

**“Education for Knowledge Science and Culture”**

- Dr Bapuji Salunkhe



**Shri Swami Vivekanand  
Shikshan Sanstha's**



**VIVEKANAND COLLEGE**

**KOLHAPUR**

**(AUTONOMOUS),**

**Syllabus For  
Bachelor of Science Part - I  
BIOTECHNOLOGY (ENTIRE)  
SEMESTER I AND II**

**(Syllabus to be implemented from June, 2021 onwards.)**

**CHOICE BASED CREDIT SYSTEM SYLLABUS**  
**For Bachelor of Science Part - I**  
**BIOTECHNOLOGY (Entire) to be implemented from June 2021**

**1. TITLE: Biotechnology-Entire**

**2. YEAR OF IMPLEMENTATION:-** CBCS Syllabus will be implemented from June, 2021 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. 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 vigour 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 / PAPER:**

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 human health.

**5. DURATION**

• **The course shall be three year full time course.**

**6. PATTERN:-**

Pattern of theory Examination will be Semester. Practical examination will be annual

**7. MEDIUM OF INSTRUCTION:**

The medium of instruction shall be English.

## **8. OTHER FEATURES:**

### **(A) LIBRARY:**

Reference and Text Books, Journals and Periodicals, Reference Books. – List Attached

### **(B) 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.

## Index

<b>Sr.No.</b>	<b>Name</b>	<b>Page No.</b>
1.	B.Sc. I CBCS Biotechnology Entire Pattern	
2.	Syllabus	
3.	Nature of Question paper	
4.	Scheme of marking	
5.	Subject Code	

## Semester - I

Sr.No	Course Title	Theory
1	DSC-A-1331-Chemistry	35+15
2	DSC-A-1332-Biochemistry	35+15
3	DSC-A-1333-Plant Science	35+15
4	DSC-A-1334-Biotechnology for Human Welfare-I	35+15
5	DSC-A-1335-Computer and Introduction to Bioinformatics	35+15
6	DSC-A-1336-Bio techniques & Instrumentation	35+15
7	DSC-A-1337-Microbiology	35+15
8	DSC-A-1338-Biotechnology for Human Welfare-II	35+15
9	AECC-1A-1339- English for Communication	35+15

## Semester - II

Sr.No	Course Title	Theory
1	DSC-B-1331-Chemistry	35+15
2	DSC-B-1332-Biochemistry	35+15
3	DSC-B-1333-Animal Science	35+15
4	DSC-B-1334-BioStatistics	35+15
5	DSC-B-1335-Computer	35+15
6	DSC-B-1336- Basics in Cell Biology	35+15
7	DSC-B-1337-Microbiology	35+15
8	DSC-B-1338-Developmental Biology	35+15
9	AECC-1B-1339-English for Communication	35+15

Sr. No	Course Name	Practicals (Annual)
1	Practical-I---Techniques in Chemistry and Biochemistry	50
2	Practical-II---Laboratory Exercise in Microbiology and Instrumentation	50
3	Practical-III---Laboratory Exercise in Plant Science and Animal Science	50
4	Practical-IV---Techniques in biotechnology for human welfare and Methods in Biostatistics & Computer Application in Biotechnology	50

