Shivaji University, Kolhapur

Revised Syllabus For Bachelor of Science Part – I : Biotechnology (Entire)

Syllabus to be implemented from June, 2013 onwards.

1. **TITLE : Biotechnology (Entire)**

2. **YEAR OF IMPLEMENTATION**:- Revised Syllabus will be implemented from June, 2013 onwards.

3. **PREAMBLE:**

This syllabus is framed to give sound knowledge with understanding of Biotechnology to undergraduate students at first year of three years of B.Sc. Biotechnology (Entire) degree course.

Students learn Biotechnology as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of Biotechnology popular, interesting and encouraging to the students for higher studies including research.

The new and updated syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields.

The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. **GENERAL OBJECTIVES OF THE COURSE:**

1) To make the students knowledgeable with respect to the subject and its practicable applicability.
2) To promote understanding of basic and advanced concepts in Biotechnology.
3) To expose the students to various emerging areas of Biotechnology.
4) To prepare students for further studies, helping in their bright career in the subject.
5) To expose the students to different processes used in industries and in research field.
6) To prepare the students to accept the challenges in life sciences.
7) To develop skills required in various industries, research labs and in the field of agriculture, food, human health.

5. **DURATION**

- **The course shall be a full time course.**

6. **PATTERN:-**

Pattern of Examination will be Semester.

7. MEDIUM OF INSTRUCTION:

The medium of instruction shall be in English.

8. STRUCTURE OF COURSE-

(Note – The structure & title of papers of the degree as a whole should be submitted at the time of submission / revision of first year syllabus.)

1)

FIRST SEMESTER --------- (NO.OF PAPERS 9)

Semester I

Course Code/Paper		Theory
BTE-101	Paper-I	50
BTE-102	Paper-II	50
BTE-103	Paper-III	50
BTE-104	Paper-IV	50
BTE-105	Paper-V	50
BTE-106	Paper-VI	50
BTE- 107	Paper-VII	50
BTE- 108	Paper-VIII	50
BTE-109	Paper-IX	50

Note :- Practical Examination will be Conducted Annually

SECOND SEMESTER--------- (NO.OF PAPERS 9)

Semester II

Course Code/Paper		Theory
BTE-201	Paper-X	50
BTE-202	Paper-XI	50
BTE -203	Paper-XII	50
BTE - 204	Paper-XIII	50
BTE - 205	Paper-XIV	50
BTE - 206	Paper-XV	50
BTE - 207	Paper-XVI	50
BTE - 208	Paper-XVII	50
BTE-209	Paper-XVIII	50
Practicals (Annual)		
BTE-211	Practical - I	50
BTE-212	Practical -II	50
BTE-213	Practical -III	50
BTE-214	Practical -IV	50

Note :- Practical Examination will be Conducted Annually

2) OTHER FEATURES :

(A) LIBRARY :

Reference and Text Books, Journals and Periodicals, Reference Books for Advanced Books for Advanced studies. – List Attached

(B) SPECIFIC EQUIPMENTS : Necessary to run the Course.
OHP, Computer, L.C.D., Projector

(C) LABORATORY SAFETY EQUIPMENTS :

1) **Fire extinguisher**
2) **First aid kit**
3) **Fumigation chamber**
4) **Stabilized power supply**
5) **Insulated wiring for electric supply.**
6) **Good valves & regulators for gas supply.**
7) **Operational manuals for instruments.**
8) **Emergency exits.**

Semester I

Course Code/Paper		Title of the Course	Theory
BTE-101	**Paper-I**	**Chemistry –I**	**50**
BTE-102	**Paper-II**	**Physics-I**	**50**
BTE-103	**Paper-III**	**Plant Science**	**50**
BTE-104	**Paper-IV**	**Mathematical Methods**	**50**
BTE-105	**Paper-V**	**Biomolecules**	**50**
BTE-106	**Paper-VI**	**Biotechniques and Instrumentation**	**50**
BTE-107	**Paper-VII**	**Microbiology- I**	**50**
BTE-108	**Paper-VIII**	**Computer Basics and Bioinformatics**	**50**
BTE-109	**Paper-IX**	**English for Communication-I**	**50**

Note :- Practical Examination will be Conducted Annually

BTE 101- Paper-I : Chemistry- I

Topic No.	Unit	Lectures 45
	Unit- I	
1.	**Electrochemistry** (Reduction potentials 4. to be used) 1.1 Introduction- Conductance- Definition and types. 1.2 Kohlrausch law- Statement and its applications. 1.3 Galvanic cells, half-cell potentials, emf.- meaning and definition. 1.4 Thermodynamics of electrode potentials, Nernst equation and its derivation, K from cell emf, determination of ΔG, ΔH and ΔS. 1.5 Types of electrodes, construction and working of calomel and glass electrodes. 1.6 Numerical Problems.	**13**
2.	**Reaction Kinetics** 2.1 Introduction-Meaning and definitions of- rate constant, order and molecularity of reaction, activation energy. 2.2 Integrated rate expressions for zero,1st and 2nd order reactions. 2.3 Characteristics of 1st order reactions. 2.4 Catalysis- Definition, types of catalysis with example, characteristics of catalysis. 2.5 Elementary enzyme catalyzed reactions- Meaning and examples. 2.6 Numerical problem	
	Unit- II	
3.	**Thermodynamics** 3.1 Introduction- Reversible and irreversible processes, internal energy. 3.2 Enthalpy, heat of reaction and its types, First Law- Statement and mathematical expression, Hess law. 3.3 Measurement of ΔH, Trouton's rule, Kirchoff's equation. 3.4 Second law- Statement, concept of entropy (Criteria for spontaneous and non-spontaneous processes). 3.5 Third law-Absolute entropies and their uses. 3.6 Gibbs and Helmholtz free energy functions-Criteria for thermodynamic equilibrium and spontaneity. 3.7 ΔG and K, ΔG and work function.. 3.8 Relation between ΔH and ΔG(Gibbs-Helmholtz equation). 3.9 Phase equillibria- Clapeyron-Clausis equation and its applications. 3.10 Numerical problems.	**12**
	Unit- III	
4.	**Structure and Bonding.** 4.1 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. 4.2 VBT- Postulates. 4.3 Concept of Hybridization, sp, sp2, sp3 hybridization with respect to $BeCl_2$, BF_3, $SiCl_4$(Along with consequences with respect to bond length, bond angle, bond energy and shape of the molecule. 4.4 Dipole moment- Definition and significance. 4.5 Hydrogen bonding- Definition, intra and intermolecular hydrogen bonding with suitable example (Proteins, alcohols, Hydroxy acids, Zhenols). 4.6 Ionic solids- Definition and general characteristics, comparison between, ionic and covalent compounds.	**11**
	Unit- IV	
5.	**Coordination Complexes**	**09**

