

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: This updated syllabus is prepared for first year undergraduate students of Biotechnology. At this level, to develop their interest towards Biotechnology as applied science and also to prepare them for the academic and industrial exposure simultaneously. Introduction of basic subjects like Chemistry, Physics, Statistics and computer with the other life science subjects will help to form a basic foundation of concepts for students. The interdisciplinary approach with vigor and depth is compatible to the syllabi of other universities, at the same time is not rigid for the students at first year of their graduation. The units in the syllabus are well defined with scope and the number of lectures. The references are mentioned with relevance.

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

Program Outcomes:

- The students will graduate with proficiency in the biotechnology
- The students will be eligible to continue higher studies in the subject.
- The students will be eligible to peruse higher education abroad.
- The students will be eligible to appear for the examination for job in government sector.
- The students will be eligible to appear for jobs with minimum requirement for B.Sc. program.

Program Specific Objectives:

- The students are expected to understand the fundamentals, principles, concept and recent developments in Biotechnology.
- The practical course is framed in relevance with theory courses to improve understanding of various concepts in biotechnology.
- It is expected to inspire and boost interest of students in Biotechnology.

Program Specific Outcomes:

- Understand basics of Biotechnology.
- Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learnt in the classroom.
- Develop the ability to apply the knowledge acquired in classroom and laboratories to specific problems in theoretical and experimental biotechnology.
- Identify the area of interest in the academic research and development.

- Perform job in various fields like food, pharmaceutical, agriculture, health care, public services and business etc.
- Be an entrepreneur with precision, analytical mind, innovative thinking, and clarity of thought, expression and systematic approach.

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:

| Rayat Shikshan Sanstha's | | | | | | | | |
|---|-----------------------|------------------------|--------------|----------------|------------------|------------------------|--------------|----------------|
| YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA | | | | | | | | |
| COURSE STRUCTURE UNDER AUTONOMY | | | | | | | | |
| B. Sc. BIOTECHNOLOGY (ENTIRE) | | | | | | | | |
| B. Sc. I SEMESTER– I (Duration – 6 Months) | | | | | | | | |
| Sr. No. | SUBJECT CODE | TEACHING SCHEME | | | | | | |
| | | Theory | | | Practical | | | |
| | | No. of lectures | Hours | Credits | Subject | No. of lectures | Hours | Credits |
| 1 | BBTT--101 | 3 | 2.4 | 2 | BBTP--110 : | 4 | 3.2 | 2 |
| 2 | BBTT--102 | 3 | 2.4 | 2 | | | | |
| 3 | BBTT--103 | 3 | 2.4 | 2 | BBTP--111: | 4 | 3.2 | 2 |
| 4 | BBTT--104 | 3 | 2.4 | 2 | | | | |
| 5 | BBTT--105 | 3 | 2.4 | 2 | BBTP--112: | 4 | 3.2 | 2 |
| 6 | BBTT--106 | 3 | 2.4 | 2 | | | | |
| 7 | BBTT--107 | 3 | 2.4 | 2 | BBTP--113: | 4 | 3.2 | 2 |
| 8 | BBTT--108 | 3 | 2.4 | 2 | | | | |
| 9 | BBTT-AECC-1 | 3 | 2.4 | 2 | | | | |
| | Total of SEM I | 27 | 21.6 | 18 | | 16 | 12.8 | 8 |
| TOTAL NO OF CREDITS FOR SEMESTER I: 26 | | | | | | | | |

