

Rayat Shikshan Sanstha's  
Yashavantrao Chavan Institute of Science, Satara  
Syllabus for Bachelor of Science Part I

1. Title: **B.Sc. Biotechnology (Entire)**

2. Year of Implementation: 2018-19

3. Preamble: Shivaji University, Kolhapur

4. General Objectives:

- Reconstruction and redesigning of the courses to suite local needs.
- More emphasis on applied aspects of biotechnology
- To develop aptitude of students in the field of research.
- Enrichment of basic knowledge in areas of Biotechnology

5. Duration: One Year

6. Pattern: Semester wise

7. Medium of Instruction: English

8. Structure of Course:

a. Semester I :

Theory: 09 Papers

Practical's: 04 Papers

b. Semester I :

Theory: 09 Papers

Practical's: 04 Paper

9. Structure of Course:

<b>Rayat Shikshan Sanstha's</b>								
<b>YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA</b>								
<b>COURSE STRUCTURE UNDER AUTONOMY</b>								
<b>B. Sc. BIOTECHNOLOGY (ENTIRE)</b>								
<b>B. Sc. I SEMESTER– I (Duration – 6 Months)</b>								
<b>Sr. No.</b>	<b>SUBJECT CODE</b>	<b>TEACHING SCHEME</b>						
		<b>Theory</b>			<b>Practical</b>			
		<b>No. of lectures</b>	<b>Hours</b>	<b>Credits</b>	<b>Subject</b>	<b>No. of lectures</b>	<b>Hours</b>	<b>Credits</b>
1	BBTE--101 T	3	2.4	2	BBTE--110 P:	4	3.2	2
2	BBTE--102 T	3	2.4	2				
3	BBTE--103 T	3	2.4	2	BBTE--111 P:	4	3.2	2
4	BBTE--104 T	3	2.4	2				
5	BBTE--105 T	3	2.4	2	BBTE--112 P:	4	3.2	2
6	BBTE--106 T	3	2.4	2				
7	BBTE--107 T	3	2.4	2	BBTE--113 P:	4	3.2	2
8	BBTE--108 T	3	2.4	2				
9	BBTE-AECC-1 T	3	2.4	2				
<b>Total of SEM I</b>		<b>27</b>	<b>21.6</b>	<b>18</b>		<b>16</b>	<b>12.8</b>	<b>8</b>
<b>TOTAL NO OF CREDITS FOR SEMESTER I: 26</b>								

<b>Rayat Shikshan Sanstha's</b>								
<b>YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE ,SATARA</b>								
<b>COURSE STRUCTURE UNDER AUTONOMY</b>								
<b>B. Sc. BIOTECHNOLOGY (ENTIRE)</b>								
<b>B. Sc. I SEMESTER– II (Duration – 6 Months)</b>								
<b>Sr. No.</b>	<b>SUBJECT CODE</b>	<b>TEACHING SCHEME</b>						
		<b>Theory</b>			<b>Practical</b>			
		<b>No. of lectures</b>	<b>Hours</b>	<b>Credits</b>	<b>Subject</b>	<b>No. of lectures</b>	<b>Hours</b>	<b>Credits</b>
1	BBTE--201 T	3	2.4	2	BBTE--210 P:	4	3.2	2
2	BBTE--202 T	3	2.4	2				
3	BBTE-- 203 T	3	2.4	2				
4	BBTE-- 204 T	3	2.4	2	BBTE--211 P:	4	3.2	2
5	BBTE-- 205 T	3	2.4	2				
6	BBTE-- 206 T	3	2.4	2	BBTE--212 P:	4	3.2	2
7	BBTE-- 207 T	3	2.4	2				
8	BBTE-- 208 T	3	2.4	2	BBTE--213 P:	4	3.2	2
9	BBTE-AECC 2 T	3	2.4	2				
	<b>Total of SEM II</b>	<b>27</b>	<b>21.6</b>	<b>18</b>		<b>16</b>	<b>12.8</b>	<b>8</b>
<b>TOTAL NO OF CREDITS FOR SEMESTER II: 26</b>								
<b>TOTAL NO OF CREDITS FOR SEMESTER I + II: 52</b>								

• Student contact hours per week : 34 Hours (Min.)	• Total Marks for B.Sc.-I (Including English) : 1100
• Theory lectures and practical : 48 Minutes Each	• Total Credits for B.Sc.-I (Semester I & II) : 52
• <b>AECC1</b> - Ability Enhancement Compulsory Course (BTE-AECC-1 and BTE-AECC-2)- English	
• <b>BBTE</b> : B.Sc. Biotechnology (Entire) for Semester I BBTE--101 to BBTE-113 and for semester II BBTE-201 to BBTE-213)	
• Course list as per enclosed Annexure. <i>Separate passing is mandatory for Theory, Internal and Practical.</i>	
• Practical Examination will be conducted at semester end for 50 Marks per subject.	

Other Feature:

A) Library:

Reference and Textbooks, Journals and Periodicals

B) Specific Equipment's:

Computer, LCD Projector, Visualizer, Smart Board

C) Laboratory Equipment's:

<b>Sr No.</b>	<b>Name of Instrument</b>
1	Atomic Absorption Spectrometer
2	Autoclave Vertical
3	Bacteriological Incubator
4	Binocular Research Microscope CX 21i
5	BOD Incubator
6	Centrifuge Remi R-4C
9	COD refluxing unit
10	Colorimeter
11	Combined pH and Conductivity Meter
12	Compound Microscope
13	Conductivity Meter
14	Deep freezer
16	Dissection microscope
17	Distillation assembly
18	Flame Photometer
19	Hemocytometer
24	Horizontal Electrophoresis unit
25	Horizontal Laminar Airflow
26	Hot Plate
27	Lux Meter
29	Microcentrifuge
30	Microscope camera device
31	Microwave Oven
32	MiniCentrifuge Remi
33	Mixer
34	pH Meter
35	Refractometer
38	Refrigerator
39	Rotary Shaker

40	Sonicator Waterbath
42	Spectrophotometer UV-Vis
43	Stabilizer
44	Thermal Cycler
45	Ultra microtome
46	UV transilluminator
47	Vacuum pump
48	Variable type power pack
49	Vertical Electrophoresis Unit
51	Visible Spectrophotometer
52	Water bath
53	Weighing balance

## SEMESTER I

<b>Subject Code</b>	<b>Title of Paper</b>
BBTE-101 T	Chemistry-I
BBTE-102 T	Biomolecules
BBTE-103 T	Plant Science
BBTE-104 T	Physics-I
BBTE-105 T	Biotechniques and Instrumentation-I
BBTE-106 T	Basics in Microbiology I
BBTE-107 T	Introduction to Biotechnology
BBTE-108 T	Computer Basics and Bioinformatics
BBTE-109 T	English for communication I
BBTE-110 P	Laboratory Exercise in Chemistry and Biochemistry-I
BBTE-111 P	Laboratory Exercise in Plant Science
BBTE-112 P	Laboratory Exercise in Microbiology and Instrumentation
BBTE-113 P	Laboratory Exercise in Mathematics and Computer Basics

## BBTE- 101 T: Chemistry- I

### Lecture: 36

#### Objectives :-

**Total credits: 02**

- To make students aware of fundamentals of Chemistry.
- To understand concepts of thermodynamics in life science.
- To study use and applications of chemistry in biological science.

#### UNIT I

**(09)**

##### Electrochemistry

Introduction- Conductance- Definition and types, Kohlrausch law- Statement and its applications, Galvanic cells, half-cell potentials, emf.- meaning and definition, Thermodynamics of electrode potentials, Nernst equation and its derivation, K from cell emf, Types of electrodes, construction and working of calomel and glass electrodes.

##### Reaction Kinetics

Introduction-Meaning and definitions of- rate constant, order and molecularity of reaction, activation energy, Integrated rate expressions for zero, 1st and 2nd order reactions, Characteristics of 1st order reactions, Catalysis- Definition, types of catalysis with example, characteristics of catalysis, Elementary enzyme catalyzed reactions- Meaning and examples.

#### UNIT II

**(09)**

##### Thermodynamics

Introduction- Reversible and irreversible processes, internal energy, Enthalpy, heat of reaction and its types,

First Law- Statement and mathematical expression, Hess law, Measurement of  $\Delta H$ , Trouton's rule, Kirchoff's equation., Second law- Statement, concept of entropy (Criteria for spontaneous and non-spontaneous processes), Third law- Absolute entropies and their uses.