	5.1 Definition and formation of Co-ordinate bond in $BF_3 \leftarrow NH_3$ & NH_4^+ 5.2 Distinction between double salt and complex salt 5.3 Description of terms Ligand, Co-ordination number (CN), Co-ordination sphere. 5.4 Essential and trace elements in biological process, Metallo porphyrins w.r.t. Hemoglobin and Myoglobin.	

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 Glassstone
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

BTE 102 – (Paper-II) : Basics in Physics

Topic No.	Unit	Lectures 45
1.	**Unit- I** **Elasticity:** Introduction, definitions of stress and strain in solids, types of strain and stress, Hooks law, definition of Young's modulus (Y), bulk modulus (K) and modulus of rigidity (□), relation between Y, □, and K (without derivation), stress strain curve, importance of elasticity .	**9**
2.	Unit- II **Viscosity and Surface Tension** Introduction, streamline and turbulent flows, concept of viscosity, coefficient of viscosity, effect of temperature and pressure on viscosity of liquids, concept of pressure energy and Bernoulli's theorem (without proof), Application of Bernoulli's eoremventurimeter, Pitots tube (working only), review of surface tension, surface energy, capillary action, angle of contact, wetability, relation between surface tension, excess pressure and curvature (without derivation), factors affecting surface tension, methods of measurement of surface tension- Jaegers method (formula and working only), applications of surface tension.	**13**
3.	Unit- III **Sound waves:** Introduction, mechanical and electromagnetic waves, transverse and longitudinal waves with characteristics, principle of superposition of waves (Statement only), phenomenon of beats and expression for	**11**

	frequency of beats, application of beats, audible, ultrasonic and infrasonic waves, properties of ultrasonic waves and their applications, Doppler effect and its applications	
4.	Unit- IV **Thermodynamics and Thermometry:** Introduction, various temperature scales (Kelvin, Celsius, Fahrenheit, Reaumer and Rankin), thermal energy, platinum resistance thermometer-principle, construction and working,	**12**

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. Subrahmanyan 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 Publication
14. Biophysics, Vastala Piramal, Dominent Publishers and Distributor

BTE 103, (Paper-III) : Plant Science

Topic No.	Unit	Lectures 45
1.	**Unit-I** **Plant Diversity** 1.1 Outline of General Classification of Plant Kingdom. 1.2 Algae – General characters and economic importance 1.3 Fungi – General characters and economic importance 1.4 Lichens -General account and economic importance 1.5 Bryophytes – General characters and economic importance 1.6 Pteridophytes – General characters and economic importance 1.7 Gymnosperms – General characters and economic importance 1.8 Angiosperms – General characters and economic importance	**13**
2.	**Unit-II** **Taxonomy of Angiosperms** 2.1 Taxonomy :- Definition, Aims, objectives and functions 2.2 Binomial nomenclature and its significance 2.3 Principles of ICBN 2.4 Study of outline of Bentham and Hooker's system of Classification of plants.	**10**

3.	**Unit- III** **Sexual Reproduction in Angiosperms:-** 3.1 Structure of Typical Flower – Floral whorls and functions:-Calyx, corolla, Androecium, Gynoecium. 3.2.Pollination- Definition, Types –Self and Cross, Advantages of Self and Cross Pollination 3.3 Development of male and female gametophyte 3.4 Fertilization:- Definition, Double fertilization and its significance 3.5 Fruit- Definition, formation, Types:-.a)Simple- i) Dry- Dehiscent Legume-Pea, ii) Indehiscent Caryopsis-Maize, ii) Fleshy- Indehiscent Drupe- Mango b) Aggregate - Etaerio of drupes- Custard apple c) Composite - i)) Sorosis- Pine apple ii) Syconus- Fig 3.6 Parthenocarpy- Definition and significance.	**12**
4.	**Unit- IV** **Seed and Plant Anatomy** 4.1 **Seed** –Definition, Formation, structure of Monocot and Dicot seed 4.2 Dormancy of seed- Definition, Causes and Breaking of seed dormancy. 4.3 Seed germination- Concept, Types-Epigeal and Hypogeal, factors affecting seed germination. **Plant Anatomy** 4.4 Tissues- Simple and complex (Xylem and Phloem) 4.5 Primary structure of Dicot stem and root(Sunflower) 4.6 Primary structure of Monocot stem and root(Maize) 4.7 Normal secondary growth in Dicot stem(Sunflower)	**10**

References:

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

BTE104-(Paper-IV) : Mathematical Methods

Topic No.	Unit	Lectures
1.	**Unit- I** **Complex Numbers** 1.1 Introduction 1.2 Operations on complex numbers. 1.3 Complex conjugate, Modules and argument of complex number and simple examples on it. 1.4 DE MOIVRE'S Theorem. 1.5 Simple examples on above theorem	**10**
2.	**Unit- II** **Matrices** 2.1 Definition and types of Matrices 2.2 Algebra of Matrices (addition, subtraction, scalar multiplication and multiplication of matrices) 2.3 Examples on operation of Matrices 2.4 Characteristic Polynomial Equation; Caley Hamilton theorem with Proof, Inverse of matrix using Caley Hamilton Theorem 2.5 Rank of a Matrix (Definition) and examples. 2.6 System of Linear equation. i) Non homogenean ii) Homogenean with examples 2.7 Eigen values and eigen vectors with simple examples.	**13**
3.	**Unit- III** **Differential equation** 3.1 Definition of ordinary differential equation and degree, order of differential equation 3.2 Exact differential equation with simple examples. 3.3 Linear differential equation $\frac{dy}{dx} + py = Q$ method of solution with simple examples. 3.4 Bernoulli's differential equation with examples. 3.5 Application of differential equation i) Growth and decay problems ii) Newton's law of cooling with examples	**10**
4.	**Unit- IV** **Partial differentiation** 4.1 Introduction 4.2 Simple examples on evaluation of partial derivatives 4.3 Composite function with examples 4.4 Homogenous function (Definition) 4.5 Euler's theorem for first and second order. 4.6 Simple examples on above theorems. 4.7 Maxima and Minima (Two variables)	**12**