| Rayat Shikshan Sanstha's | | | | | | | | |
|--|------------------------|-----------------|-------------|-----------|------------|-----------------|-------------|----------|
| YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE ,SATARA | | | | | | | | |
| COURSE STRUCTURE UNDER AUTONOMY | | | | | | | | |
| B. Sc. BIOTECHNOLOGY (ENTIRE) | | | | | | | | |
| B. Sc. I SEMESTER– II (Duration – 6 Months) | | | | | | | | |
| Sr. No. | SUBJECT CODE | TEACHING SCHEME | | | | | | |
| | | Theory | | | Practical | | | |
| | | No. of lectures | Hours | Credits | Subject | No. of lectures | Hours | Credits |
| 1 | BBTT—201 | 3 | 2.4 | 2 | BBTP--210: | 4 | 3.2 | 2 |
| 2 | BBTT—202 | 3 | 2.4 | 2 | | | | |
| 3 | BBTT—203 | 3 | 2.4 | 2 | BBTP--211: | 4 | 3.2 | 2 |
| 4 | BBTT—204 | 3 | 2.4 | 2 | | | | |
| 5 | BBTT—205 | 3 | 2.4 | 2 | BBTP--212: | 4 | 3.2 | 2 |
| 6 | BBTT—206 | 3 | 2.4 | 2 | | | | |
| 7 | BBTT—207 | 3 | 2.4 | 2 | BBTP--213: | 4 | 3.2 | 2 |
| 8 | BBTT—208 | 3 | 2.4 | 2 | | | | |
| 9 | BBTT-AECC 2 | 3 | 2.4 | 2 | | | | |
| | Total of SEM II | 27 | 21.6 | 18 | | 16 | 12.8 | 8 |
| TOTAL NO OF CREDITS FOR SEMESTER II: 26 | | | | | | | | |
| TOTAL NO OF CREDITS FOR SEMESTER I + II: 52 | | | | | | | | |

| | |
|---|--|
| • 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 |
| • AECC1 - Ability Enhancement Compulsory Course (BTE-AECC-1 and BTE-AECC-2)- English | |
| • BBTE : B.Sc. Biotechnology (Entire) for Semester I BBTT--101 to BBTT-113 and for semester II BBTT-201 to BBTT-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:

| Sr No. | Name of Instrument |
|---------------|--------------------------------------|
| 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

| Subject Code | Title of Course |
|---------------------|---|
| BBTT-101 | Chemistry-I |
| BBTT-102 | Biomolecules |
| BBTT-103 | Plant Science |
| BBTT-104 | Physics-I |
| BBTT-105 | Bio-techniques and Instrumentation-I |
| BBTT-106 | Basics in Microbiology I |
| BBTT-107 | Introduction to Biotechnology |
| BBTT-108 | Computer Basics and Bioinformatics |
| BBTP-110 | Laboratory Exercise in Chemistry and Biochemistry-I |
| BBTP-111 | Laboratory Exercise in Plant Science |
| BBTP-112 | Laboratory Exercise in Microbiology and Instrumentation |
| BBTP-113 | Laboratory Exercise in Computer Basics |

BBTT- 101: 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 ΔH , 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, ΔG and K, ΔG and work function, Relation between ΔH and ΔG (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, CH₄, Cl₂, H₂.

VBT- Postulates, Concept of Hybridization, sp, sp², sp³ hybridization with respect to BeCl₂. BF₃, SiCl₄ (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 $\text{BF}_3 \leftarrow \text{NH}_3$ & 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. C. N. R. Rao, University general chemistry, macmillan india ltd-new delhi, 1st, (2000)
2. Robert A. Albery, Physical chemistry (Wiley Eastern Ltd., Times Roman by Publication Services, Inc. 4th edition)
3. B. K. Sen, Quantum chemistry including molecular spectroscopy McGraw Hill Education, (1992)
4. Donald J. Cram, George S. Hammond Organic chemistry McGraw-Hill Inc. US; International student edition (1 December 1964)
5. Peter Sykes, A Guide-book to mechanism of organic chemistry, Pearson Education; 6th edition (1 January 2003)
6. G.S. Manku, Theoretical principles of inorganic chemistry McGraw-Hill Education; New edition (1 August 1982)
7. B. R. Puri, L.R. Sharma, Physical chemistry, Vishal Publishing Co.; 1st edition (1 January 2020)
8. Dr. G.R. Chatwal, Sham Anand Instrumental methods of chemical analysis- Hph (1 January 2011)
9. Dr. B. K. Sharma, Instrumental methods of chemical analysis- Krishna Prakashan Media, (1981)
10. I. L. Finar, Organic chemistry VOL-II 5th Edition (2011)

11. J.D. Lee, Concise inorganic chemistry, Oxford University Press; Fifth edition (1 February 2008)

BBTT-102: 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 Lehniger Principles of Biochemistry, 5th Edition, WH Freeman and Company, New York, USA. (2004)
2. U. Satyanarayanan, Biochemistry Elsevier; 4th edition (15 June 2013)
3. Trevor Palmer, P L Bonner Enzymes: Biochemistry, Biotechnology, and clinical Chemistry, 2nd Edition, Woodhead Publishing, (2007).
4. J. L. Jain, Fundamentals of Biochemistry, S. Chand Pub. (2004)
5. Donald Voet, Judith G. Voet, Charlotte W. Pratt, Fundamentals of Biochemistry, 5th Ed. John Wiley and Sons Inc, New York, USA (2016).