Gibbs and Helmholtz free energy functions-Criteria for thermodynamic equilibrium and spontaneity,  $\Delta G$  and K,  $\Delta G$  and work function, Relation between  $\Delta H$  and  $\Delta G$  (Gibbs-Helmholtz equation).

#### UNIT III

**(09)**

##### Structure and Bonding.

Introduction- types of bonds. Ionic covalent bond, Co-ordinate bond, Metallic bond, hydrogen bond, Vanderwaal's forces. formation of ionic and covalent bond with examples, e.g. NaCl, KCl, HCl, CH<sub>4</sub>, Cl<sub>2</sub>, H<sub>2</sub>.

VBT- Postulates, Concept of Hybridization, sp, sp<sup>2</sup>, sp<sup>3</sup> hybridization with respect to BeCl<sub>2</sub>. BF<sub>3</sub>, SiCl<sub>4</sub> (Along with consequences with respect to bond length, bond angle, bond energy and shape



of the molecule. Dipole moment- Definition and significance, Hydrogen bonding- Definition, intra and intermolecular hydrogen bonding with suitable example (Proteins, alcohols, Hydroxy acids, Zhenols). Ionic solids- Definition and general characteristics, comparison between ionic and covalent compounds

## UNIT IV

(09)

### Coordination Complexes

Definition and formation of Co-ordinate bond in  $\text{BF}_3 \leftarrow \text{NH}_3$  &  $\text{NH}_4^+$ , Distinction between double salt and complex salt, Description of terms Ligand, Co-ordination number (CN), Coordination sphere, Essential and trace elements in biological process, Metallo porphyrins w.r.t. Hemoglobin and Myoglobin.

### Optical behaviour of Materials

Metals, Insulators and Semiconductors, band theory, band structure of metals, insulators & semiconductors, Intrinsic and extrinsic semiconductors, doping of semiconductors and conduction mechanism

### Learning Outcomes:

- Student is expected to understand basics of chemical science
- Student should gain an insight in the fascinating topics like thermodynamics, electrochemistry and structure and bindings.

### References-

1. University general chemistry - C. N. R. Rao, Macmillan.
2. Physical chemistry - R. A. Alberty, Wiley Eastern Ltd.
3. Quantum chemistry including molecular spectroscopy- B. K. Sen.
4. Organic chemistry - D. J. Cram and G. S. Hammond (Mcgraw-Hill).
5. A Guide-book to mechanism of organic chemistry-Peter Sykes-6th Edition.
6. Theoretical principles of inorganic chemistry- G.S. Manku
7. Physical chemistry by Sharma and Puri
8. Instrumental methods of chemical analysis- Chatwal & Anand
9. Instrumental methods of chemical analysis- B. K. Sharma
10. Organic chemistry VOL-II 5th Edition- I. L. Finar
11. An introduction to electrochemistry- Samuel Glasstone
12. The elements of physical chemistry – P.W. Atkins.
13. Essential of physical chemistry- B .S. Bahel. & G. D.Tuli.
14. Principels of physical chemistry – S.H Maron & Pruton
15. Concisein inorganic chemistry
16. Organic chemistry – Morrison & Boyd

## BBTE-102 T: Biomolecules

Lectures: 36

Total credits: 02

### OBJECTIVES

- To make students aware of fundamentals of Biochemistry.
- To make the student aware of basics of chemical science in relevance to biological systems.

### UNIT I

(09)

#### Origin of life :

Basic concept, A.I. Oparin concept, Urey Miller's experiment, Concept of Biomolecules- in general about Carbohydrate, protein, lipid just definition with at least one example. pH, pk value definition, H-H Equation, Biological buffer systems- e.g. Phosphate, Bicarbonate, Hemoglobin buffer system, Protein buffer system

### UNIT II

(09)

#### Nucleic Acids:

Structure and functions of Nucleic acids, purines & pyrimidines, Nucleosides & Nucleotides, Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and denaturation of DNA, RNA and its Types (rRNA, tRNA, mRNA, hnRNA, snRNA, snoRNA).

### UNIT III

(09)

#### Carbohydrates:

Structure, Function, Classification, Characteristic Reactions, Physical and Chemical Properties, D & L Glyceraldehydes, structure of Monosaccharide, Disaccharides, and Polysaccharides. Isomers of Monosaccharides, Chemical/Physical Properties of Carbohydrate, Chemical Reactions for Detection of Mono., Di and Polysaccharides, Biological importance of carbohydrates.

### UNIT IV

(09)

#### Lipids:

Classification of Lipids, Properties of Saturated, Unsaturated Fatty Acids, Rancidity, and Hydrogenation of Oils

Phospholipids: Lecithin Cephalin, Plasmalogen Triacylglycerol-Structure and Function

Sterols: Cholesterol: Structure and Function , Lipoproteins: Structure and Function, Storage Lipids, Structural Lipids, Action of Phospholipases, Steroids

### **Learning Outcome:**

Student should understand:

- Basic concepts and experiments about origin of life,
- Concept of buffer and its importance in biological system,
- Fundamentals of biochemistry i.e. Nucleic acid, carbohydrates and lipids,
- Structure, function, properties and types of nucleic acids,
- Classification, structure and function of carbohydrates
- Classification, structure and function of lipids
- Basics of chemical science in relevance to biological systems

### **References:**

1. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 5th Edition, WH Freeman and Company, New York, USA. (Unit I,II)
2. U. Satyanarayanan, Biochemistry: Uppala Author Publisher Interlinks, 3<sup>rd</sup> Ed.(Unit III,IV)
3. Trevor Palmer, Enzymes –Woodhead Publishing
4. J. L. Jain, Fundamentals of Biochemistry, S. Chand Pub. (Unit I, III, IV)
5. Voet & Voet , Fundamentals of Biochemistry, 5<sup>th</sup> Ed. John Wiley and Sons Inc, New York, USA (Unit: I, II, III, IV)

## BBTE--103 T: Plant Science

No of Lectures: 36

Total credits: 02

### Objectives :

- To understand general classification of plant kingdom.
- To understand morphology and anatomy of plants.
- To study basic knowledge of angiosperm and its reproduction.
- To study the basic knowledge of plant cloning.
- To study the overall general ideas of plant world

### UNIT I

08

#### Plant Diversity

Outline of General Classification of Plant Kingdom. General characters and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms.

### UNIT II

08

#### Taxonomy of Angiosperms

Taxonomy :- Definition, Aims, objectives and functions, Binomial nomenclature and its significance, Principles of ICBN, Study of outline of Bentham and Hooker's system of Classification of plants.

### UNIT III

10

#### Sexual Reproduction in Angiosperms:-

Structure of Typical Flower – Floral whorls and functions:-Calyx, corolla, Androecium, Gynoecium., Pollination- Definition, Types –Self and Cross, Advantages of Self and Cross Pollination, Development of male and female gametophyte, Fertilization:- Definition, Double fertilization and its significance, Parthenocarp- Definition and significance. Cloning of plants:- Bulbs, corms, tubers, Bulblets and Rhizomes, Runners, Cuttings, Layering, Grafting and mericloning.

### UNIT IV

10

#### Seed and Plant Anatomy

Seed –Definition, Formation, structure of Monocot and Dicot seed, Dormancy of seed-, Causes and Breaking of seed dormancy., Seed germination- Concept, Types-Epigeal and Hypogeal, factors affecting seed germination.

Plant Anatomy Tissues- Simple and complex (Xylem and Phloem)

### **Learning outcome:-**

#### **Students should be able to understand:**

- The general classification system of plant kingdom.
- The terminology used in Morphology and Anatomy.
- Diversity in plant kingdom and need of classification.
- The Basic knowledge of Angiosperms .
- The basic and advanced knowledge of plant cloning.