Reference books:

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

BTE 105 – (Paper-V) : Biomolecules

Topic No		Lectures 45
1.	**Unit- I** **Origin of life** 1.1 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. 1.2 PH, pk value definition, H-H Equation, Biological bufeer systems- e.g. Phosphate, Bicarbonate, Hemoglobin buffer system, Protein buffer system	**10**
2.	**Unit- II** **Nucleic acids:** Nucleosides, nucleotides, polynucleotide, DNA and its different forms with properties. (A, B, C, D, & Z), RNA and its types.- m-RNA, t-RNA. r-RNA Forces Stabilizing nucleic acid structure.	**11**
3.	**Unit- III** **Carbohydrates:** Classification, glyceraldehydes, simple aldoses & ketoses, confirmation of D-glucose, biological importance of carbohydrates, reactions of monosaccharide (Oxidation, reduction, osazone), glycosidic bond, disaccharides (Sucrose, maltose, lactose), polysaccharides- homo polysaccharides- (Starch, glycogen, Cellulose.)	**12**
4.	**Unit- IV** **Lipids** 4.1 Classification,- Simple lipid- Triacyl glycerol & waxes .Compound lipid- Phospholipid e.g- Phosphotidyl choline, ethanolamine Glyserolipid, Sphingolipids fatty acids (Physical properties,- state,color, odour,melting point, solubility, specific gravity, geometric isomerism, insulation, emulsification ,surface tension. 4.2 Chemical properties- sap value, acid value, iodine no., rancidity); (Sphingomycelin, cerebrosides, gangliosides); Derived lipid- Cholestrol lipoprotein- LDL,VLDL, HDL ,Chylomicrons. Liposome.	**12**

References:-

1) Biochemistry – Nelson & Cox
2) Biochemistry - Stryer
3) Enzymes - Trevor Palmer
4) Biochemistry - Voiet & Voiet
5) Biochemistry - J. L. Jain
6) Basic Biophysics- M. Daniel
7) Biochemistry - Powar and Chatwal
8) Protein Purification- Harris and Angel
9) Principles of Biochemistry - T. N. Pattabriraman.
10) Biochemistry 3rd Edition – Hames & Hopper.
11) General Biochemistry – J. H. Well.
12) Biochemistry – J. H. Ottaway & D. K. Apps
13) Biochemistry – Trchan
14) Text Book of Biochemistry- R. A. Joshi.
15) Biochemistry – U. Satyanarayanan
16) Biochemistry a Functional Approach – Robert W McGilvery & Goldstein
17) Text Book of Biochemistry – A.V. S. S. Rama Rao
18) Clinical Biochemistry –Praful B. Godkar.

BTE 106-(Paper-VI) : Biotechniques and Instrumentation

Topic No.	Unit	Lectures 45
1.	**Unit - I** **Chromatography :** Introduction, Theory, Principle and applications of Thin layer chromatography, paper chromatography, column chromatography, size exclusion chromatography, Ion exchange chromatography, Affinity chromatography, HPLC, GLC. **Electrophoresis-** Introduction, Principle, theory and applications of paper electrophoresis, Agarose gel Electrophoresis, PAGE.	**12**
2.	**Unit- II** **UV-Visible Spectroscopy** 2.1 Introduction of spectroscopy, properties of electromagnetic radiation, Electromagnetic spectrum, 2.2 Electronic Transitions and designation of UV-bands. 2.3 General applications, spectrum, isolated double bonds, conjugated dienes, carbonyl compounds, aromatics. 2.4 Analytical uses. 2.5 Lambert-Beer's law 2.6 Principle, Instrumentation with respect to colorimeter and single beam spectrophotometer. 2.7 Principle, Instrumentation, Applications of UV and Visible spectroscopy.	**11**
3.	**Unit III** **Microscopy** a] General principles of microscopy- Image formation, magnification, numerical aperture (Uses of oil immersion objective), resolving power of microscope and working distance. b] Ray diagram, special features, applications and comparative study of compound microscope and Electron Microscope (Scanning and Transmission Electron Microscope). **Centrifugation-** Basic principles, RCF, Sedimentation coefficient, Svedberg's constant. Types of centrifuge: Desktop, High speed and Ultracentrifuge, Preparative centrifugation: Differential and density gradient centrifugation, applications	**13**
4.	**Unit- IV** **Basic Laboratory Instruments:** Principle, working and application of pH meter, Conductometer, Colorimeter, Refractometer, Autoclave, Laminar Air Flow.	**09**

References:-

1) Biophysical Chemistry by Nath and Upadhya.
2) Practical biochemistry principles and techniques by Wilson and Walker.
3) Instrumental methods of chemical analysis by Chatwal and Anand.
4) Lab Manual in Biochemistry by J. Jayaraman.
5) Chromatography: Concepts and Contrasts- 1988 James Miller, John Wiley and Sons, Inc.
6) Analytical Biochemistry by Holme.
7) Spectroscopy by B.P. Straughan and S. Walker
8) Introduction to HPLC by R.J. Hamilton and P.A. Sewell