BBTT-103: Plant Science

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 e ideas of plant l 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, Parthenocarpy- Definition and significance. Cloning of plants:- Bulbs, corns, tubers, Bulblets and Rhizomes, Runners, Cuttings, Layering , Grafting and mericloneing.

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. H. C. Dube, *A Text Book of Fungi Bacteria and Viruses*, Jodhpur: Agrobios, (2009)
2. Harold C. Bold, *The Plant kingdom*, New Delhi: Prentice - Hall India (1977)
3. A.C. Dutta, *A Class book of botany*, New Delhi: Oxford University Press(1959)
4. V. N. Naik, *Taxonomy of angiosperms*. New Delhi: Tata McGraw-Hill (1984)
5. G. L. Chopra, *Angiosperms: Systematic and life cycle*. Jalandhar: Pradeep Pub., (1984)
6. Robert M. Devlin, *Fundamentals of plant physiology* New York: MacMillan (1983)
7. G.L Chopra, *A Text book of Algae* Jalandhar: Pradeep Pub., (1978)
8. G. L. Chopra and V Verma, *Text Book of Fungi* Pradeep Publications, Jalandar (1983)
9. Arthur J. Eames and Laurence H. MacDaniels *An introduction of plant anatomy*, New York: McGraw-Hill, (1947)

BBTT- 104: Physics-I

Lectures: 36

Total credits: 02

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

UNIT I

Elasticity: (09)

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, watability, 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. Devid Hallday Roberet Resnik, Physics by (Vol-I and Vol-II) Wiley; Fifth edition (1 January 2007)
2. S. K. Saxena, Fundamental of mechanics, Himalaya Publications (2012)
3. Aurthur Beiser, Perspectives of modern physics, McGraw-Hill Inc.US (1 January 1969)
4. Mark Zemansky, Richard Dittman, Heat and thermodynamics, McGraw Hill Education; 8th

- edition (1 July 2017).
5. Francis Jenkins, Harvey White, Fundamentals of optics, McGraw Hill Education; 4th edition (1 July 2017)
 6. N. Subrahmanyam Brijlal, Text book of optics, Schand; 23rd Rev. Edn. 2006 edition (1 December 2006)
 7. Ajoy Ghatak ,Optics, McGraw Hill Education India Private Limited; Sixth edition (1 July 2017)
 8. D. S. Mathur, Properties of matter, S Chand & Company (1 December 2010)
 9. Suhas Sukatme ,Solar energy, McGraw-Hill Education, (1st April 1984)
 10. V. K. Mehta, Rohit Mehta Principle of electronics, S Chand; 7th edition (3 February 2014)
 11. Donald P. Leach, Albert Paul Malvino, Digital principles and application, McGraw-Hill Education; 5th edition (30 April 1994)

BBTT- 105: Bio-techniques and Instrumentation-I

Lectures: 36

Total 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. Nath and Upadhyaya, Biophysical Chemistry (Himalaya Publication House:2009)

2. Wilson and Walker, Practical biochemistry principles and techniques (Cambridge University Press:2000)
3. James Miller, John Wiley and Sons, Inc. Chromatography: Concepts and Contrasts (John Wiley & Sons Inc:11 September 2009)
4. L.Veera Kumari Bioinstrumentation (MJPPublishers:2006)