#### **References:**

1. Dube H.C. Text of fungi, bacteria and viruses.( Unit I)
2. Bold H.C. The Plant kingdom, Prentice - Hall India.( Unit I)
3. Chopra G.L. i. Class book of algae, ii. Class book of fungi.( Unit I)
4. Vasishtha P.C. Botany for degree students-Gymnosperms.( Unit I)
5. Mukherji H. Plant groups (New central book depot) .( Unit I)
6. Dutta A.C. A Class book of botany, Oxford University Press.( Unit II)
7. Naik V.N. Taxonomy of angiosperms.( Unit II & Unit III)
8. Chopra G.L. Angiosperms (Systematic and life cycle) .( Unit III)
9. Shivarajan V.V. Introduction to principles of taxonomy. .( Unit II)
10. Pandey B.P. Text book of angiosperms .( Unit III)
11. Devlin R.M. Fundamentals of plant physiology (MacMillan) ( Unit III & Unit IV)
12. Malik C.P. Plant physiology, Kalyani publishers( Unit III & Unit IV)
13. Eames A.J. and An introduction of plant anatomy, Mac Daniels L.H..( Unit IV)
14. Esau K. Anatomy of seed plants..( Unit IV)
15. Esau K. Plant anatomy..( Unit IV)
16. Fahn A. Plant anatomy..( Unit IV)

## BBTE--104 T: Physics-I

Lectures: 36

Total credits: 02

- To understand concepts of Physics
- To learn applicability of physics in biology

### UNIT I

#### Elasticity:

9

Introduction, definitions of stress and strain in solids, types of strain and stress, Hooks law, Young's modulus (Y), bulk modulus (K) and modulus of rigidity, relation between Y, and K (with derivation), stress strain curve, importance of elasticity . Bending of beam, Bending moment, Cantilever (without considering weight of cantilever), Torsional oscillation.

### UNIT II

10

#### Viscosity and Surface Tension

Introduction, streamline and turbulent flows, concept of viscosity, Viscous fluids ,coefficient of viscosity, effect of temperature and pressure on viscosity of liquids, concept of pressure energy and Bernoulli's theorem , Application of Bernoulli's , surface energy, capillary action, angle of contact, wettability, relation between surface tension, , Flow of liquid through capillary tube, Poiseuille's equation, factors affecting surface tension, methods of measurement of surface tension- Jaegers method (formula and working only), applications of surface tension.

### UNIT III

10

#### Sound waves:

Introduction, Types of waves, Differential equation of progressive wave, principle of superposition of waves (Statement only), phenomenon of beats and expression for frequency of beats, application of beats, audible, ultrasonic and infrasonic waves, properties of ultrasonic waves and their applications, Doppler effect and its applications

### UNIT IV

07

#### Thermodynamics and Thermometry:

Introduction, various temperature scales (Kelvin, Celsius, Fahrenheit, Reaumer and Rankin), thermal energy, platinum resistance thermometer-principle, construction and working,

#### Expected Outcomes:

1. Student should be able to understand basic concepts of physics like elasticity, sound waves, thermodynamics.

**References:**

1. Physics by Devid Hallday Roberet Resnik, (Vol-I and Vol-II) Wiley Eastern limited (Unit I, II)
2. Fundamental of mechanics, S. K. Saxena, Himalaya Publications (Unit I, II, III, IV)
3. Perspectives of modern physics, Aurthur Beiser, McGrawHill Publication
4. Heat and thermodynamics, Zemansky, McGrawHill Publication
5. Fundamentals of optics, Jenkins white, McGrawHill Publication
6. Text book of optics, N. Subrahmanyam Brijlal, S. Chand and Company Limited
7. Optics by Ajoy Ghatak, Tata McGrawHill Publication
8. Properties of matter, D. S. Mathur, Sha, alal Charetible trust
9. Solar energy, Suhas Sukatme, Tata McGrawHill Publication
10. Principle of electronics, V. K. Mehta, S. Chand and Company Limited
11. Digital principles and application, Malvino and Leach, Tata McGrawHill Publication
12. Elements of spectroscopy, Gupta, Kumar, Sharma, Pragati Prakashan
13. Introduction to atomic spectra, H. E. White, McGrawHill Publicatio
14. Biophysics, Vastala Piramal, Dominent Publishers and Distributor

## BBTE- 105T: Biotechniques and Instrumentation-I

Total no of credit: 02

### Objective:

- To study working and instrumentation of instruments.
- To learn applicability of instruments in biology
- To understand concepts of bioinstrumentation
- To study use and applications of biophysics.

### Unit I: (09)

#### Chromatography:

Introduction, Theory, Principle and applications of Thin layer chromatography, Paper chromatography, Column chromatography, Adsorption column chromatography, Size exclusion chromatography, Ion exchange chromatography, Affinity chromatography, HPLC, GLC

### Unit II: (08)

#### Electrophoresis:

Introduction, Principle, theory and applications of paper electrophoresis, Agarose gel Electrophoresis, SDS PAGE, Pulse field electrophoresis, 2D PAGE.

### Unit III: (09)

#### Centrifugation:

Basic principles, RCF, Sedimentation coefficient, Svedberg's constant, Types of centrifuge: High speed and Ultracentrifuge, Differential and density gradient centrifugation, application of preparative & analytical centrifuges, gradient centrifuge.

### Unit IV: (10)

#### Microscopy:

General principles of microscopy- Image formation, magnification, numerical aperture (Uses of oil immersion objective), resolving power of microscope and working distance.

Ray diagram, special features, applications and comparative study of compound microscope and Electron Microscope (Scanning and Transmission Electron Microscope), Dark field and bright microscope, Phase contrast microscope.

### Expected Outcome:

- Student should be able to understand basic concepts of Instruments and its Application
- To be able to apply this knowledge in the laboratory
- Student should be able to handle instruments during project.
- Student should understand principle behind the instruments



**References:**

1. Biophysical Chemistry by Nath and Upadhya. (Unit I,II,III,IV)
2. Practical biochemistry principles and techniques by Wilson and Walker. (Unit I,II,III,IV)
3. Chromatography: Concepts and Contrasts- 1988 James Miller, John Wiley and Sons, Inc. (Unit I)
4. Bioinstrumentation :VeeraKumari. ( Unit I, IV)

## BBTE 106T: Basics in Microbiology I

Lectures -36

Credit -02

### Objectives:

- General bacteriology and microbial techniques
- Define the science of microbiology and describe some of the general methods used in the study of microorganisms
- Discuss the historical concept of spontaneous generation and the experiments that were performed to disprove this erroneous idea
- Discuss how Koch's postulates are used to establish the causal link between a suspected microorganism and a disease
- Describe some of the various activities of microorganisms that are beneficial to humans
- Describe prokaryotic and eukaryotic morphology, the two types of cellular anatomy, and also the distribution of microorganisms among the various kingdoms or domains in which living organisms are categorized
- Discuss the importance of the field of microbiology to other areas of biology and to general human welfare
- Principles of physical and chemical methods used in the control of microorganisms and apply this understanding to the prevention and control of infectious diseases.
- Appropriate laboratory and techniques to the isolation, staining, identification and control of microorganisms.

### UNIT I

(09)

Microbiology: Definition, History, Discovery of microscope (Anton von Leeuwenhoek and Robert Hooke), Contributions of various Scientists (Aristotle, Francesco Redi, Louis Pasteur, Tyndall) Introduction to types of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses, Morphology of Bacteria – i) Size, ii) Shape, iii) Arrangements

Cytology of Bacteria, Structure and functions of :i) Cell wall ii) Cell membrane iii) Capsule and slime layer iv) Flagella v) Pilli vi) Nuclear material vii) Mesosome viii) Ribosome, Cell inclusions ( PHB granules, metachromatic granules and glycogen bodies)

Viruses- General characteristics and lytic cycle of T4 bacteriophage

### UNIT II

(09)

#### **Bacterial taxonomy:**

General principles of bacterial nomenclature.-Taxonomic ranks, Common or Vernacular name, Scientific or International name, Criteria for bacterial classification- Morphological, cultural, biochemical & serological characters.