BTE 107 – Paper-VII : Basics in Microbiology

Topic No.	Topics	Lectures 45
1.	**Unit-I** **Microbiology :** Definition, History, Introduction to types of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses, Beneficial and harmful activities of microorganisms, Applied branches of Microbiology, major microbiological institutes in India. **Morphology and cytology of Bacteria** A. Morphology of Bacteria – i) Size, ii) Shape, iii) Arrangements B. 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 C. Viruses- General characteristics and Cultivation, lytic cycle of T4 bacteriophage.	**13**
2.	**Unit- II** **A) Bacterial taxonomy:** 1. General principles of bacterial nomenclature.- a) Taxonomic ranks b) Common or Vernacular name c) Scientific or International name 2. Criteria for bacterial classification- Morphological, cultural, biochemical & serological characters. 3. Concept of bacterial species & strain. **B) Microbial nutrition** 1) Nutritional requirements of microorganisms : Water; Micronutriets; Macronutrients; Carbon, Energy source; Oxygen and Hydrogen; Nitrogen, Sulpher and Phosphorous and growth factors- auxotroph,prototroph and fastidious organisms. 2) Nutritional types of microorganism based on carbon and energy sources. a. Autotrophs b. Heterotrophs c. Phototrophs d. Chemotrophs e. Photoautotrophs f. Chemoautorphos g. Phtoheterotrophs h. Chemoheterotrophs.	**12**
3.	**Unit- III** **Concept of Sterilization:-** **Definitions of:** Sterilization, Disinfection, Antiseptic, Germicide, Microbiostasis, Asepsis, Sanitization. **Methods of sterilization by-** **a) Physical agents:** i) temperature-dry heat, moist heat ii) Radiation- U.V, Gamma radiation iii) Bacteria proof filter- membrane filter. **b) Chemical agents:-** Phenol & Phenolic compounds, Alcohol, Heavy metals(e.g. mercury). **c) Gaseous agents-** Ethylene oxide, formaldehyde.	**09**
4.	**Unit- IV** **Stains and staining procedures -** A. Definition of dye and stain	**11**

	B. Classification of stains – Acidic, Basic and Neutral C. Principles, Procedure, Mechanism and application of staining procedures i) Simple staining ii) Negative staining iii) Differential staining : Gram staining and Acid fast staining iv) Special staining: Capsule staining, cell wall staining, endospore staining	

References:

1) General microbiology-Stanier
2) Introduction to microbiology-Ingraham
3) Brock biology of microorganisms-Madigan et al
4) Fundamentals of microbiology-Frobisher
5) Microbiology-Pelczar
6) General microbiology –Pawar & Daginawala
7) Text book of microbiology-Ananthanarayan

BTE 108 – (Paper-VIII) : Computer Basics and Bioinformatics

Topic No.	Unit	Lectures 45
1.	**Unit- I** **Computer basics & Operating System:** 1.1 Computer basics: Definition, Block Dig.(I/O/Secondary storage), Applications, Generations, Types of computer, Numbering system (binary to decimal & decimal to binary) 1.2 Operating System: Definition, functions, process management, multiprogramming, multitasking, multiprocessing, time sharing, memory management, uniprogramming, memory model, multiprogramming, memory model, virtual memory, security, some popular O.S., Ms-DOS, Microsoft Windows, Unix	**12**
2.	**Unit- II** 2.1 **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. 2.2 PowerPoint-Slide presentation, slide layout, Design, custom animation.	**12**
3.	**Unit- III** **Database Management System-**Need of database, data models-Hierarchical, Network, Relational, Object Oriented, Main components of DBMS-DDL, DML.	**11**
4.	**Unit- IV** 4.1 **Basics of Bioinformatics:** Internet, world wide web, web browser, search engine (Google), searching data from search engine. 4.2 **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.	**10**

References :-

1) Computer Fundamentals by P. K. Sinha
2) C Application programs and Projects by Pramod Vasambekar
3) Use of Computer from Vision Publication
4) Let Us C by Kanetkar
5) Ansi C by Balgurusami

Semester II

Course Code/Paper		Title of the Course	Theory
BTE-201	**Paper-X**	**Chemistry –II**	**50**
BTE-202	**Paper-XI**	**Physics-II**	**50**
BTE -203	**Paper-XII**	**Animal Science**	**50**
BTE-204	**Paper-XIII**	**Statistical Methods**	**50**
BTE-205	**Paper-XIV**	**Proteins and Enzymes**	**50**
BTE-206	**Paper-XV**	**Basics in Cell Biology**	**50**
BTE-207	**Paper-XVI**	**Microbiology- II**	**50**
BTE-208	**Paper-XVII**	**Computer Programming**	**50**
BTE-209	**Paper-XVIII**	**English for Communication-II**	**50**
Practicals (Annual)			
BTE-211	**Practical - I**	**Techniques in Chemistry and Biochemistry**	**50**
BTE-212	**Practical -II**	**Laboratory Exercises in Microbiology and Instrumentation**	**50**
BTE-213	**Practical -III**	**Laboratory Exercises in Plant Science and Animal Science**	**50**
BTE-214	**Practical -IV**	**Methods in Mathematics, Statistics and Computer applications in Biology**	**50**

