

**SAURASHTRA UNIVERSITY****FACULTY OF SCIENCE****CBCS BASED COURSE STRUCTURE FOR SEMESTER 1 TO 6 & SYLLABUS FOR SEMESTER 3  
& 4 FOR UNDERGRADUATE PROGRAMME IN MICROBIOLOGY TO BE EFFECTIVE FROM  
JUNE 2019 AND JUNE 2020 RESPECTIVELY**

<b>No.</b>	<b>Diploma/ Graduate/ Post Graduate</b>	<b>Semester</b>	<b>Title Of Paper</b>	<b>Paper No.</b>	<b>Credits</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Practical &amp; Viva Marks</b>	<b>Total Marks</b>
1	Graduate	01	Introduction to Biotechnology and Cell Biology	BT-101	4	30	70	50	150
2	Graduate	02	Fundamentals of Biomolecules	BT-201	4	30	70	50	150
3	Graduate	03	Metabolism of Biomolecules	BT-301	4	30	70	50	150
4	Graduate	04	Environmental Biotechnology and Biostatistics	BT-401	4	30	70	50	150
5	Graduate	05	Bioprocess and Biochemical Engineering	BT-501	4	30	70	50	150
6	Graduate	05	Genetics & Molecular Biology	BT - 502	4	30	70	50	150
7	Graduate	05	Immunology	BT - 503	4	30	70	50	150
8	Graduate	06	Principles of Biotechnology Applied to Plants And Animals	BT-601	4	30	70	50	150
9	Graduate	06	Analytical Techniques in Biotechnology	BT-602	4	30	70	50	150
10	Graduate	06	Advanced Molecular Techniques & Bioinformatic	BT-603	4	30	70	50	150

## **BT-301 –METABOLISM OF BIOMOLECULES (THEORY)**

### **Unit-1:-ENZYME**

- 1.1 Enzymes: - General properties, Nomenclature and Classification. Biocatalyst and Chemical Catalyst, Coenzymes, Cofactors, Isoenzyme and Allosteric Enzyme
- 1.2 Catalytic Mechanism (Proximity and Orientation effects, Acid base Catalysis, Covalent Catalysis and Metal ion catalysis and Transition state analog)
- 1.3 Enzyme Kinetics (derivation of Michaelis–Menten constant, linear transformation of the equation)
- 1.4 Enzyme Inhibition: Mechanism and Types (Irreversible and Reversible)
- 1.5 Mechanism of Enzyme Regulation: Covalent and Allosteric Regulation

### **UNIT-2:-METABOLISM - 1**

- 2.1 Carbohydrate Metabolism: Glycolysis, fate of pyruvate
- 2.2 Carbohydrate Metabolism: TCA
- 2.3 Carbohydrate Metabolism: Gluconeogenesis and HMP
- 2.4 Lipid Metabolism:  $\beta$ -oxidation of fatty acids
- 2.5 ETC and Oxidative Phosphorylation

### **UNIT-3:-METABOLISM - 2**

- 3.1 Protein Metabolism: Transamination, Decarboxylation and Deamination
- 3.2 Protein Metabolism: Urea Cycle
- 3.3 Biosynthesis of Nucleic Acid
- 3.4 Photosynthesis
- 3.5 Inborn Errors of Metabolism (Phenylketonuria, Alkaptonuria, Albinism, Sickle Cell Anemia and Galactosemia)

### **UNIT-4:-HORMONES**

- 4.1 Introduction to Hormones: Endocrine and Exocrine
- 4.2 Plant Hormones and its functions
- 4.3 Animal Hormones and its functions
- 4.4 Types of Animal Hormones
- 4.5 Disorders due to hormonal imbalance in humans

### **UNIT-5:- MOLECULAR TRANSPORTATION AND SIGNALING(credit-0.8)**

- 5.1 Composition and architecture of membrane
- 5.2 Solute transport across membrane
- 5.3 Signal transduction cascade
- 5.4 Regulation of cell cycle by protein kinase
- 5.5 Role of signal transduction by hormones

### **LIST OF PRACTICALS**

- Exp.1. To demonstrate working operations of spectrophotometer.
- Exp.2. Estimation of Protein by Biuret method.

Exp.3. Estimation of Reducing Sugar by Nelson- Somogyi method

Exp. 4, 5,6 Assaying of various enzymes (any three):

- a) Amylases by KI-I<sub>2</sub> method.
- b) Phenol oxidase (Potato).
- c) Phosphatases
- d) Urease.
- e) Invertase by GOD/POD and DNSA method.
- f) Proteolytic enzymes (Trypsin or Pepsin).
- g) Lipases (Germinating castor seeds).