BBTT 106: 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) Pili 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. General Microbiology, 5th Edition. Macmillan Press Ltd. (1987).
2. Ingraham J. L. and Ingraham C.A., Introduction to Microbiology. 3rd Edition.Thomson Brooks / Cole. (2004).
3. Martin Frobisher. Fundamentals of microbiology. 9th ed. Philadelphia : Saunders,(1974.)
4. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. Microbiology, 5 thEdition, Tata MacGraw Hill Press. (1993).
5. C. B. Powar, H. F. Dagainawala , Microbiology , Himalaya Pub., -(1982)
6. C K Jayaram Paniker; R Ananthanarayan, Medical microbiology. 7th ed. (2005).
7. Prescott L.M., Harley J.P., and Klein D.A. Microbiology, 6th Edition. MacGraw HillCompanies Inc. (2005)

BBTT--107: Introduction to Biotechnology

Lectures -36

Total Credit -02

Objectives:

- To make students aware of Biotechnology
- To introduce different areas in Biotechnology
- To introduce the applications of biotechnology in Health care

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, Renounced 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. B. D. Singh, Biotechnology (Kalyani Publishers 2020) Edition 4th, 225-319
2. Mohan P Arora, Biotechnology (Himalaya Publisher 2017) 161-193.
3. Dr. R.C Dubey, A text book in Biotechnology, (S.Chand and Co. Pvt. Ltd. 2006 edition)

BBTT-108: Computer Basics and Bioinformatics

Lectures-36

Total Credit: 02

Objectives:

- To make students aware of basics of computer & Operating System
- To introduce database Management System

UNIT I

(09)

Computer basics & Operating System: Computer basics: Definition, Block Dig.(I/O/Secondary storage), printer and its types, Control Panel, memory classification , Applications, Generations, Types of computer, Numbering system (binary to decimal & decimal to binary) 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- II

(09)

Office Operation: Microsoft Word-concept of toolbar, character, paragraph & document formatting, drawing toolbar, Header, Footer, Document editing, Page setup, short cut Keys, Text and graphics, Microsoft Excel-Concept of spreadsheet, Creating worksheet, Well formatted documents, concept of row, column, cell and formula bar, using function, using shortcuts, charts, conditional formatting. Power Point-Slide presentation, slide layout, Design, custom animation.

UNIT- III

(09)

Database Management System-Need of database, data models- E-R model, Hierarchical, Network, Relational, Object Oriented, Main components of DBMS-DDL, DML. Flowchart

UNIT- IV

(09)

Basics of Bioinformatics: Internet, World Wide Web, web browser, searching data from search engine. Creating user account, sending Email(uploading & downloading files)Basic services of Internet (ELECTRONIC MAIL, TELNET, INTRANET, EXTRANET) , Protocols (FTP, SMTP, TCP/IP, PPP etc.) Introduction to Bioinformatics, 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 computer & Operating System
- Student Should get Knowledge of Database Management System
- Student should be able to understand basics of Bioinformatics

References:

1. V.K. Puri, Digital Electronics circuits and systems Tata McGraw Hill Education (1 January 2006)
2. Priti Sinha, Pradeep K., Sinha, Computer Fundamentals: Concepts, Systems & Applications, BPB Publications; 6th edition (30 November 2004)
3. S. C. Rastogi, N. Mendiratta, P. Rastogi, Bioinformatics methods and applications, PHI Learning; 4th edition (22 May 2013)

BBTP 110- : Techniques in Chemistry and Biochemistry

Learning objectives:

- To teach students basic laboratory concepts of chemistry and biochemistry
- To demonstrate the students with concept of molarity, normality etc
- To provide the students with exposure of biochemical tests.

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. A .I. Vogel, Chemistry Text book of practical organic chemistry (British library cataloguing:1989)
2. Morrison & Boyd ,Organic Chemistry (Pearson Education India:2011)
3. J. Jayaraman, Practical Biochemistry (Shivaji shankara publisher: 2001)
4. David Plummer Practical Biochemistry (McGraw-Hill Book Company (U.K.) Ltd.:London 1978)

BBTP 111- : Laboratory Exercises in Plant Science

Learning Objectives:

- To teach students the Identification and classification of various plant material
- To make students user friendly to the microscopic techniques.
- To provide practical exposure plant Anatomy and Physiology.
- To demonstrate the basic knowledge of plant germination and seed

Total Credits: 02

| | |
|---|------|
| 1. Study of algae (<i>Nostoc, Sargassum</i>) | (01) |
| 2. Study of bryophyte (<i>Riccia / 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. R. C. Mathur, *Systematic Botany Angiosperms*. Agra: Agra Book Store (1963)
2. Peter B. Kaufman, *Practical Botany*. New York: Prentice Hall (1983)

BBTP--112 Laboratory Exercises in Microbiology and Instrumentation

Total Credits: 02

Learning Objectives:

- To teach students hands skills in microbial staining techniques
- To provide practical exposure to culture medium preparations.
- To provide practical exposure to different equipment's in laboratory.