Note :- Practical Examination will be Conducted Annually

BTE 201 –Paper-X Chemistry –II

Topics	Unit	Lectures 45
1.	**Unit I** **Fundamentals and Mechanistic Basis of Organic Reaction** 1.1 Introduction ,Reaction mechanism-Definition, curved arrow notation, substrate , Reagents, Types of reagents, types of reactions, Reactive intermediate Carbocataion, Carbanion, Carbon Free radicals SN1 and SN2 mechanisms (Hydrolysis of t-butyl halide and primary alkyl halide) with energy profile diagram. 1.2 Elimination reactions- E1 and E2 mechanisms (Dehydration of alcohol), Hoffman's and Saytzeff's rules- statements and justifications. 1.3 Addition reactions- Electrophilic addition reactions in alkenes (Markovnikoff and anti-Markovnikoff additions), nucleophilic addition reactions of carbonyl compounds (cyanohydrin formation). 1.4 Concept of an aromaticity. 1.5 Mechanism of SE reactions in benzene- Nitration, sulphonation, halogenation, diazotization, Friedel-Craft's alkylation and acylation reactions. 1.6 Orientation effects as exemplified by– NO_2, OH functional groups.	**13**
2.	**Unit-II** **Stereochemistry** 2.1 Geometrical isomerism in alkenes. 2.2 Optical activity-Plane polarized light (PPL), Polarimeter, specific rotation, 2.3 Chirality- Chiral molecules, symmetry elements, asymmetric carbon, compounds with one and two chiral centers, diastereomers, enantiomers, tartaric acid 2.4 E-Z and R-S nomenclatures. 2.6 Numerical Problems	**10**
3.	**Unit- III** **Radioactivity :** **Introduction**, properties of alpha, beta and gamma radiation, Neutron-proton ratio and nuclear Stability, Process of radioactive decay, radioactive decay energy, rate of radioactive decay, units of radioactivity, Dosimeter: Absorbed dose(D), Dose equivalent(H) and effective dose equivalent **Radioactivity detecting techniques**: Ionization chamber, Geiger Muller counter, Scintillation counter, Hazards biological effect of radiation, Biological Applications of Radioisotope.	**12**
4.	**Unit IV** **Chemistry of Natural Products** 3.1 Terpenoids-Isoprene rule, structure determinations of citral. 3.2 Natural Pigments- Carotenoids and their functions in Plants, structural details of chlorophyll. 3.3 Alkaloids- Basic structure, classification with suitable examples.	**10**

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 Glassstone
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 – J.D. Lee

BTE 202 – Paper-XI : Physics- II

Topic No.	Unit	Lectures 45
1.	**Unit-I** **Optics correlated with microscopy:** Concept of interference and diffraction, Diffraction gratin (Description only), concept of polarization and plane polarized light, production of polarized light by absorption, reflection, refraction and scattering, Nicol prism, definition of optical activity, LASER- LASER action (Energy level diagram), properties of LASER, applications of LASER.	**13**
2.	**Unit- II** **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),	**10**
3.	**Unit- III** **Semiconductor Devices and Digital Electronics** Light Emitting Diode (LED), seven segment display, photodiode, optocoupler, spectral distribution of solar energy, solar cellconstruction, 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	**10**
4.	**Unit- IV** **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,, Quantum numbers, Nuclear models and forces(Liquid drop modem and shell model), production of x-rays and its properties, Continuous and characteristics X-ray spectrum, Brags law, Applications of X-rays	**12**

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.Subrahmanyan 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 Publication
14. Biophysics, Vastala Piramal, Dominent Publishers and Distributor

BTE 203 – Paper-XII : Animal Science

Topic No	Unit	Lectures 45
1.	**Unit- I** **TAXONOMY** 1.1. General classification of animal kingdom.(up to classes) 1.2.Non-chordates –Study of phylum Porifera, Ceolenterata, Platyhelmenthes, Nemathelmenthes, Arthropoda, Mollusca & Echinodermata – General characters with representative examples- Sycon, Hydra, Liver fluke/ Taenia, Earthwarm / Nereis, Cockroach, Pearl oister / Pila, Starfish 1.3. Chordates:- Study of class Pisces, Amphibia, Reptilia & Mammalia – General characters with representative examples – Lebeo, Frog, Cobra, Alligator, Fowl and Rat	**12**
2.	**Unit- II** **Host Parasite Relationship** 2.1 Protozoan parasite- Plasmodium (Morphology,parasitic adaptations, Life cycle) 2.2 Nematode parasite- Ascaris (Morphology, parasitic adaptations, Life cycle) 2.3 Platehelminthes parasite- Liver fluke(Morphology, parasitic adaptations, Life cycle)	**11**
3.	**Unit- III** **Tissues** : Definition and types 3.1 i) Epithelial ii) Muscular iii) Nervous iv) Connective tissue Blood Plasma, Serum, Corpuscles), Bone, Cartilage. 3.2. Histological Architecture i) Skin ii) Stomach/Intestine v) Uterus	**11**
4.	**Unit- IV** **Applied zoology** **Vermiculture** :Systematic position of species/types, 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 **Pearl culture** :Systematic position ,various species, Stages in commercial Pearl culture, economic importance	**11**

References-

1. Kotpal – Invertebrates
2. Kotpal – Chordates
3. Shukla and U. Pandey- Applied Zoolgy

BTE 204 – Paper-XIII : Statistical Methods

Topic No.	Unit	Lectures 45
1.	**Unit-I** **Introduction to statistics and collection of data**. 1.1 Meaning of statistics 1.2 Scope of statistics in Biological and medical sciences 1.3 Primary and Secondary data 1.4 Classification of data, Inclusive and Exclusive methods, Discrete and Continuous frequency Distribution. 1.5 Cumulative frequencies 1.6 Graphical representation :- Histogram and give Curves	**09**
2.	**Unit-II** **Measures of central tendency and measures of dispersion** 2.1 Concept of measures of central tendency 2.2 Definitions of A.M., Median, Mode, Quartiles, Weighted mean, Examples on ungrouped and grouped data. 2.3 Properties of A.M. (statement only) 2.4 Methods of obtaining mean& quartiles graphically;- in place of mean mode is expected. 2.5 Concept of measures of dispersion . Absolute and Relative measures of dispersion. 2.6 Definitions of Range, Q.D, S.D and variance ,coefficient of variation. Examples on grouped and ungrouped data	**13**
3.	**Unit-III** **Correlation and Regression** 3.1 Concept of correlation between two variables and types of correlation. 3.2 Method of obtaining correlation (i) by scattar diagram method ii) By Karl Pearson Correlation coefficient Properties of correlation coefficient. 3.3 Examples on ungrouped data 3.4 Concept of regression, Lines of regression Regression coefficients and properties without proof. 3.5 Examples on ungrouped data.	**10**
4.	**Unit-IV** **Probability and Sampling** 4.1 Definition of sample space, Outcomes, events, exhaustive events, Mutually exclusive events, Equally likely events, certain events impossible events. 4.2 Definition of probability, Limits of probability. Probability of complementary event, Additive law of probability. Simple illustrative examples. 4.3 Definition of conditional probability, Multiplicative law of probability,Independent events, Simple illustrative examples. 4.4 Idea of population and sample.Simple Random Sampling and Stratified Random sampling. Advantages and disadvantages of both the methods. 4.5 Testing of hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, types of errors, Critical region, Acceptance region, level of significance. 4.6 Tests of significance: Chi square tests, t tests and F test	**13**

References :

1) Goon A. M., Gupta M. K. and Dasgupta B.:

Fundamentals of mathematical statistics vol. I & II. World Press, Calcutta.