**Semester - I**  
**DSC-1331-A- Chemistry (Credit-2)**

Credit - I	Units	Lectures (30)
	<p><b>Basics Concepts in Chemistry</b>  <b>Introduction</b> - Definition and Explanation of important basic terms of following, Solutions – Problems based on Normality, Molarity, Mole Fraction, Mixed Solution, ppb, ppm, Mili moles Exercises  <b>Acids and Bases</b> - Lowry–Bronsted and Lewis concepts, strong and weak acids and bases, Ionic product of Water, pH, pKa, pKb, Hydrolysis of salts.  <b>Buffers</b> - Solutions concept, types, Henderson equation for acid and basic buffers, Buffer action and buffer capacity.  <b>Analytical and Industrial Chemistry</b>-Introduction, Importance of Analysis, Analytical processes (Qualitative and Quantities) Classification of Analysis, sampling of solids, liquids, gases, Green Chemistry and its Principle  <b>Reaction Kinetics</b>                      Introduction-Meaning and definitions of- rate constant, order and Molecularity of reaction, Integrated rate expressions for zero order reaction.</p>	15
Credit– II	<p><b>Structure and Bonding.</b>  <b>Introduction</b> - Types of bonds. Ionic covalent bond, Co-ordinate bond, Metallic bond, hydrogen bond, Electrostatic Interaction, Vander waal’s forces. Formation of ionic and covalent bond with examples, e.g. NaCl, KCl, HCl, CH<sub>4</sub>, Cl<sub>2</sub>, H<sub>2</sub>.  <b>VBT</b>- Postulates.  <b>Concept of Hybridization</b>, sp, sp<sup>2</sup>, sp<sup>3</sup> hybridization with respect to BeCl<sub>2</sub>. BF<sub>3</sub>, SiCl<sub>4</sub> (Along with consequences with respect to bond length, bond angle, bond energy and shape of the molecule.                      Dipole moment- Definition and significance.  <b>Hydrogen Bonding</b>- Definition, intra and intermolecular hydrogen bonding with suitable example (Water, Proteins, alcohols, Hydroxy acids, Zhenols).                      Ionic solids- Definition and general characteristics, comparison between, ionic and covalent compounds.  <b>Coordination Complexes</b>                      Definition and formation of Co-ordinate bond in BF<sub>3</sub>← NH<sub>3</sub> &amp; NH<sub>4</sub><sup>+</sup>,                      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, Metalloenzymes (Zn, Mg, Mn)</p>	15

### **References-**

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

## DSC-A-1332- Biochemistry (Credit-2)

	Units	Lectures (30)
<b>Credit - I</b>	<p><b>Origin of life:</b> - 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.</p> <p><b>p<sup>H</sup>, pka value</b> definition, H-H Equation, <b>Biological Buffer Systems</b>- e.g. Phosphate, Bicarbonate, Haemoglobin buffer system, Protein buffer system</p> <p><b>Nucleic acids:</b> Nucleosides, nucleotides, polynucleotide, DNA and its different forms with properties. (A, B, C, D, &amp; Z), RNA and its types. - m-RNA, t-RNA. r-RNA Forces Stabilizing nucleic acid structure.</p>	15
<b>Credit - II</b>	<p><b>Carbohydrates:</b> Classification, glyceraldehyde, simple aldoses &amp; ketoses, confirmation of D-glucose, biological importance of carbohydrates, reactions of monosaccharide (Oxidation, reduction, osazone), glycosidic bond, disaccharides (Sucrose, maltose, lactose), polysaccharides - homo polysaccharides, e.g. Starch, glycogen, Cellulose.</p> <p><b>Lipids:</b> Classification, Simple lipid - Triacyl glycerol &amp; waxes. Compound lipid - Phospholipid, e.g- Phosphotidyl choline, ethanolamine Glycerolipid, Sphingolipids, e.g. Sphingomyelin, cerebrosides, gangliosides.</p> <p>Physical properties,- state,color, odour,melting point, solubility, specific gravity, geometric isomerism, insulation, emulsification , surface tension.</p> <p>Chemical properties- sap value, acid value, iodine no., rancidity; Derived lipid- Cholesterol, lipoprotein - LDL, VLDL, HDL, Chylomicrons. Liposome.</p>	15

### References:-

- 1) *Biochemistry – Nelson & Cox*
- 2) *Biochemistry - Stryer*
- 3) *Enzymes - Trevor Palmer*
- 4) *Biochemistry - Voiet & Voiet*
- 5) *Biochemistry - J. L. Jain*
- 7) *Biochemistry - Powar and Chatwal*
- 8) *Protein Purification- Harris and Angel*
- 9) *Principles of Biochemistry - T. N. Pattabriraman.*
- 10) *Biochemistry 3<sup>rd</sup> Edition – Hames & Hopper.*
- 11) *General Biochemistry – J. H. Well.*
- 12) *Biochemistry – J. H. Ottaway & D. K. Apps*
- 13) *Biochemistry – U. Satyanarayanan*