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)

Learning Outcomes:

- Students will acquire the hands skills in microbial staining techniques
- Students will learn culture medium preparations.
- Students will be able to understand principle and handling of different equipment's in laboratory.

References:

1. Aneja K.R. Laboratory Manual of Microbiology and Biotechnology, /e Paperback (1 January 2018)
2. Michael J. Leboffe, Burton E. Pierce Microbiology Laboratory Theory & Application: Brief Loose Leaf – Import, (15 January 2012)
3. Ted Johnson, Christine Case Laboratory Experiments in Microbiology (What's New in Microbiology) Spiral-bound – Illustrated, (1 January 2018)

4. Zothansanga, B.Senthil Kumar Practical Microbiology - A Laboratory Manual Publisher: Panima Publishing Corporation, New Delhi, India,(2013)
5. Upadhyay Biophysical Chemistry Paperback – (1 January 2010)
6. B. Nagamani ,Bio Instrumentation Paperback – (1 January 2016)
7. L. Veerakumari, Bioinstrumentation Paperback – (1 January 2011)
8. Wilson/Walker, Principles and Techniques of Biochemistry and Molecular Biology Paperback – (14 July 2010)
9. Gerald D. Fasman Practical Handbook of Biochemistry and Molecular Biology Hardcover – Import, (31 March 1989)

BBTP- 113 Computer applications in Biology

Total Credits: 02

Learning Objectives:

- To teach students basic computer skills
- To teach students data presentation methods

Computer applications

| | |
|--|----|
| 1. Study of commands of word. | 01 |
| 2. Creation of worksheet with graphs | 01 |
| 3. Power Point presentation | 01 |
| 4. Write program to convert temperature in Celsius into Fahrenheit | 02 |
| 5. Write program to find area of circle | 02 |
| 6. Write program to find given number is even or odd. | 02 |
| 7. Write program to display Fibonacci series | 02 |
| 8. Data Presentation: Bar Diagrams, Histograms, Frequency Curves, Pie Chart, Scatter Plot | 02 |

Learning Outcomes:

- Students will acquire the knowledge of basic computer skills
- Students will learn data presentation using computer programs and software's.

Reference:

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

SEMESTER II

| Subject Code | Title of Paper |
|---------------------|---|
| BBTT-201 | Chemistry-II |
| BBTT-202 | Proteins and Enzymes |
| BBTT-203 | Animal Science |
| BBTT-204 | Physics-II |
| BBTT-205 | Biotechniques and Instrumentation-II |
| BBTT-206 | Basics in Microbiology II |
| BBTT-207 | Biostatistics |
| BBTT-208 | Computer Basics and Bioinformatics |
| BBTP-210 | Laboratory Exercise in Chemistry and Biochemistry-II |
| BBTP-211 | Laboratory Exercise in Animal Science |
| BBTP-212 | Laboratory Exercise in Microbiology and Instrumentation |
| BBTP-213 | Laboratory Exercise in methods in Statistics |