2) Gupta & Kapoor: Fundamental of mathematical statistics.

3) Thingale T. K. and Dixit P. G. (2003): A text book of paper- I for B.Sc. I, Nirali Publication, Pune.

4) Waiker and Lev: Elementary Statistical methods.

5) Rohatgi V. K. and Sauh A. K. Md E. (2002)

An Introduction to probability and statistics (John Wiley & Sons-Asia).

6) Thigale T. K. and Dixit P. G. (2003): A text book Of paper II for B.Sc. I.

7) Meyer P. L. (1970): Introductoryto probability and statistical Application. Addision wesly.

8) Cochran, W.G.: Sampling Techiniques, Wiley Estern Ltd., New Delhi.

9) Des Raj : Sampling theory

BTE 205 – Paper-XIV : Proteins and Enzymes

Topic No	Unit	Lectures 45
1.	**Unit- I** **Protein:** Amino acid classification (Depending upon R group), structure of amino acids, peptide bond, Determination of primary structure (Sanger's method, Edman's method, Dansyl chloride,), Forces stabilizing secondary structure, Tertiary structure (Describe different bonds), w.r.to Myoglobin .Quaternary structure w.r.t. Hemoglobin.	13
2.	**Unit- II** **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,	10
3.	**Unit- III** **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.	11
4.	**Unit- IV** **Co-enzymes:** Thiamine, riboflavin, niacin, pyridoxol phosphate, (Introduction, structure, sources, daily requirement, biological functions, deficiency,)	11

References:-

1) Biochemistry – Nelson & Cox
2) Biochemistry - Stryer
3) Enzymes - Trevor Palmer
4) Biochemistry - Voiet & Voiet
5) Biochemistry - J.L.Jain
6) Basic Biophysics- M. Daniel
7) Biochemistry - Powar and Chatwal
8) Protein Purification- Harris and Angel
9) Practical biochemistry – Keith Wilson And Walker
10) Principles of Biochemistry - T. N. Pattabriraman.
11) Biochemistry 3rd Edition – Hames & Hopper.
12) General Biochemistry – J. H. Well.
13) Biochemistry – J. H. Ottaway & D. K. Apps
14) Biochemistry – Trchan
15) Text Book of Biochemistry- R.A. Joshi.
16) Biochemistry – U. Satyanarayanan
17) Biochemistry a Functional Approach – Robert W McGilvery & Goldstein
18) Text Book of Biochemistry – A.V.S.S. Rama Rao
19) Clinical Biochemistry –Praful B. Godkar.

BTE 206-(Paper-XV) : Basics in Cell Biology

Topic No.	Unit	Lectures 45
1.	**Unit- I** **Cell structure** 1.1Discovery of Cell 1.2.Cell theory -Definition, discovery, three assumptions of cell theory, exceptions, organismal theory , protoplasm theory	12

	1.2.Organization of Prokaryotic cell 1.3.Organization of Eukaryotic cell (plant and animal cell) 1.4.Ultra structure & functions of cell organelles Mitochondria, Chloroplast, E.R., Golgi apparatus ,Lysosome, Peroxisome, Ribosomes.	
2.	**Unit- II** **Nucleus** 2.1 Introduction,morphology,occurrence,shape,size,number,position 2.2. Ultra structure of nucleus-Nuclear membrane, nucleoplasm, nucleopore complex, nucleolus. 2.3. Chromosome structure- introduction, General features of Prokaryotic chromosome. 2.4 General features of Eukaryotic chromosome-. Chromosome number, size, Chromosomal nomenclature & General structure.	**09**
3.	**Unit- III** **Cytoskeletal assembly** 3.1 Introduction 3.2 Cytoskeletal elements 3.3Microtubules-ccurrence, structure, chemical composition, microtubule associated proteins, HMW proteins, DAU proteins MTOC , assembly and disassembly of microtubules, functions 3.4 Microfilaments- occurrence, structure, chemical composition, functions 3.5 Intermediate filaments(IF)- -occurrence, structure, chemical composition, types of IF, functions 3.6 Organization of cilia and flagella	**12**
4.	**Unit- IV** **Cell membrane & Membrane transport** 4.1.Cell membrane –components 4.2 Molecular models of cell membrane-Unit membrane model, Protein crystal model, fluid mosaic model, Types of membrane transport Passive transport-simple diffusion, facilitated diffusion, osmosis. Active transport-primary and secondary transport, Sodium pump, Na+-K+ ATPase pump 4.3 Bulk transport-endocytosis and exocytosis	**11**

References:-

1) Molecular biology of cell-Albert
2) Molecular biology & cell biology – Loddish etal
3) Cell biology –De Robertis
4) Cell biology-Genetics, molecular biology-P.S. Warma & Agarwal
5) Genes Lewin
6) Cell biology –Geral karp
7) Practical biochemistry – Keith, Wilson and Walker
8) Cell Biology- C.B.Pawar