## DSC-A -1333- Plant Science (Credit 2)

	Units	Lectures (30)
<b>CREDIT - I</b>	<p><b>Plant Diversity</b>                      Outline of General Classification of Plant Kingdom.                      Algae – General characters and economic importance                      Fungi – General characters and economic importance                      Lichens -General account and economic importance                      Bryophytes – General characters and economic importance                      Pteridophytes – General characters and economic importance                      Gymnosperms – General characters and economic importance                      Angiosperms – General characters and economic importance</p> <p><b>Taxonomy of Angiosperms</b>                      Taxonomy :- Definition, Aims, objectives and functions, Binomial nomenclature and its significance, Categorize of plant species as per IUCN, Methods of conservation, study of Outline of Bentham &amp; Hookers System of classification of plants.</p>	<b>15</b>
<b>CREDIT II.</b>	<p><b>Sexual Reproduction in Angiosperms:-</b>                      Structure of Typical Flower – Floral whorls and functions:-Calyx, corolla, Androecium, Gynoecium.                      Fertilization:- Definition, Double fertilization and its significance  <b>Fruit</b> - Definition, formation, Types: a) Simple, b) Aggregate, c) Composite.  <b>Seed</b> – Definition and its types, Dormancy of seed- Definition, Causes and Breaking of seed dormancy, Seed germination- Concept, Types-Epigeal and Hypogeal, factors affecting seed germination.  <b>Plant Anatomy</b>, Tissues- Simple and complex (Xylem and Phloem)                      Meristem its types and functions.</p>	<b>15</b>

### Reference Books:

- 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*

## DSC-A - 1334-Biotechnology for Human Welfare-I (Credit 2)

	Units	Lectures (30)
<b>Credit I</b>	<p><b>Introduction to Biotechnology:</b> Biotechnology-Origin and definition, History, interdisciplinary nature, Scope and importance of Biotechnology, Branches of Biotechnology, colour codes of Biotechnology,</p> <p>Introduction to National Research funding institutes and Biotechnological importance in India (UGC, DBT, CSIR, ICMR etc.), National and International Research Institutes (NCL, NIV, IISER, NCCS, DST, DRDO,DAE) Commercial potential of Biotechnology, Achievements of Biotechnology, Prevention of Misuse of Biotechnology, Future of Biotechnology.</p>	<b>15</b>
<b>Credit II</b>	<p><b>Agricultural Biotechnology- Introduction and Scope</b> <b>Biofertilizer</b> -Definition ,types with examples, Mass production and field application and use of – <i>Azotobacter</i>, <i>Rhizobium</i> and <i>PSB</i>. Crop modification techniques, Traditional breeding, Mutagenesis Polyploidy, Protoplast fusion, RNA interference ,Improved nutritional content, Genes and traits of interest for crops, Agronomic traits, Insect resistance, Herbicide tolerance, Disease resistance, Temperature tolerance <b>Biopesticide</b> – Definition ,types with examples production and applications of Bacterial ( <i>Bacillus thuringensis</i>) and fungal (<i>Trichoderma</i>) Biopesticides</p> <p><b>Need of genetically modified crops</b> - GMOs in Agriculture - Role of Biotechnologist and recent developments in this field</p>	<b>15</b>

### References:

1. B.B. Nanda and R.K. Triwari, *Forensic Science in India: A Vision for the Twenty First Century*, Select Publishers, New Delhi (2001). \_
2. M.K. Bhasin and S. Nath, *Role of Forensic Science in the New Millennium*, University of Delhi, Delhi (2002). \_
3. S.H. James and J.J. Nordby, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 2nd Edition, CRC Press, Boca Raton (2005).
4. *Biotechnology* – U. Satyanarayana
5. *Medical biotechnology* – S. N. Jogdand
6. *Advances in Biotechnology*- S.N.Jogadand
7. *A textbook of Biotechnology* - R. C. Dubey
8. *Pharmaceutical Biotechnology* – S. P. Vyas ,V. K. Dixit
9. *Biotechnology* – B. D. Singh
10. *Fundamentals of agriculture biotechnology* – S. S. Purohit
11. *Agriculture application of Microbiology*- Neelima Rajvaidya.