Exp.7, 8, 9, 10 Enzyme Kinetics:

- a) Effect of Substrate concentration (Determination of  $K_m$  and  $V_{max}$ ).
- b) Effect of temperature on enzyme activity
- c) Effect of pH on enzyme activity
- d) Effect of Enzyme inhibitors on enzyme activity

Exp. 11 One day Field visit.

#### **LIST OF INSTRUMENTS**

1. pH Meter
2. Hot Air Oven
3. Weigh Balance
4. Water Bath
5. Refrigerator
6. Autoclave
7. Spectrophotometer and/or Colorimeter
8. Incubator
9. Stirrer
10. Centrifuge
11. Vortex

#### **LIST OF REFERENCES**

1. Lenhinger. Principles of Biochemistry, Nelson & Cox, 4th Edition.
2. Voet & Voet Donald. 3rd Edition. Fundamentals of Biochemistry, J/W.
3. Mathews, Van Holde, Biochemistry, 3rd Edition Pearson Education.
4. Garret and Grisham, Biochemistry, Thomsan Edition, 3rd Edn.
5. U Satyanarayan, Biochemistry, 3<sup>rd</sup> Edn, Books and Allied Pvt. Ltd.

6. Salisbury and Rose, Plant Physiology, 4th Edn, Wadsworth Pub.
7. Arthur M. Lask, Introduction to Protein Science, Oxford publication.
8. Stryer – Biochemistry. W.H.Freeman& Co.
9. Price & Steven, Fundamentals of Enzymology,3rd Edition
10. Cohn and Stumph. Outline of Biochemistry. Wiley eastern.
11. Creighton, proteins: Structure & Molecular Properties, Freeman Pub.
12. Zube's Biochemistry.4<sup>th</sup> Edition Macmillan.
13. Switzer and Garrity. Experimental Biochemistry WH Freeman.2nd Edition
14. Hames and Hooper. 2000. Instant notes in Biochemistry. BIOS Sci. Publ.
15. Smith G.Biotechnology. Cambridge Univ. Press.
16. Geoffrey Cooper. The cell with CD- Rom. Sinauer Asso. Incorp.
17. Elliott & Elliot.3rd Edition Biochemistry and molecular biology.
18. Seidman and Moore. 2000. Basic laboratory methods for biotechnology. Longman
19. Boyer, Concepts in biochemistry. Thomson
20. A.V.S.S. Rama Rao, A Text book of Biochemistry, , UBS Publisher
21. S.R. Thimmaiah, Standard methods in Biochemical Analysis, Kalayani Pub.
22. Sawhney and Randhir Singh, Introductory Practical Biochemistry, Narosa Pub.
23. BeeduSashidar Rao & Vijay Deshpande, Experimental Biochemistry, I K Int. Pvt. Ltd.
24. Plummer. An introduction to practical Biochemistry,3rd Edition
25. J.Jayraman. Lab Manual in Biochemistry.
26. Biotechnology, U. Satyanarayan, Books and Allied
27. Practical manuals of Biotechnology, S. Chand

**P.S. The above reference book list are common for all the unit**

### **Unit 1:- Ecosystem and its component (credit-0.8)**

- 1.1 Terrestrial Biomes: - Deserts, Grasslands, Tundra & Forests
- 1.2 Aquatic Biomes: Freshwater & Saline Ecosystem
- 1.3 Biodiversity: - Factors affecting biodiversity, Biodiversity conservation
- 1.4 Interaction within, between & among populations
- 1.5 Population Ecology, Population characteristics, Models of population growth and Interactions

### **Unit 2:- Environmental pollutions and its remedies (credit-0.8)**

- 2.1 Diversity of metabolic processes among bacteria
- 2.2 Overview: Biodegradation of Hydrocarbon & Xenobiotics
- 2.3 Biodegradation of DDT, Nitrobenzene
- 2.4 An overview of process of Bioremediation & Biomagnification
- 2.5 Conventional Air Pollutants & Acid rain & Acid mine drainage

### **Unit 3:- Microbial Application in Environment (credit-0.8)**

- 3.1 Physical, Chemical & Biological properties of water and waste-water
- 3.2 Primary, Secondary and Tertiary treatment processes
- 3.3 Treatment of solid wastes (Anaerobic digestion and composting)
- 3.4 Biofertilizers and Biocontrol
- 3.5 Bioleaching and Bioplastics