**Microbial nutrition** :Nutritional requirements of microorganisms : Water; Micronutrients; Macronutrients; Carbon, Energy source; Oxygen and Hydrogen; Nitrogen, Sulphur and Phosphorous and growth factors auxotroph, prototroph and fastidious organisms., Nutritional types of microorganism based on carbon and energy sources (Autotrophs Heterotrophs, Phototrophs, Chemotrophs, Photoautotrophs, Chemoautotrophs, Photoheterotrophs, Chemoheterotrophs)

### UNIT III

(09)

#### **Concept of Sterilization:-**

**Definitions of:** Sterilization, Disinfection, Antiseptic, Germicide, Microbiostasis, Asepsis, Sanitization.

**Methods of sterilization by Physical agents:** (i) temperature-dry heat, moist heat ii) Radiation-U.V, Gamma radiation iii) Bacteria proof filter- membrane filter) **Chemical agents** (Phenol & Phenolic compounds, Alcohol, Heavy metals e.g. mercury), **Gaseous agents-** Ethylene oxide, formaldehyde. Checking of Efficiency of Sterilization – Biological and Chemical Indicators

### UNIT IV

(09)

#### **Staining Techniques:**

Definitions: dye and stain (Basic and Acidic ),Fixative ,Mordant, Decoloriser, Accentuator  
Classification of stains – Acidic, Basic and Neutral, Principles, Procedure, Mechanism and application of staining procedures- Monochrome staining and Negative staining, Differential staining - Gram staining and Acid fast staining, Special staining techniques – Spore ,Capsule, Cell wall staining

#### **Learning Outcomes:**

**After completing the credits students should gain knowledge about:**

- Milestones in Microbiology,
- Cytology of Prokaryotic and Eukaryotic Cell structure and function, and the differences between these cells
- Characteristics of viruses and lytic cycle
- Class of microorganisms according to Microbial nutrition
- Nutritional requirement of micro organism
- Basic components of Nutrient medium and their role
- Basic terms in sterilization
- Principles of sterilization
- Various agents of sterilization
- Basic terms in staining
- The Principles and procedures of staining microorganisms

#### **References:**

1. Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5<sup>th</sup> Edition.Macmillan Press Ltd.(Unit I)
2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3<sup>rd</sup> Edition.Thomson Brooks / Cole.(Unit I,II III)
3. Fundamentals of microbiology-Frobisher.( Unit I,II,III and IV)
4. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata MacGraw Hill Press.( Unit I,II,III and IV)
5. General microbiology –Pawar & Daginawala (Unit I)
6. Text book of microbiology-Ananthanarayan (Unit I,II,III,IV)
7. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 6th Edition. MacGraw HillCompanies Inc.( Unit I,II,III and IV)

## BBTE--107 T: Introduction to Biotechnology

Lectures -36

Credit -02

### Objectives:

- To make students aware of Biotechnology
- To introduce different areas in Biotechnology

### UNIT I

09

**About Biotechnology:** Introduction, Milestones in the History of Biotechnology, Traditional and Modern Biotechnology, Branches of Biotechnology, commercial potential of biotechnology, Biotechnology in India, Renowned Biotechnology institutes in India (IIT, IISER, NCL, NCCS, ARI, NIV, CCMB, CDFD etc.)

### UNIT II

09

**Biotechnology and Healthcare:** Disease diagnosis, detection of genetic diseases, disease treatment, stem cell technology

### UNIT III

09

**Agricultural Biotechnology:** Introduction, Plant Tissue culture, genetically modified crops, GMOs in Agriculture, Plant Based Vaccines

### UNIT IV

09

**Food Biotechnology:** Biotechnological applications in enhancement of Food Quality, Food Products, Microbial role in food products Yeast, Bacterial and other Microorganisms based process and products Modern Biotechnological Regulatory Aspects in Food Industries Biotechnology and Food - Social Appraisal

### Learning Outcomes:

Students should be able to understand

- What is biotechnology?
- About the biotechnology institute in India
- Different areas in biotechnology

### References:

1. Biotechnology by B. D. Singh. Edition, 4<sup>th</sup> Publisher, Kalyani Publishers, 2010.
2. Biotechnology by Mohan P Arora, Himalaya Publisher.
3. A text book in Biotechnology, R.C Dubey, S.Chand and Co. Pvt. Ltd.

## BBTE--108 T: Computer Basics

36 Lectures

Total Credit 2

### Unit- I

09

Computer basics

Introduction to Computer -Evaluation of computer and its generations, Classification of Computer, Computer Software's ( System and Application), Software's used in biotechnology. Block Dig.(I/O/Secondary storage), printer and its types, Control Panel, memory classification

### Unit-II

09

Number System- Operating system's introduction (Installation and un installation), Number system and its conversions, Boolean Algebra and its laws, Computer Codes and combinational circuits

### Unit-III

09

Operating System: Definition, functions, multiprogramming, multitasking, multiprocessing, time sharing, some popular O.S.(Windows-X/XP)and its installation, Ms-DOS(Commands) , Comparative study of Windows and Linux o.s. Secondary storage devices and its installation, Software installation (Antivirus, Microsoft office, Drivers, Browser ).

### Unit-IV

09

Computer Languages- Introduction to Microcontrollers , Algorithms and flowchart, Computer Languages( High , Middle and Low level languages), Introduction to Internet, its History and applications.

### Reference Books:

1. Digital Electronics circuits and systems by V.K. Puri, TMH- Unit-I ,II
2. Computer Fundamentals by P.K. Sinha ( Unit-I ,II,III,IV)

## BBTE 110- P: Techniques in Chemistry and Biochemistry

### Chemistry

1. Determination of dissociation constant of a weak acid and study of effect of substituent on dissociation constant of weak acid (01)
2. Verification of Beer-Lambert's Law using copper ammonia complex (01)
3. Acid catalyzed hydrolysis of methyl acetate (01)
4. Inorganic preparations: Ferrous ammonium sulphate, Tetrammine copper sulphate (02)
5. Determination of pH of fruit juice and soil sample. (01)
6. Organic Preparations, 1. Phthalimide 2. Methyl salicylate (02)

### Biochemistry

7. Preparation of buffers (Phosphate buffer, acetate buffer) and determination of pH with pH meter (01)
8. Protein estimation (Lowery method) (01)
9. Isolation and characterization of casein from milk (01)
10. Estimation of amino acid by Ninhydrin method (01)
11. General test for carbohydrates and detection of unknown Carbohydrate from mixture (Glucose, fructose, maltose, sucrose, xylose and starch) (01)

### Learning outcome:

- At the end of this module, student is expected to know simple applied chemistry and Biochemistry techniques for detection of common yet important analytes.
- Models should bring clarity in concepts of conformations of biomolecules.
- Standardization and calibration of pH meter.

### Reference:-

1. Chemistry Text book of practical organic chemistry (4th Edition, Longman) – A .I. Vogel.
2. Organic Chemistry – Morrison & Boyd
3. Practical Biochemistry - J. Jayaraman
4. Practical Biochemistry - David Plummer

## BBTE 111- P: Laboratory Exercises in Plant Science

**Total Credits: 02**

1. Study of algae ( <i>Nostoc</i> , <i>Sargassum</i> )	(01)
2. Study of bryophyte ( <i>Riccia</i> / <i>Anthoceros</i> )	(01)
3. Study of Pteridophyte ( <i>Selaginella</i> )	(01)
4. Study of gymnosperms ( <i>Pinus</i> )	(01)
5. Study of Angiosperms (Sunflower, Maize)	(01)
6. Plant anatomy – Dicot and monocot root, stem, leaf	(02)
7. Study of apical meristem (Stem and root)	(01)
8. Study of typical flower	(01)
9. Study of plant using Bulbs, runners and cutting	(01)
10. Study of plant grafting	(01)
11. Study of morphology and anatomy of seed (Monocot & dicot)	(01)
12. Breaking of seed dormancy	(01)
13. Detection of seed viability	(01)
14. Study tour	(01)

### **Expected outcomes:-**

#### **Students should be able to acquaint:-**

- The Identification and classification of various plant material
- Use and handle the microscopy for basic and advanced research in applied Biosciences.
- The basic and advanced knowledge of branches of plant science.
- Basic knowledge of plant Anatomy and Physiology.
- Basic knowledge of plant germination and seed

### **References:**

1. Vikas Handbook of Botany
2. Mathur R.C. Systematic Botany
3. Kaufman P.B. Practical Botany.

## BBTE--112 P-: Laboratory Exercises in Microbiology and Instrumentation

**Total Credits: 02**

### Microbiology

1. Microscopic examination of bacteria by,
  - a. Monochrome staining (01)
  - b. Gram staining (01)
  - c. Negative staining (01)
  - d. Cell wall staining. (01)
2. Preparation of bacteriological culture media (Peptone water, Nutrient broth, Nutrient agar, Mac Conkey's agar). (01)
3. Preparation of culture media for fungi (Sabouraud's agar, PDA) (01)
4. Observation of motility by hanging drop technique (01)

### Instrumentation

1. Use, care and study of compound microscopy. (01)
2. Separation of amino acid by Paper Electrophoresis (01)
3. Estimation of Na, K, and Ca in water /soil sample by using flame photometer (01)
4. Demonstration (Principle, working, construction) of pH meter & Conductivity meter. (01)
5. Demonstration (Principle, working, construction) of Autoclave & Centrifuge (01)
6. Demonstration (Principle, working, construction) of Hot air oven & Incubator (01)