## DSC-A -1335- Computer (Credit 2)

	Units	Lectures (30)
<b>Credit I</b>	<p><b>Computer basics:</b> Definition, Block Dig. (I/O/Secondary storage), Applications, Generations, Types of computer, Numbering system (binary to decimal &amp; decimal to binary)</p> <p><b>Operating System:</b> 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</p> <p><b>Office Operation:</b> Microsoft Word-concept of toolbar, character, paragraph &amp; 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 PowerPoint-Slide presentation, slide layout, Design, custom animation.</p>	<b>15</b>
Credit-II	<p><b>Web technology: HTML web page designing Introduction Structure, Tags (b,u,l,br, no,br, marquee, imgsrc,a href, font, pre, list tags etc) Table Tags.</b></p> <p><b>Basic of Bioinformatics</b> - Internet, World wide web, Web browser, Search Engine (Google), Searching data from Search Engine, Bioinformatics Introduction - Nature of Biological data, characteristics of data, Tools for protein function analysis - Homology and similarity, structure analysis, sequence analysis, BLAST, FASTA, EMBOSS, Clustal w, Applications &amp; scope of Bioinformatics.</p>	<b>15</b>

### **Reference Books**

- 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

## DSC-A -1336- Bio techniques & Instrumentation (Credit 2)

	Units	Lectures (30)
<b>Credit - I</b>	<p><b>Protein Purification</b> : Method of cell disruption (Blenders, grinding with abrasives, presses, enzymatic method, sonication); Salt participation- Salting in, salting out, organic solvent precipitation, dialysis, ultra filtration.</p> <p><b>Centrifugation</b>- Basic principles, RCF, Sedimentation coefficient, Svedberg's constant, Types of centrifuge: Desktop, High speed and Ultracentrifuge, Preparative centrifugation: Differential and density gradient centrifugation</p>	15
<b>Credit II</b>	<p><b>Microscopy</b> 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).</p> <p><b>UV-Visible Spectroscopy</b> Introduction to spectroscopy, properties of electromagnetic radiation (UV and Visible range, Electromagnetic spectrum, Electronic Transitions, Principle, Instrumentation with respect to colorimeter and single beam spectrophotometer. Principle, Instrumentation, Applications of UV and Visible spectrophotometer and colorimeter Lambert-Beer's law,</p> <p><b>Basic Laboratory Instruments:</b> Introduction, Principle and applications of electrophoresis-Supporting media- Agarose, PAGE. Construction &amp; Working pH meter, Autoclave, Laminar Air Flow.</p>	15

### **References:-**

- 1) *Biophysical Chemistry* by Nath and Upadhyia.
- 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