BTE 207- Paper-XVI: Microbiology-II

Topic No.	Unit	Lectures 45
1.	**Unit-I** **Culture media and pure culture techniques:** A. Common components of media and their functions Peptone, Yeast extract, NaCl, Agar and Sugar B. Culture media a) Living Media (Lab. animals, plants, bacteria, embryonated eggs, tissue cultures) b) Non living media – i)Natural, ii) Synthetic, iii) Semisynthetic, iv) Differential, v) Enriched, vi) Enrichment, vii) Selective. C. Methods for isolation of pure culture. i) Streak plate ii) Pour plate iii) Spread plate	**12**
2.	**Unit- II** **Microbial growth:** Definition of growth, phases & growth curve a] Continuous culture b] Synchronous growth c] Diauxic growth Effect of environmental factors on growth-temperature, pH., osmotic pressure, hydrostatic pressure, surface tension, heavy metals, ultra violet light.	**10**
3.	**Unit- III** A) Water Microbiology – a)Sources of microorganisms in water, b)fecal pollution of water, c) Routine bacteriological analysis of water i)SPC ii) Tests for coliforms- • Qualitative: detection and differentiation of coliforms • Quantative: MPN technique. B) Soil microbiology: a)Types of microorganisms in soil and their role in soil fertility. b) Microbial interactions in soil- symbiosis, commensalism, amensalism, parasitism and predation. c) Concept of Biofertilizers and Biopesticides.	**11**
4.	**Unit- IV** **Medical microbiology** 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 diseases: Epidemic, Endemic, Pandemic, Sporadic. Types of infections: Chronic, Acute, Primary, Secondary, Reinfection, Iatrogenic, Congenital, Local, Generalized, Covert, Simple, Mixed, Endogenous, Exogenous, Latent, Pyogenic, Nasocomial. Mode of transmission of diseases: Air borne transmissions, Vehicle transmissions, Contact transmissions,	**12**

	Vector borne transmissions. General principles of prevention and control of microbial diseases	

References:

1) General microbiology-Stanier
2) Introduction to microbiology-Ingraham
3) Brock biology of microorganisms-Madigan etal
4) Fundamentals of microbiology-Frobisher
5) Microbiology-Pelczar
6) General microbiology -Pawar&Daginawala
7) Text book of microbiology-Ananthanarayan

BTE 208 – Paper-XVII : Computer Programming

Topic No.	Unit	Lectures 45
1.	**Unit- I** Introduction to Programming Algorithm, Flowchart, Pseudocode	**10**
2.	**Unit- II** Fundamentals of C Character set, keywords, identifiers, data types, constants, symbolic constants, escape sequences, variables. arithmetic, relational & logical operators, type conversions in expressions.	**10**
3.	**Unit- III** Input/output Printf(), scanf(), getchar(), putchar(), gets(), puts(), enum, sizeof() operator Formatting input/output.	**10**
4.	**Unit- IV** Control Structures & Array If, if..else, nested if, switch statement, while loop , do.. while loop , for loop, continue & break statement Array- declaration, initialization of One dimensional & two dimensional array, character array, strlen(), strcpy(), strcmp(), strcat().	**15**

References:-

1) Computer Fundamentals by P. K. Sinha
2) C Application programs and Projects by Pramod Vasambekar
3) Use of Computer from Vision Publication
4) Let Us C by Kanetkar
5) Ansi C by Balgurusami

BTE 211- Practical I : Techniques in Chemistry and Biochemistry

Sr. No.	Name of the Practicals	Practicals (30)
	Chemistry	
1	Determination of dissociation constant of a weak acid and study of effect of substituent on dissociation constant of weak acid.	**01**
2	Conductometric titration- Strong acid, strong base	**01**
3	Acid catalyzed hydrolysis of methyl acetate.	**01**
4	Activation energy for an acid catalyzed hydrolysis of methyl acetate.	**01**
5	Determination of pH of fruit juice and soil sample.	**01**
6	Organic Preparations 1. Phthalimide 2. Methyl salicylate	**02**
7	Estimation of Vit. C	**01**
8	Estimation of sap value of given oil sample.	**01**
9	Preparation of standard potassium dichromate solution and determination of strength of ferrous ammonium sulphate solution	**01**
10	Preparation of dilute solution from given stock solution.	**01**
11	Inorganic preparations 1. Ferrous ammonium sulphate 2. Hexammine Nickel (II) Chloride	**02**
12	Inorganic Estimation :- Estimation of amount of magnesium from talcum powder by complexometric titration.	**01**
13	Verification of Beer-Lambert's Law using copper ammonia complex.	**01**
	Biochemistry	
14	Preparation of buffers (Phosphate buffer, acetate buffer) and determination of pH with pH meter	**01**
15	General test for carbohydrates and detection of unknown Carbohydrate from mixture (Glucose, fructose, maltose, sucrose, xylose and starch)	**03**
16	Estimation of reducing sugar from apple juice by Benedict's method	**01**
17	General test for Amino acids and detection of unknown Amino acid from mixture (Arginine, methionine, cystine, tyrosine, histidine, proline, tryptophan)	**02**
18	Protein estimation (Biuret method)	**01**
19	Isolation and characterization of casein from milk.	**02**
20	Qualitative assay of α- amylase using starch as substrate.	**01**
21	Isolation and characterization of starch from potatoes	**01**
22	Estimation of Glucose by 3,5 Dinitro salicylic acid method	**01**
23	Estimation of Cholesterol by iron reagent	**01**
24	Estimation of amino acid by Ninhydrin method	**01**

Reference:-

1. ChemistryText 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

BTE-212- Practical II : Laboratory Exercises in Microbiology, Biotechniques and Instrumentation

Sr. No.	Name of the Practical Practicals	Practicals (30)
	Instrumentation	
1	Use, care and study of compound microscopy.	**01**
2	Demonstration (Principle, working, construction) of Colorimeter & Determination of λ max of a dye solution.	**01**
3	Demonstration (Principle, working, construction) of P^H meter & Conductivity meter	**01**
4	Demonstration (Principle, working, construction) of Autoclave & Centrifuge	**01**
5	Demonstration (Principle, working, construction) of Hot air oven & Incubator	**01**
6	Demonstration (Principle, working, construction) of Laminar Air Flow & Refractometer.	**01**
7	Spectrophotometric determination of nucleic acid purity and concentration	**01**
8	Study of UV absorption spectra of macromolecules (protein and nucleic acid)	**01**
9	Separation and identification of plant pigments using Ascending paper chromatography	**01**
10	Separation and identification of amino acids using TLC	**01**
11	Separation of amino acid by Paper Electrophoresis	**01**
	Microbiology	
12	Microscopic examination of bacteria by a. Monochrome staining. b. Gram staining c. Negative staining. d. Capsule staining. e. Cell wall staining. f. Endospore staining	**06**
13	Isolation, mounting and identification of Mold. a. *Aspergillus* b. *Penicillium* c. *Mucor* d. *Rhizopus*	**02**
14	Preparation of bacteriological culture media i) Peptone water. ii) Nutrient broth. iii) Nutrient agar. iv) Mac Conkey's agar.	**02**
15	Preparation of Fungal culture media i) Sabouraud's agar ii) PDA	**02**
16	Enumeration of bacteria by total viable count from soil by spread plate technique and pour plate technique	**02**
17	Observation of motility by hanging drop technique.	**01**
18	Study of growth curve of bacteria	**02**
19	Isolation, colony characters, Gram staining & motility of *E.coli, Bacillus* sp.	**02**