### References:

1. Laboratory manual of microbiology and biotechnology by K.R.Aneja
2. Microbiology : Laboratory theory and Application by Michael J. Leboffe and E.Pierce
3. Laboratory Experiments in microbiology by Ted R. Johnson and Christine
4. Practical Microbiology : a laboratory manual by B.Senthil Kumar, Zothansanga, D.Senbagam, N.Senthil Kumar and G. Gurusubramanian.
5. Textbook of biophysical chemistry- Nath upadhyay Nath.
6. Bio-instrumentation – B. Nagamani
7. Bio-instrumentation – Veerakumari
8. Principles and techniques of Biochemistry and Molecular Biology - Wilson and walker.
9. Practical handbook of Biochemistry and Molecular Biology- Gerald D.Fasman



## BBTE- 113 P: Computer applications in Biology

Total Credits: 02

### Computer applications

1. Introduction to computer motherboard and Identifying components 01
2. Convert Decimal to other number systems (Taking 2 examples on each) 01
3. Convert Binary numbers to other number systems (Taking 2 examples on each) 01
4. Convert Octal numbers to other number systems (Taking 2 examples on each) 01
5. Convert Hexadecimal to other number systems (Taking 2 examples on each) 01
6. Installing System and application software. 01
7. Working with anti-virus . 01
8. Understanding control panel settings. 01
9. Working with Internet connectivity. 01
10. Working with Internet connectivity and creating account on any three servers. 01

### Reference:

1. Mathematics for biologists by Sujata Tapare (vision publication).
2. Algebra and geometry by G. V. Khumbojkar.
3. Calculus and differential equation (Phadake prakashan). Prof. L. G. Kulkarni, Dr. P. B. Jadhav

## SEMESTER II

<b>Subject Code</b>	<b>Title of Paper</b>
BBTE-201 T	Chemistry-II
BBTE-202 T	Proteins and Enzymes
BBTE-203 T	Animal Science
BBTE-204 T	Physics-II
BBTE-205 T	Biotechniques and Instrumentation-II
BBTE-206 T	Basics in Microbiology II
BBTE-207 T	Biostatistics
BBTE-208 T	Computer Basics and Bioinformatics
BBTE-209 T	English for communication I
BBTE-210 P	Laboratory Exercise in Chemistry and Biochemistry-I
BBTE-211 P	Laboratory Exercise in Plant Science
BBTE-212 P	Laboratory Exercise in Microbiology and Instrumentation
BBTE-213 P	Laboratory Exercise in Mathematics and Computer Basics

## BBTE 201 T- Chemistry-II

Lectures -36

Credit -02

- To make students aware of fundamentals of advance chemistry.
- To understand concepts of fundamentals and Mechanistic Basis of organic Reaction.
- To study use and applications of chemistry in biological science.

### UNIT I

(11)

#### Fundamentals and Mechanistic Basis of Organic Reaction

Introduction, Reaction mechanism-Definition, curved arrow notation, substrate, Reagents, Types of reagents, types of reactions, Reactive intermediate Carbocation, Carbanion, Carbon Free radicals SN1 and SN2 mechanisms (Hydrolysis of t-butyl halide and primary alkyl halide) with energy profile diagram.

Elimination reactions- E1 and E2 mechanisms (Dehydration of alcohol), Hoffman's and Saytzeff's rules- statements and justifications

Addition reactions- Electrophilic addition reactions in alkenes (Markovnikoff and anti-Markovnikoff additions), nucleophilic addition reactions of carbonyl compounds (cyanohydrin formation). Mechanism of SE reactions in benzene- Nitration, sulphonation, halogenation, diazotization, Friedel-Craft's alkylation and acylation reactions

### UNIT II

(09)

#### Stereochemistry

Geometrical isomerism in alkenes, Optical activity-Plane polarized light (PPL), Polarimeter, specific rotation, Chirality- Chiral molecules, symmetry elements, asymmetric carbon, compounds with one and two chiral centers, diastereomers, enantiomers, tartaric acid E-Z and R-S nomenclatures.

### UNIT III

(10)

#### Radioactivity:

Introduction, properties of alpha, beta and gamma radiation, Neutron proton ratio and nuclear Stability, Process of radioactive decay, Radioactivity detecting techniques: Ionization chamber, Geiger Muller counter, Scintillation counter, chemical effects of nuclear transformation, Biological Applications of Radioisotope.

**Nano materials** General introduction to nanomaterials and emergence of nanotechnology; Nanoscale building blocks; Applications of nanomaterials

### UNIT IV

#### Natural Products

(06)

Terpenoids: isoprene rule, structure determinations of citral. Natural pigments: Carotenoids and their functions in plants, structural details of chlorophyll, Alkanoids: Basic structure, classification with suitable example

**Learning Outcomes:**

- Student is expected to understand basics of chemical science
- Student should gain an insight in the fascinating topics like radioactivity, stereochemistry.

**References-**

1. University General Chemistry - C. N. R. Rao, Macmillan.
2. Physical Chemistry - R. A. Alberty, Wiley Eastern Ltd.
3. Quantum Chemistry Including Molecular Spectroscopy- B. K. Sen.
4. Organic Chemistry - D. J. Cram and G. S. Hammond (Mcgraw-Hill).
5. A Guide-book to Mechanism of Organic Chemistry-Peter Sykes-6th Edition.
6. Theoretical Principles of Inorganic Chemistry- G.S. Manku
7. Physical Chemistry by Sharma and Puri
8. L. E. Smart, E. A. Moore, Solid State Chemistry: An Introduction.
9. T. Pradeep, Nano The Essentials: Understanding Nanoscience and Nanotechnology.
10. J. Schulte, Nanotechnology: Global Strategies, Industry Trends and Applications.

## BBTE- 202T PROTEINS AND ENZYMES

Lectures -36

Credit -02

### Objectives:

- To make the student aware of basic concepts of proteins, enzymes and vitamins.
- To make the student aware of basics of chemical science in relevance to biological systems.

### UNIT I

09

**Proteins and Amino Acids:** Classification of amino acids based on Properties, Proteins: Classification based on Structure and Functions, Denaturation of protein Structure of Peptides, Ramchandran Plot, Titration Curve of Amino Acids, Concept of Isoelectric pH, Zwitter ion. Types of Protein: Globular, Fibrous, Elastic Proteins

### UNIT II

09

**Enzymes:** Introduction, IUB classification, active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis, enzyme inhibition types competitive, non-competitive, un-competitive. M-M equation, Line weaver-Burk plot, Eadie-Hofstee plot

### UNIT III

11

**Vitamins:** Classification and deficiency diseases of Vitamins, RDA, source, structure of Vitamin and Coenzyme, of: Ascorbic acid, thiamine, riboflavin, folic acid, pyridoxine, niacin, pantothenic acid, biotin, lipoic , folic acid and cyanocobalamin.

### UNIT IV

07

**Protein purification:** Method of cell disruption (Blenders, grinding with abrasives, presses, enzymatic method, sonication); Salt participation- Salting in, salting out, organic solvent precipitation, dialysis, ultra filtration

### Expected Outcome:

Student should be able to

- Understand fundamentals of biochemistry.
- Understand basics of chemical science in relevance to biological systems.
- Learn basic concepts of amino acids, proteins and enzymes.
- Understand the basic concepts of vitamin, their function and deficiency diseases.
- Should be able to relate it to day today life.

**References:**

1. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 5th Edition, WH Freeman and Company, New York, USA. (Unit I)
2. U. Satyanarayanan, Biochemistry: Uppala Author Publiser Interlinks, 3<sup>rd</sup> Ed.(Unit III)
3. Trevor Palmer, Enzymes –Woodhead Publishing (Unit II)
4. J.L.Jain, Fundamentals of Biochemistry, S.Chand Pub. (Unit I, III, IV)
5. Voet & Voet, Fundamentals of Biochemistry, 5<sup>th</sup> Ed.John Wiley and Sons Inc, New York, USA (Unit I, II, III, IV)

## BBTE--203 T: Animal Science

Lectures -36

Credit -02

Objectives :--

- To study the general concept of classification system of Animal kingdom.
- Application of animal science to study the Host and parasite relationship.
- To study the Human anatomy and physiology with reference to Tissues and Histology of different mammalian organs.
- Application of animal science with reference to vermiculture, sericulture, apiculture and pisciculture.
- To study the overall general ideas of Animal world.