BBTT 201: Chemistry-II

Lectures -36

Total 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, stereochemistr

References-

1. C. N. R. Rao, University general chemistry, macmillan india ltd-new delhi, 1st, (2000)
2. Robert A. Alberty, Physical chemistry (Wiley Eastern Ltd., Times Roman by Publication Services, Inc. 4th edition)
3. B. K. Sen, Quantum chemistry including molecular spectroscopy McGraw Hill Education, (1992)
4. Donald J. Cram, George S. Hammond Organic chemistry McGraw-Hill Inc.,US; International student edition (1 December 1964)
5. Peter Sykes ,A Guide-book to mechanism of organic chemistry, Pearson Education; 6th edition (1 January 2003)
6. G.S. Manku, Theoretical principles of inorganic chemistry McGraw-Hill Education; New edition (1 August 1982)
7. B. R. Puri , L.R.Sharma, Physical chemistry, Vishal Publishing Co.; 1st edition (1 January 2020)
8. Dr. G.R. Chatwal , Sham Anand Instrumental methods of chemical analysis- Hph (1 January 2011)
9. Dr.B. K. Sharma, Instrumental methods of chemical analysis- Krishna Prakashan Media, (1981)
10. I. L. Finar ,Organic chemistry VOL-II 5th Edition(2011)
11. J.D. Lee, Concise in inorganic chemistry, Oxford University Press; Fifth edition (1 February 2008)
12. Elaine A. Moore, Lesley E. Smart, Solid State Chemistry: An Introduction. CRC Press; Fifth edition (29 June 2012)
13. T. Pradeep, Nano the Essentials: Understanding Nanoscience and Nanotechnology. McGraw Hill Education; 1st edition (1 July 2017)
14. Jurgen Schulte , Nanotechnology: Global Strategies, Industry Trends and Applications. Wiley; 1st edition (11 March 2005)

BTT- 202 PROTEINS AND ENZYMES

Lectures -36

Total 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 Lehninger Principles of Biochemistry, 5th Edition, WH Freeman and Company, New York, USA. (2004)
2. U. Satyanarayanan, Biochemistry Elsevier; 4th edition (15 June 2013)

3. Trevor Palmer, P L Bonner Enzymes: Biochemistry, Biotechnology, and clinical Chemistry, 2nd Edition, Woodhead Publishing, (2007).
4. J. L. Jain, Fundamentals of Biochemistry, S. Chand Pub. (2004)
5. Donald Voet, Judith G. Voet, Charlotte W. Pratt, Fundamentals of Biochemistry, 5th Ed. John Wiley and Sons Inc, New York, USA (2016).

BBTT- 203: Animal Science

Lectures -36

Total 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 e 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. R .L. Kotpal, Modern Textbook of Zoology : Invertebrates, India,Rastogi Publications, Rastogi Publications; (2014)
2. ,R.L. Kotpal, Modern Textbook of Zoology : Vertebrates India, Rastogi Publications ,(2019)
3. E.L. Jordan, and P.S. Verma (i) Chordate Zoology S. Chand & Company Ltd. Ram Nagar. New Delhi.(1978)
4. E.L. Jordan, and P.S Verma (ii) Invertebrate Zoology. S. Chand &Company Ltd. Ram Nagar. New Delhi.(1978)
5. R.L.Kotpal., Modern Text Book of Zoology: Invertebrates , Rastogi Publications, 2012.
6. K D Chatterjee ,Parasitology (Protozoology and Helminthology) ,CBS publications,India,; 13th edition (1 January 2019)
7. F.E.G Cox ,Modern Parasitology : A Textbook of Parasitology , USA, Wiley-Blackwell & Sons ,2 nd edition ,(1993)
8. Tortora and Derrickson,Tortoras Principles of Anatomy and Physiology ,wiley,15Th edition ,(2017)
9. Arthur C. Gyton ,John E.Hall ,Textbook of medical Physiology (Gyton Physiology) Saunders; 9th edition ,(1995)
10. G.S.Shukla and V.B.Upadhyay ,Appliedand Economic Zoology , Rastogi Publications; First Edition ,(2014)
11. V .G Jhingran , Fish and Fishreis of india, Hindusthan Pub.Corporation, Delhi, India, (1991)
12. J.E Bardarch, J.H.Ryther ,W.O.Mclarney,Aquaculture:The farming and Husbandary of fresh water and Marine organisms,Wiley India PvtLtd,(2013)