### **Unit 4: Basics and concepts of Biostatistics (Credit - 0.8)**

- 4.1 Scope and applications of Biostatistics
- 4.2 Samples and population concept, Collection, Processing and Presentation of data
- 4.3 Frequency distribution
- 4.4 Measures of Central tendency- Arithmetic, Harmonic and Geometric Mean, Mode and Median, their applications, merits and demerits
- 4.5 Measures of dispersion- Range, Variance, Standard Deviation, Coefficient of Variance, their applications, merits and demerits

### **Unit – 5: Statistical tests in Biology (Credit - 0.8)**

- 5.1 Inferential statistics
- 5.2 Student's t-test: Paired and Unpaired
- 5.3 Analysis of Variance
- 5.4 Regression and Correlation analysis
- 5.5 Chi-square test

### **LIST OF PRACTICALS**

- Exp. 1. Physical parameters of waste water (Color, Turbidity, Odor, pH, TS, TDS and TSS Estimation)
- Exp. 2.  $\text{NH}_4\text{-N}$  Estimation
- Exp. 3.  $\text{NO}_2\text{-N}$  Estimation and  $\text{NO}_3\text{-N}$  Estimation

- Exp. 4. Chloride Estimation
- Exp. 5. Ca-Mg Hardness
- Exp. 6. Phosphorus Phosphate Estimation
- Exp. 7. Dissolved oxygen (DO)
- Exp. 8. Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)
- Exp. 9. Bacteriological analysis by MPN technique
- Exp. 10. Biostatistics examples:
  - a. Calculation of Mean, Standard Deviation and Coefficient of Variance
  - b. Frequency distribution graphs and curves
  - c. Value of confidence limit for the population mean
  - d. Significant test: Student's t-test for paired and unpaired data
  - e. Chi-square test
  - f. Analysis of variance (ANOVA) - Randomized Block Design (RBD)
  - g. Regression coefficient and Correlation coefficient
- Exp. 11. One day Field visit

#### **LIST OF INSTRUMENTS**

1. pH Meter
2. Hot Air Oven
3. Weigh Balance
4. Water Bath
5. Refrigerator
6. Incubator
7. BOD Incubator
8. Autoclave
9. UV Spectrophotometer and Colorimeter
10. COD Apparatus
11. Incubator
12. Stirrer
13. Vortex

## LIST OF REFERENCES

1. Jerrold H Zar, Biostatistical analysis, 4th Edition, Pearson Education
2. P.S.S.Sundar Rao, An Introduction to Biostatistics, Eastern Economy Edition.
3. N.Gurumani, An Introduction to Biostatistics, 2nd Edition, MJP Publisher.
4. Saras Publication, Biostatistics applications
5. Wayne W. Daniel, Biostatistics: a foundation for analysis in the health sciences. Wiley & Sons
6. Manoj Tiwari & Kapil Khulbe, Environmental studies, IK International
7. Bimal Bhattacharya & Rintu Banerjee, Environmental Biotechnology, Oxford Pub.
8. H.R. Singh, Environmental Biology, S. Chand Pub.
9. P.D. Sharma, Environmental Microbiology, Narosa Pub.
10. Nuzhat Ahmed, Industrial And Environmental Biotechnology, Horizon press
11. S.K. Agrawal, Advanced Environmental Biotechnology, APH pub.
12. Gareth M. Evans & Judith C. Furlong, Environmental Biotechnology, Wiley pub.
13. K. Omasa, Pollution & Plant Biotechnology, Springer Int Edn
14. Indu Shekhar Thakur, Environmental Biotechnology, IK International
15. William P. Cunningham, Environmental Science, McGraw Hill
16. Pradipta Kumar Mohapatra, Textbook of Environmental Biotechnology, IK Int.
17. A. Mackenzie, Instant notes in Ecology, Viva books Pvt Ltd
18. Rajvaidhya, Environmental Biochemistry, APH Pub
19. Ahmed, Industrial & Envi. Biotech, Horizon
20. Bitton, Wastewater Microbiology - 2 ed, Wiley
21. Purohit Shammi, Environmental Sciences, Student Edi
22. Eugene Odum, Ecology, Oxford
23. Gerba & Pepler, Environment microbiology
24. Hammer. Water and Wastewater technology. Prentice-Hall.
25. APHA. Water and Wastewater analysis.
26. Scragg, A. H. 1999. Environ. Biotechnology. Longman.
27. Rittman & Mc Carthy. Environ. Biotechnology. Principles & application. McGraw-Hill.
28. N.P. Cheremisinoff. 1999. Biotechnology for waste and wastewater treatment. Noyes Pub.
29. Michael Heal. (Ed). Environ monitoring & biodiagnostics of hazardous Contaminants.
30. Milton, Wainwright. 1999. An Introduction to Environ. Biotechnology. Kluwer Academy.

**P.S. The above reference book list are common for all the unit**