1) Experimental Microbiology – Patel & Patel
2) Bacteriological techniques by F. J. Baker.
3) Stains and Staining procedures by Desai and Desai.

BTE 213- Paper III : Laboratory Exercises in Plant Science and Animal Science

Sr. No.	Name of the Practical	Practicals (30)
	Plant Science	
1	Study of algae (*Nostoc, Sargassum*)	**01**
2	Study of bryophyte (*Riccia / Anthoceros*)	**01**
3	Study of Pteridophyte (*Selaginella*)	**01**
4	Study of gymnosperms (*Pinus*)	**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 types of inflorescence	**01**
10	Study of fruit types as per theory	**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**
	Animal Science	
15	Classification and Identification of Non-chordates & Chordates. (One animal each). Non- chordates- Sycon, Hydra, Liver fluke/ Earthwarm / Nereis, Cockroach, Pearl oister/Pila, Starfish. Chordates- Lebeo, Frog, Cobra, Alligator, Fowl and Rat.	**02**
16	Dissection of Labeo- Visceral organs like Gill, Digestive tract, Heart, Kidney, air bladder.	**02**
17	Earthworm Dissection(Digestive system,Nervous system)	**02**
18	Study of Plasmodium, Ascaris, Liver Fluke, Taenia- Salium	**01**
19	Blood slide Preparation and Identification of Blood cells.	**01**
20	Blood cell count i) Differential count of W. B. Cs. ii) Total count of W. B. Cs and R. B. Cs.	**02**
21	Preparation of Haemin Crystals	**01**
22	Study of Bone Marrow cells	**01**
23	Histology of Skin, Tooth, Liver, Kidney, Uterus.	**01**
24	Demonstration of – ii) Bee Keeping- Study of Instruments iii) Sericulture - Study of different Stages.	**02**
25	Study Tour-Visit to Biodiversity, Sericulture, Apiculture, Vermicomposting unit)	

Reference:-

1. Vikas Hand book of Botany – Srivastava K. C., B. S. Dattatreya, A. B. Raizada (1977)
2. Practical zoology---Lal

BTE – 214- Paper IV: Methods in Mathematics , Statistics and Computer applications in Biology

Sr. No.	Name of the Practical	Practicals 30
	Mathematics	
1	1. Applications of differential equation i) Growth & decay ii) Newton's law of cooling	**02**
2	Eigen values & Eigen vectors	**02**
3	Complex numbers: Geometrical representation of complex numbers	**02**

	(Argand's diagram) Graphical representation of $\bar{Z}$,Z_1+Z_2 ,$Z_1 - Z_2$,$Z_1 . Z_2$, Z_1/ Z_2 [Z-a] = b	
	Statistics	
4	. Frequency distribution – Graphical, Histogram, ogive curve [less & greater than].	**02**
5	Measures of central tendency (Grouped and ungrouped) A. M., Median, Mode.	**02**
7	Measures of Dispersion – Range, s. d., C. V. combined s. d.	**01**
8	Correlation, Regression. Scattered diagram, Karl Pearson's correlation coefficient, eqn of Regression line.	**02**
9	Testing of Hypothesis: Large sample test: Normal, proportion. Small sample test.: x2, t, f.	**02**
	Computer applications	
10	Study of commands of word.	**01**
11	Creation of worksheet with graphs	**01**
12	Power Point presentation.	**02**
13	Write program to convert temperature in Celsius into Fahrenheit.	**02**
14	Write program to find area of circle	**01**
15	Write program to find given number is even or odd.	**01**
16	Write program to display Fibonacci series	**01**
17	Write program to find class from given marks of subject.	**01**
18	Write program to print sum of 1 to n numbers	**01**
19	Write program to display number, square & cube upto given number.	**01**
20	Write program to sort elements of array	**01**
21	Write program for addition of two matrix	**01**
22	Introduction to biological database	**01**

Nature of Question Paper

Nature of Question Paper for all (Theory) papers U.G. Courses under Faculty of Science.

Nature of Question Paper		
Q.No.1	**Multiple Choice based objective type question (four options for each question be given)**	**10Marks**
Q.No. 2	**Attempt any two of the following (out of three)**	**20 Marks**
Q.No. 3	**Shot notes (4 out of 6)**	**20 Marks**
Total		**50 Marks**

Nature of question paper:

Annual Practical Examination

A) Every candidate must produce a certificate from the Head of the Department in his college, stating that he has completed in a satisfactory manner a practical course on the lines laid down from time to time by the Academic Council on the recommendations of the Board of Studies and that the laboratory Journal has been properly maintained. Every candidate must have recorded his/her observations in the Laboratory journal and written a report on each exercise performed. Every journal is to be signed periodically by a member of the teaching staff and certified by the Head of the Department at the end of the year. Candidates are to produce their journals at the practical examination and such journals will be taken into account by the examiners in assigning marks.

B) The practical examination will be of 6 hours duration and will be conducted on two successive days (3 hours per day)

Distribution of Marks for Practical Examination:

1. One major experiment 10 marks
   One minor experiment 05 marks
2. One major experiment 10 marks
   One minor experiment 05 marks
3. Spotting 10 marks
4. Oral on Practicals 05 marks
5. Journal 05 marks

Total Marks: 50 marks

Note: Experiments may be arranged as per convenience of the examiner.