BBTT 204: Physics- II

Lectures -36

Total 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, Brags

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. Devid Hallday Roberet Resnik, Physics by (Vol-I and Vol-II) Wiley; Fifth edition (1 January 2007)
2. S. K. Saxena, Fundamental of mechanics, Himalaya Publications (2012)
3. Aurthur Beiser, Perspectives of modern physics, McGraw-Hill Inc.US (1 January 1969)
4. Mark Zemansky, Richard Dittman, Heat and thermodynamics, McGraw Hill Education; 8th edition (1 July 2017).
5. Francis Jenkins, Harvey White, Fundamentals of optics, McGraw Hill Education; 4th edition (1 July 2017)
6. N. Subrahmanyam Brijlal, Text book of optics, Schand; 23rd Rev. Edn. 2006 edition (1 December 2006)
7. Ajoy Ghatak ,Optics, McGraw Hill Education India Private Limited; Sixth edition (1 July 2017)
8. D. S. Mathur, Properties of matter, S Chand & Company (1 December 2010)
9. Suhas Sukatme ,Solar energy, McGraw-Hill Education, (1st April 1984)
10. V. K. Mehta, Rohit Mehta Principle of electronics, S Chand; 7th edition (3 February 2014)
11. Donald P. Leach, Albert Paul Malvino, Digital principles and application, McGraw-Hill Education; 5th edition (30 April 1994)

BTT-205: Bio techniques and Instrumentation-II

Lectures -36

Total 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. Nath and Upadhyaya, Biophysical Chemistry (Himalaya Publication House:2009)
2. Wilson and Walker, Practical biochemistry principles and techniques (Cambridge University Press:2000)
3. James Miller, John Wiley and Sons, Inc. Chromatography: Concepts and Contrasts (John Wiley & Sons Inc:11 September 2009)
4. L. Veera Kumari Bioinstrumentation (MJP Publishers:2006)

BBTT 206- Basics in Microbiology–II

Lectures -36

Total 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. John L. Ingraham, Catherine A. Ingraham Introduction to Microbiology: A Case-History Study Approach 3rd Edition (April 14, 2003)
2. John M. Madigan, Michael T.; Martinko Brock Biology Of Microorganisms 11th edition Perfect Paperback (January 1, 2006)
3. Prescott, Lansing M.; Harley, John P; Klein, Donald A. Microbiology 6th edition published by McGraw-Hill Science/Engineering/Math Hardcover Unknown Binding – (March 2, 2004)
4. Patel A H ,Industrial Microbiology Paperback (1 January 2011)
5. C K Jayaram Paniker; R Ananthanarayan, Text book of microbiology, 7th ed, Himayatnagar,(2005)
6. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg.Microbiology, 5th Edition, Tata McGraw Hill Press(1993)
7. 7 A.J. Salle Fundamental Principles of Bacteriology Paperback (1 March 1984)
8. R.Y. Stanier General Microbiology Paperback – Import, (8 September 1987)
9. Gerard J. Tortora Berdell R. Microbiology: An Introduction Hardcover – Import, (31 December 2014)
10. Peter F Stanbury, Allan Whitaker Principles of Fermentation Technology Paperback (14 September 2016)

BBTT--207-: Biostatistics

Lectures -36

Total 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. S.C. Gupta & V. K. Kapoor, Fundamental of mathematical statistics (Sultan chand & sons 2014)

2. Dr. V. R. Prayag and Dr. Dixit P. G., A text book of paper- I for B.Sc. I, (Nirali Publication, Pune 2020)
3. H.M. Walker and J. Lev, Elementary Statistical methods (Holt, Rinehart & Winston of Canada Ltd; 3rd Revised edition)
4. Rohatgi V. K. and Ehsanes A. K. Md, An Introduction to probability and statistics (Wiley India Pvt. Ltd.).
5. Meyer P. L., Introduction, probability, and statistical Application. Addison Wesley. (Generic Publications 1970)
6. Cochran W.G., Sampling Techniques, (Wiley Eastern Ltd., New Delhi. 1977)
7. Des Raj, Pramod Chandak, Sampling theory (Createspace Independent Pub. 2013).

BBTT--208: Computer Applications

Lectures-36

Total Credits: 02

Objective:

- To understand basics of Programming Algorithm.
- To understand basics of C- Language.
- To get Knowledge about Array.

Unit I

(09)

Introduction to Programming Algorithm, Flowchart, Fundamentals of C, Character set, keywords, identifiers, data types, constants, symbolic constants

Unit- II

(09)

Escape sequences, variables. arithmetic, relational & logical operators, type conversions in expressions. Input/output Printf(), scanf(), getchar(), putchar(), gets(), puts(), enum, sizeof(), operator Formatting input/output.

