hands with disinfectant, soap when you arrive in the lab and again before you leave.
2. Absolutely no food, drinks, chewing gum, or smoking is allowed in the laboratory. Do not put anything in your mouth such as pencils, pens, labels, or fingers. Do not store food in areas where microorganisms are stored.
3. Do not enter the lab without lab coat and Put off lab coat in the lab and do not wear it to other non-lab areas.
4. Wear lab slippers (sandals are not allowed) in the lab. Always put your slippers in shoe rack.
5. Keep your workspace free of all unnecessary materials.
6. Before each lab and at the completion of each lab you must wipe your lab bench thoroughly with disinfectant.
7. Label everything clearly and properly.
8. Replace caps on reagents, solution bottles, and bacterial cultures.
9. If you are accidentally exposed to the UV light, immediately go to the sunlight.
10. Do not open Petri dishes in the lab unless absolutely necessary. Do not speak while handling Petri plates as it will increase the chances of contamination as well as infection.
11. Inoculating loops and needles should be flame sterilized in a Bunsen burner before you lay them down.
12. Turn off Bunsen burners when not in use.
13. Long hair must be tied up when Bunsen burners are in use.
14. Long nails and painted nails are not allowed.
15. When you flame sterilize with alcohol, be sure that you do not have any papers and cottons under you.
16. Use appropriate care for all cultures and do not take cultures out of the laboratory.
17. Wear disposable gloves when working with potentially infectious microbes or samples (e.g. sewage). If you are working with a sample that may contain a pathogen, then be extremely careful to use good bacteriological technique.
18. Never pipette hazardous chemicals by mouth. [mouth pipetting is strictly prohibited].
19. Consider everything a biohazard. Do not pour anything down the sink. Autoclave liquids and broth cultures to sterilize them before discarding.
20. Dispose broken glass in the given container.
21. Report all injuries or accidents immediately to the instructor, do not clean them yourself, no matter how small they seem.