### UNIT I

11

**TAXONOMY** : General classification of animal kingdom.(General characteristics and one representative example) Non-chordates –Study of phylum Porifera, Coelenterata, Platyhelminthes, Nematelminthes, Arthropoda, Mollusca & Echinodermata – General characters with representative examples- Sycon, Hydra, Liver fluke/Taenia, Earthworm / Nereis, Cockroach, Pearl oyster / Pila, Starfish

Chordates:-Study of class Pisces, Amphibia, Reptilia & Mammalia – General characters with representative examples – Lebeo, Frog, Cobra, Alligator, Fowl and Rat.

### UNIT II

09

Host and Parasite Relationship: Protozoan parasite- Plasmodium (Morphology, parasitic adaptations, Life cycle), Nematode parasite- Ascaris (Morphology, parasitic adaptations, Life cycle), Plathelminthes parasite- Liver fluke (Morphology, parasitic adaptations

### UNIT III

08

Tissues: Definition and types of tissues (Epithelial, Muscular, Nervous, Connective tissue). Blood Plasma, Serum, Corpuscles, Bone, Cartilage. Histological Architecture of Skin, Stomach/Intestine, Uterus

### UNIT IV

08

Applied zoology : Vermiculture :- species/types of earthworms , stages of vermiculture, various models/methods, economic importance, Apiculture: Types/ species of Honey bees, castes of Honey bees, Economic Importance ., Sericulture : Types of Silkworms, Life cycle, economic importance., Pisciculture: History ,Inland ,Marine and culture fisheries, Economic importance.

**Expected Outcomes:-**

- Animal Science is a multidisciplinary course in learning Classification , Parasitology animal physiology, Anatomy , economic zoology etc. along with fundamental principles of animal life.
- Students should be able to understand basic and applied biological sciences.
- Students should be able to understand basic knowledge of classification of animal kingdom.
- Students should be able to understand basic concepts of host and parasite relationship which may be useful to develop an interest in diagnosis and modern research in parasitology.
- Students should be able to understand basic concepts of Human physiology and anatomy.
- Professional education in Animal Science prepares the students for career opportunities in the field of diagnostic parasitology as well as in sericulture, apiculture, vermiculture and pisciculture etc, which are highly demandable today commercially and for applied research.

### References:-

1. Modern Textbook of Zoology : Invertebrates ,R .L. Kotpal. Rastogi Publications,2012.Unit - I
2. Modern Textbook of Zoology : Vertebrates ,R .L. Kotpal. Rastogi Publications ,2012. Unit-I
3. Jordan, E.L. and Verma P.S. 1978, (i) Chordate Zoology S. Chand & Company Ltd. Ram Nagar. New Delhi. (Unit-I)
4. Jordan, E.L. and Verma P.S. 1978 (ii) Invertebrate Zoology. S. Chand & Company Ltd. Ram Nagar. New Delhi. . (Unit-I)
5. Modern Text Book of Zoology: Invertebrates., R.L.Kotpal. Publisher, Rastogi Publications, 2012. (Unit-I)
6. Parasitology (Protozoology and Helminthology) 13<sup>th</sup> Edition by K D Chatterjee.(Unit II)
7. Modern Parasitology : A Textbook of Parasitology , 2<sup>nd</sup> edition ,(1993) F.E.G Cox , Wiley & Sons , USA. (Unit -II)
8. Textbook of Physiology – Torotora and Derrickson.(Unit-III)
9. Textbook of Physiology – Gyton .( Unit-III)
10. Applied Zoology : Shukla and Upadhyay.(Unit –IV)
11. V .G Jhingran - Fish and Fishreis of india. .(Unit –IV)
12. J.E Bardarch- Aquaculture. .(Unit –IV)



## BBTE -204T: Physics- II

Lectures -36

Credit -02

Learning Objectives:

- To make students aware of fundamentals of Bioelectricity.
- To make the student aware of basics of electronic devices.

### UNIT I

09

#### Optics correlated with microscopy:

Concept of interference and diffraction, concept of polarization and plane polarized light, production of polarized light by absorption, polarization by double refraction, Huygens explanation of double refraction through uniaxial crystals, Nicol prism, definition of optical activity, Chromatic aberration, Common types of eyepieces, Huygen's eyepiece and Ramsden's eyepiece ,LASER- LASER action (Energy level diagram), Ruby laser ,properties of LASER, Uses of LASER.

### UNIT II

09

#### Bioelectricity

Introduction, electricity observed in living systems-examples, origin of bioelectricity, resting potential and action potential, Nernst equation, conduction velocity, origin of compound action potential, Electrocardiogram (ECG), Electroencephalogram (EEG),

Electromyogram (EMG), Electroculogram( EOG),

### UNIT III

09

#### Semiconductor Devices and Digital Electronics

Seven segment display, spectral distribution of solar energy, solar cell construction, working efficiency and fill factor, applications of solar cell, Binary and BCD number system, Basic logic gates OR, NOR, AND, NANA and NOT, Demorgans theorem, NAND and NOR as the universal gates, Half adder and Full adder. R-S flip flop, J-K flip-flop.

### UNIT IV

09

#### Atomic structures and X-rays

Introduction, J. J. Thomson atomic model, Rutheford atomic model and Bohr model, Limitations of Bohr atomic model, Energy level diagram

of Hydrogen atom, Space quantization, electron spin hypothesis, Quantum numbers, Pauli's exclusion principle, normal Zeeman effect, Nuclear models and forces (Liquid drop model and shell model), production of x-rays and its properties, Continuous and characteristics X-ray spectrum, Bragg's law, intensity of X-rays, Mosley's experimental work, Mosley's diagram, Mosley's law. Applications of X-rays

### **Learning Outcomes:**

- Student should be able to understand atomic structure of biological things and optical devices.

### **References:**

1. Physics by Devid Hallday Roberet Resnik, (Vol-I and Vol-II) Wiley Eastern limited
2. Fundamental of Mechanics, S.K.Saxena, Himalaya Publications
3. Perspectives of modern physics, Aurthur Beiser, McGrawHill Publication
4. Heat and Thermodynamics, Zemansky, McGrawHill Publication
5. Fundamentals of optics, Jenkins white, McGrawHill Publication
6. Text book of optics, N.Subrahmanyam Brijlal, S.chand and Company Limited
7. Optics by Ajoy Ghatak, Tata McGrawHill Publication
8. Properties of Matter, D.S.Mathur, Sha, alal Charetile trust
9. Solar Energy, Suhas Sukatme, Tata McGrawHill Publication
10. Principle of electronics, V.K.Mehta, S.chand and Company Limited
11. Digital Principles and application, Malvino and Leach, Tata McGrawHill Publication
12. Elements of Spectroscopy, Gupta, Kumar, Sharma, Pragati Prakashan
13. Introduction to Atomic spectra, H.E.White, McGrawHill Publication
14. Biophysics, Vastala Pirmal, Dominent Publishers and Distributor

## BBTE-205-T: Biotechniques and Instrumentation-II

Lectures -36

Credit -02

### Objective:

- To study working and instrumentation of advance instruments.
- To understand Principle of Bioinstrumentation
- To study use and applications of Biophysics

### Unit I

09

X-ray crystallography: Brief Introduction to Lattice, Basis, Space lattice, Crystal planes and Miller indices, Bragg's law in direct lattice, X-ray diffraction by crystals, Determination of crystal structure using powder method, Laue method, and Rotating crystal method.

### Unit II

09

UV-Visible Spectroscopy: Introduction of spectroscopy, properties of electromagnetic radiation, Lambert-Beer's law, Principle, Instrumentation and application with respect to colorimeter, UV and Visible spectroscopy

### Unit III

09

IR spectroscopy – Introduction, Principle (vibration spectra (without proof), possible modes of vibrations of atoms in polyatomic molecules) Instrumentation, Applications

Atomic Absorption Spectroscopy: Introduction, Principle, Instrumentation, Applications.

### Unit IV

09

Electron Spin Resonance Spectroscopy: Introduction, Theory of ESR, Presentation of ESR spectrum, Hyperfine splitting, Instrumentation, Applications.

NMR: Spin spin coupling, chemical shift, Instrumentation, Application.

Mass Spectroscopy: Introduction, Theory, Instrumentation, Applications.

### Learning outcome:

- Student should be able to understand basic concepts of Biophysics
- Student should understand applicability of Instruments and its Application
- Student should be able to handle instruments during project.