Unit- III

(09)

Control Structures & Array If, if..else, nested if, switch statement, while loop , do.. while loop, for loop, continue & break statement.

Unit- IV

(09)

Array- declaration, initialization of One dimensional & two dimensional array, character array,

Learning Outcomes:

- Student should be able to understand basics of Programming Algorithm.
- Student should be able to understand basics of C Language.
- Student should get Knowledge about Array.

Reference:

1. Y. Kanetkar, Let us C BPB publication 12th Edition.
2. Herbert Schildt , C -The Complete Reference, 4th Edition.

BBTT 210- : Techniques in Chemistry and Biochemistry-II

Credits: 02

Learning Objectives:

- To teach students estimation of some compounds and elements.
- To impart practical knowledge of preparation of solutions.
- To provide practical exposure of inorganic compound preparations

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 α - 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. A .I. Vogel, Chemistry Text book of practical organic chemistry (British library cataloguing:1989)
2. Morrison & Boyd ,Organic Chemistry (Pearson Education India:2011)
3. J. Jayaraman, Practical Biochemistry (Shivaji shankara publisher: 2001)
4. 4. David Plummer Practical Biochemistry (McGraw-Hill Book Company (U.K.) Ltd.:London1978)

BBTP-- 211: Laboratory Exercises Animal Science

Credits: 02

Learning Objectives:-

- To develop the skill in dissection and microscopy needed for research work in animal sciences.
- To teach basics of Parasitology.
- To teach practical knowledge related to Blood.
- To impart practical knowledge in applied zoology like –Sericulture, Apiculture, Vermiculture.

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

References:-

1. S .S. Lal, Practical zoology Vertebrate, Rastogi Publications,India, (2015)
2. S .S. Lal, Practical zoology Invertebrate, Rastogi Publications,India, (2015)

BTTP--212 -: Laboratory Exercises in Microbiology and Instrumentation

Credits: 02

Learning Objectives:

- To provide students the basic knowledge about isolation and characterization of microorganisms.
- To teach practical skills of microbial culture and screening techniques.
- To provide hands on experience of instruments and basic laboratory techniques.

Microbiology

- | | |
|---|----|
| 1. Mounting and identification of <i>Aspergillus</i> , <i>Mucor</i> | 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 <i>E.coli</i> , <i>Bacillus</i> 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 |

Learning Outcomes:

- Students will acquire the basic knowledge about isolation and characterization of microorganisms.
- Students will gain practical skills of microbial culture and screening techniques.
- Students will be able to use instruments and understand basic laboratory techniques.

References:

1. Aneja K.R.Laboratory Manual of Microbiology and Biotechnology, Paperback (1January 2018)
2. Michael J. Leboffe, Burton E. Pierce Microbiology Laboratory Theory & Application: Brief Loose Leaf – Import, (15 January 2012)
3. Ted Johnson, Christine Case Laboratory Experiments in Microbiology (What's New in Microbiology) Spiral-bound – Illustrated, (1 January 2018)

4. Zothansanga, B.Senthil Kumar Practical Microbiology - A Laboratory Manual Publisher: Panima Publishing Corporation, New Delhi, India,(2013)
5. Upadhyay Biophysical Chemistry Paperback – (1 January 2010)
6. B. Nagamani ,Bio Instrumentation Paperback – (1 January 2016)
7. L. Veerakumari, Bioinstrumentation Paperback – (1 January 2011)
8. Wilson/Walker, Principles and Techniques of Biochemistry and Molecular Biology Paperback – (14 July 2010)
9. Gerald D. Fasman Practical Handbook of Biochemistry and Molecular Biology Hardcover – Import, (31 March 1989)

BBTP--213 -: Laboratory Exercises in Methods in Statistics

Credits: 02

Learning objectives:

- To teach student simple applied statistics.
- To provide knowledge about Frequency distribution.
- To teach how to draw the statistical inference based on the statistical tools and techniques.

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.: χ^2 , t, f. 02
6. Statistical analysis using SPSS software, R software 02

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