### References:

1. Biophysical Chemistry - Upadhyay, Nath, Upadhyay (Unit I)
2. Introduction to Molecular Spectroscopy – C.N.Banwell (Unit III, IV)
3. Practical biochemistry principles and techniques by Wilson and Walker. (Unit III,IV)
4. Bioinstrumentation: VeeraKumari. ( Unit II)

## BBTE 206 T- Basics in Microbiology–II

Lectures -36

Credit -02

### Objectives:

- To demonstrate good aseptic technique in culture transfer or inoculation and in handling sterile materials.
- To demonstrate skill in isolation of organisms from a mixed culture using selective and differential media.
- To isolate microorganisms from natural sources and describe their colonial morphology.
- To study the different phases of bacterial growth.
- To introduce the concept and use of indicate or bacteria in water quality monitoring.
- To describe the principal indicator bacteria used and their key characteristics which make them suitable for use as indicators.
- The role of microorganisms in a range of diseases, including the nature of the disease-causing organisms as well as their routes of transmission & how we can control them.
- To emphasize the value of *E.coli* and faecal coliforms as routine indicators.

### UNIT I

09

#### Culture media and pure culture techniques:

Common components of media and their functions (Peptone, Yeast extract, NaCl, Agar and Sugar, Techniques of enrichment) Culture media a) Living Media (Lab. animals, plants, bacteria, embryonated eggs) b) Nonliving media – i) Natural, ii) Synthetic, iii) Semisynthetic, iv)Differential, v) Enriched, vi) Enrichment, vii) Selective.

Methods for isolation of pure culture. Introduction to concept of pure culture and methods for pure culture i) Streak plate ii) Pour plate iii) Spread plate

### UNIT II

09

#### Microbial growth:

Growth Kinetics and growth curve; definitions of Growth, Generation time, Growth rate, specific growth rate, Growth curve and phases of growth curve (Continuous culture, Synchronous growth, Diauxic growth) Effect of environmental factors on growth-temperature, pH., osmotic pressure.

### UNIT III

09

**Water Microbiology:** Sources of microorganisms in water, fecal pollution of water, Routine bacteriological analysis of water (SPC, Tests for coliforms-Qualitative: detection and differentiation of coliforms, Quantative: MPN technique.)

**Soil microbiology:** Types of microorganisms in soil and their role in soil fertility, Microbial interactions in soil (Symbiosis, commensalism, amensalism, parasitism and predation.) Microbes as Biofertilizers and Biocontrol Agents (e.g. Nitrogen fixers, Phosphate Solubilizers and *Bacillus thuringensis*)

## UNIT IV

### Medical microbiology

09

Definition, Host, parasite, Saprophytes, Commensals, Infection, Etiological agent, Disease, Pathogen, Opportunistic pathogen, True pathogen, Virulence, Pathogenicity, Fomites, Incubation period, Carriers, Morbidity rate, Mortality rate, Epidemiology, Etiology, Prophylaxis, Antigen, Antibody, Hapten, Vaccine, Immunity. Virulence factor: Production of endotoxin, exotoxin, enzymes, escaping of phagocytosis. Types of infections: Chronic, Acute, Primary, Secondary, Reinfection, Iatrogenic, Congenital, Local, Generalized, Covert, Simple, Mixed, Endogenous, Exogenous, Latent, Pyogenic, Nosocomial. General principles of prevention and control of microbial diseases .Types of diseases: Epidemic, Endemic, Pandemic, Sporadic .Mode of transmission of diseases: Air borne transmissions, Vehicle transmissions, Contact transmissions, Vector borne transmissions

#### Learning Outcome:

**After completing the credits students should gain knowledge about:**

1. Basic concepts of microbial nutrition, growth and control
2. Basic techniques of pure culture isolation and preservation of microbes.
3. Bacteriological analysis of water
4. Types of microorganisms in soil and their application.
5. Basic terms in medical microbiology

#### References:

1. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole. Unit I,II, III and IV
2. Madigan M.T., Martinko J.M. (2006). Brock's Biology of Microorganisms. 11<sup>th</sup> Edition. Pearson Education Inc. Unit I,II, III and IV
3. Prescott L.M., Harley J.P., AND Klein D.A. (2005). Microbiology, 6th Edition. MacGraw Hill Companies Inc. Unit I,II, III and IV
4. Industrial Microbiology by A.H.Patel. Unit II
5. Text book of microbiology-Ananthanarayan (Unit I,II,III,IV)
6. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata MacGraw Hill Press.( Unit I,II,III and IV)
7. Salle A.J. (1971) Fundamental Principles of Bacteriology.7th Edition. Tata MacGraw Publishing Co. Unit I,II, III and IV
8. Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5<sup>th</sup> Edition. Macmillan Press Ltd. Unit I,II, III and IV
9. Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8<sup>th</sup> Edition. Pearson Education Inc.Unit I,II, III and IV
10. Principles of Fermentation Technology – Stanbury P.F.,Whitekar H., Hall S.J. – UnitII

## BBTE--207 T-: Statistical Methods

Lectures -36

Credit -02

### OBJECTIVE

- To understand data analysis of given samples.
- To understand concept of correlation and regression
- To make inference about a sample based on information we get from a population
- To understand concept of statistic and its use in biological field

### UNIT I

09

**Introduction to statistics and collection of data:** Meaning of statistics, Scope of statistics in Biological and medical sciences, Classification of data: Primary and Secondary data, Discrete and Continuous frequency Distribution, Cumulative frequencies, Graphical representation: - Histogram and Ogive Curves

### UNIT- II

09

**Descriptive Statistics:** Measure of central tendency Mean (Definition & simple problems) Mode, Median, Quartiles (Definition, Graphical calculation), Measures of dispersion: Variance (Definition, simple problems) Standard deviation, Coefficient of variance, Skewness (Definition, types of skewness, real life example), Kurtosis (Definition, types of Kurtosis, real life example)

### UNIT- III

09

**Correlation and Regression:** Concept of correlation between two variables and types of correlation, Method of obtaining correlation ( i ) by scatter diagram method ii) By Karl Pearson Correlation coefficient Properties of correlation coefficient, Concept of regression, Lines of regression coefficients and properties without proof, Examples on ungrouped data.

### UNIT- IV

09

**Probability and Sampling:** Definition of sample space, Outcomes, events, exhaustive events, mutually exclusive events, certain events, impossible events. Independent events, Definition of probability, Limits of probability, Probability of complementary event, Additive law of Probability. Simple illustrative examples, Idea of population and sample, Simple Random Sampling and Stratified Random sampling, Advantages and disadvantages of both the method, Testing of hypothesis, Null and alternative hypothesis, types of errors, Critical region, Acceptance region, level of significance., Tests of significance: t test.

### Expected Outcomes:

1. Students should understand the basic fundamentals of the statistics.
2. Students should be able to do the data analysis statistically
3. Representation of the data in tabular format and graphical representation of the data.
4. They should be able to draw the statistical inference based on the statistical tools and techniques.
5. Students should understand the basic Probability and sampling

**References:**

1. Gupta & Kapoor: Fundamental of mathematical statistics. (Unit I II III IV )
2. Thigale T. K. and Dixit P. G. (2003): A text book of paper- I for B.Sc. I, Nirali Publication, Pune. (Unit I II III IV )
3. Waiker and Lev: Elementary Statistical methods. (Unit I II III IV )
4. Rohatgi V. K. and Sauh A. K. Md E. (2002) An Introduction to probability and statistics. (Unit I II III IV )
5. Thigale T. K. and Dixit P. G. (2003): A text book Of paper II for B.Sc. I.
6. Meyer P. L. (1970): Introduction, probability and statistical Application. Addisonwesly. (Unit I II III IV )
7. Cochran, W.G.: Sampling Techniques, Wiley Estern Ltd., New Delhi. (Unit I II III IV )
8. Des Raj: Sampling theory. (Unit I II III IV )

## BBTE--208T: Computer Applications

36 Lectures

Total Credits: 02

### Objective:

- To understand basics of Microsoft office.
- To understand database management system.
- To get knowledge of basics of internet, email etc.
- To acquire the knowledge of basics of Bioinformatics.

### Unit- I:

Microsoft Office: Introduction to Office Operation: Microsoft Word- Interface , concept of toolbar, character, paragraph & document formatting, drawing toolbar, Header, Footer, Document editing, Page setup, short cut Keys, Text and graphics  
Microsoft Excel- Interface ,Concept of spreadsheet, Creating worksheet, Well formatted documents, concept of row, column, cell and formula bar, using function, using shortcuts, charts, conditional formatting.

### Unit –II

Microsoft PowerPoint- Interface, Slide presentation, slide layout, Design, custom animation. Microsoft Access- Interface, Creating database, creating table, inserting values, primary key

### Unit-III

Database Management System- Need of database, data models- E-R model, Hierarchical, Network, Relational, Object Oriented, Main components of DBMS- DDL, DML, Internet, World Wide Web, web browser, searching data from search engine.

### Unit- IV

Creating user account, sending Email (uploading & downloading files) Basic services of Internet (ELECTRONIC MAIL, TELNET, INTRANET, EXTRANET), Protocols (FTP, SMTP, TCP/IP, PPP etc.)

Bioinformatics-Introduction, Nature of Biological data , characteristics of data, Tools for Protein function analysis, Homology and similarity, structure analysis, sequence analysis, BLAST, FASTA, EMBOSS, Clustalw, Applications & scope of Bioinformatics.



**Learning Outcomes:**

- Student should be able to understand basics of Microsoft office.
- Student should be able to understand database management system.
- Student should be able to get knowledge of basics of internet, email etc.
- Student should be able to acquire the knowledge of basics of Bioinformatics.

**Reference Books:**

1. Let us C by Y. Kanetkar BPB publication 12<sup>th</sup> Edition(Unit-I-IV)
2. C -The Complete Reference, 4th Edition by Herbert Schildt (Unit-I-IV)

## BBTE 210- P: Techniques in Chemistry and Biochemistry-II

Credits: 02

### Chemistry

1. Estimation of Vit. C
2. Inorganic Estimation :- Estimation of amount of magnesium from talcum powder by complexometric titration
3. Estimation of sap value of given oil sample.
4. Preparation of standard potassium dichromate solution
5. Inorganic preparations: Hexammine Nickel (II) Chloride
6. Conductometric titration- Strong acid, strong base

### Biochemistry

1. Quantitative estimation of  $\alpha$ - amylase using starch as substrate
2. Isolation and characterization of starch from potatoes
3. Estimation of Glucose by 3,5 Dinitro salicylic acid method
4. Estimation of reducing sugar from apple juice by Benedict's method

### Learning outcome:

- At the end of this module, student is expected to know simple applied chemistry and Biochemistry techniques for detection of common yet important analytes.
- Models should bring clarity in concepts of conformations of biomolecules.
- Standardization and calibration of conductivity meter.
- Qualitative analysis of various biomolecules

### Reference:-

1. Chemistry Text book of practical organic chemistry (4th Edition, Longman) – A .I. Vogel.
2. Organic Chemistry – Morrison & Boyd
3. Practical Biochemistry - J. Jayaraman
4. Practical Biochemistry - David Plummer

**BBTE-- 211 P: Laboratory Exercises Animal Science.**

**No of Credits: 02**

1. Classification and Identification of Non-chordates & Chordates. (One animal each). Non-chordates- Sycon, Hydra, Liver fluke/ Earthworm / Nereis, Cockroach, Pearl oyster/Pila, Starfish. Chordates- Lebeo, Frog, Cobra, Alligator, Fowl and Rat. 02
2. Earthworm Dissection (Digestive system, Nervous system) 02
3. Study of Plasmodium, Ascaris, Liver Fluke, Taenia- Salium 01
4. Blood slide Preparation and Identification of Blood cells 01
5. Blood cell count      i) Differential count of W. B. Cs. 01  
                                  ii) Total count of W. B. Cs and R. B. Cs
6. Preparation of Haemin Crystals. 01
7. Determination of Hemoglobin 01
8. Demonstration of :- 02  
    i)Bee keeping – Study of instruments  
    ii)Sericulture –Study of different stages
9. Study tour – 01  
    Visit to Biodiversity spot, Sericulture ,Apiculture ,Vermicomposting

**Expected outcomes:-**

Students should be acquainted with:-

- Develop the skill in dessection and microscopy which is highly needed for any type of research work in animal sciences.
- Able to aquire Basics of Parasitology.
- Able to aquire practical knowledge related to Blood.
- Able to aquire practical knowledge in applied zoology like –Sericulture, Apiculture, Vermiculture .

**References:-** 1) Practical zoology – S .S. Lal

## BBTE--212 P: Laboratory Exercises in Microbiology and Instrumentation

No of Credits: 02

### Microbiology

1. Mounting and identification of *Aspergillus*, *Mucor* 01
2. Enumeration of bacteria by total viable count from soil by spread plate technique and pour plate technique 02
3. Study of growth curve of bacteria 01
4. Aseptic transfer techniques – types – slant to slant, broth to broth, broth to Agar 01
5. Isolation, colony characters, Gram staining & motility of *E.coli*, *Bacillus* sp 02
6. Primary screening of antibiotic producers by crowded plate technique 01

### Instrumentation

1. Demonstration (Principle, working, construction) of Laminar Air Flow & Refractometer. 01
2. Spectrophotometric determination of nucleic acid purity and concentration 01
3. Separation and identification of plant pigments by using Ascending paper chromatography. 01
4. Separation and identification of amino acids using TLC 02
5. Demonstration of Atomic absorption spectrophotometer (AAS). 01

### References:

1. Laboratory manual of microbiology and biotechnology by K.R.Aneja
2. Microbiology : Laboratory theory and Application by Michael J. Leboffe and E.Pierce
3. Laboratory Experiments in microbiology by Ted R. Johnson and Christine
4. Practical Microbiology: a laboratory manual by B. Senthil Kumar, Zothansanga, D. Senbagam, N. Senthil Kumar and G. Gurusubramanian.
5. Textbook of biophysical chemistry- Nath upadhyay Nath.
6. Bio-instrumentation – B. Nagamani
7. Bio-instrumentation – Veerakumari
8. Principles and techniques of Biochemistry and Molecular Biology - Wilson and walker.
9. Practical handbook of Biochemistry and Molecular Biology- Gerald D.Fasman

## BBTE--213 P: Laboratory Exercises in Methods in Statistics and Computer applications in Biology

No of Credits: 02

### Statistics

- |                                                                                                                |    |
|----------------------------------------------------------------------------------------------------------------|----|
| 1. Frequency distribution – Graphical, Histogram, ogive curve [less & greater than].                           | 02 |
| 2. Measures of central tendency (Grouped and Ungrouped) A. M., Median, Mode.                                   | 02 |
| 3. Correlation, Regression. Scattered diagram, Karl Pearson's correlation coefficient, eqn of Regression line. | 02 |
| 4. Measures of Dispersion – Range, s. d., C. V. combined s. d.                                                 | 01 |
| 5. Testing of Hypothesis: Large sample test: Normal, proportion, Small sample test.: $\chi^2$ , t, f.          | 02 |
| 6. Statistical analysis using SPSS software, R software                                                        | 02 |
|                                                                                                                |    |
| 1. Microsoft Word, Excel (Taking 2 examples on each).                                                          | 01 |
| 2. Microsoft PowerPoint (Taking 2 examples on it).                                                             | 01 |
| 3. Microsoft Access (Taking 2 examples on it).                                                                 | 01 |
| 4. Using Microsoft Access create database and apply primary key                                                | 01 |
| 5. Using Microsoft Access create Table.                                                                        | 01 |
| 6. Working with database management systems.                                                                   | 01 |
| 7. Working with Internet connectivity and creating account on any social site                                  | 01 |
| 8. Creating an account on any website and Uploading and Downloading files.                                     | 01 |
| 9. Downloading video, Software, Audio, Documents etc                                                           | 01 |
| 10. Visit to Online Shopping and purchase any book.                                                            | 01 |
| 11. Introduction to biological database                                                                        | 01 |

### Learning outcome:

- At the end of this module, student is expected to know simple applied statistics
- It should give basic knowledge about Frequency distribution.
- They should be able to draw the statistical inference based on the statistical tools and techniques.

### References:

1. Thigale T. K. and Dixit P. G. (2003): A text book Of paper II for B.Sc. I.
2. Meyer P. L. (1970): Introduction, probability and statistical Application. Addisonwesly.
3. Cochran, W.G.: Sampling Techniques, Wiley Estern Ltd., New Delhi.
4. Waiker and Lev: Elementary Statistical methods. (Unit I II III IV )
5. Rohatgi V. K. and Sauh A. K. Md E. (2002) An Introduction to probability and statistics. (Unit I II III IV )

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