## DSC-A -1337- Microbiology (Credit 2)

	Units	Lectures (30)
<b>Credit -I</b>	<p><b>Microbiology : Definition, History, Introduction to types</b> of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses, Beneficial and harmful activities of microorganisms, Applied branches of Microbiology, major microbiological institutes in India.</p> <p><b>Morphology and cytology of Bacteria</b>  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</p> <p><b>Viruses-</b> General characteristics and Cultivation, lytic cycle of T<sub>4</sub>-bacteriophage.</p> <p><b>Bacterial taxonomy:</b>  General principles of bacterial nomenclature.- a) Taxonomic ranks, b) Common or Vernacular name, c) Scientific or International name, Criteria for bacterial classification- Morphological, cultural, biochemical &amp; serological characters, Concept of bacterial species &amp; strain.</p> <p><b>Microbial nutrition</b>  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 - a. Autotrophs b. Heterotrophs c. Phototrophs d. Chemotrophs, e. Photoautotrophs f. Chemoautotrophs g. Photoheterotrophs, h. Chemoheterotrophs.</p>	15
<b>Credit-II</b>	<p><b>Concept of Sterilization:-</b>  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 &amp; Phenolic compounds, Alcohol, Heavy metals(e.g. mercury). c) Gaseous agents- Ethylene oxide, formaldehyde</p> <p><b>Stains and staining procedures -</b>  Definition of dye and stain, Classification of stains – Acidic, Basic and Neutral, 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</p>	15

**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 & Panikar*

## DSC-A -1338- Biotechnology for Human welfare-II (Credit 2)

	<b>Units</b>	Lecture (30)
<b>Credit I</b>	<p><b>Health Biotechnology:</b>                      Stem cells and transgenic technology                      Characteristics of stem cells ,                      Concept of stem cell progenitors.                      Concept of stem cell technology and its application.                      Monoclonal Antibodies: Production and Formulation                      Transgenic technology &amp; cloning in mammals                      Example: Transgenic mice and their applications                      Gene Therapy- concept, advantages and disadvantages.                      Vaccines- concept, types of vaccines examples,                      recombinant vaccines example and uses.</p>	<b>15</b>
<b>Credit II</b>	<p><b>History Development of Forensic Science in India</b>                      Introduction to Forensic Science ,Physics division,                      Chemistry division, Biology division, Serology division,                      Ballistics division, Toxicology division, Questioned                      document division, Fingerprint division, Photography                      division, Evidence collection division, Prohibition                      division, Digital and Cyber Division etc.</p> <p>Crime Scene Processing, Chain of Custody, Common                      type of Physical evidence, Significance of Physical                      evidence, Collection and Packaging of Physical                      evidence</p> <p><b>Forensic Science in India and International                      Perspective of Forensic Science</b>                      DFSS, CFSL, SFSL, RFSL, Mobile Crime                      Laboratories, Government Examiners of Questioned                      Documents, Central and Divisional Fingerprint                      Bureaus</p>	<b>15</b>

### **References:**

1. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001). \_
2. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002). \_
3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
4. Biotechnology – U. Satyanarayana
5. Medical biotechnology – S. N. Jogdand
6. Advances in Biotechnology- S.N.Jogadand
7. A textbook of Biotechnology - R. C. Dubey
8. Pharmaceutical Biotechnology – S. P. Vyas ,V. K. Dixit
9. Biotchnology – B. D. Singh
10. Fundamentals of agriculture biotechnology – S. S. Purohit
11. Agriculture application of Microbiology- Neelima Rajvaidya.



## DSC-B -1331- Chemistry (Credit-2)

	Units	Lectures (30)
<b>Credit I</b>	<p><b>Fundamentals and Mechanistic Basis of Organic Reaction</b> - Introduction, Reaction mechanism-Definition, curved arrow notation, substrate, Reagents, Types of reagents, types of reactions.</p> <p><b>Types of reagents:</b> Nucleophile, Electrophiles</p> <p>Inductive effect, Resonance effect, Electromeric effect, Hyperconjugation.</p> <p>Reactive intermediate generation, Structure, Stability, and Reaction of Carbocation, Carbanion and Carbon free Radical.</p> <p><b>Stereochemistry</b> - 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. Numerical Problems</p>	<b>15</b>
<b>Credit - II</b>	<p><b>Titrimetric Analysis and Gravimetric Analysis</b></p> <p>Principle of volumetric analysis, titration, titrant, titrand, endpoint, Equivalence point, titration error, indicator. Primary and secondary standards, preparation of standard solutions Characteristics and examples. Theory of acid base indicators, choice and suitability of indicators. Types of titrations—acid base, redox, precipitation, complexometric, Titration curve and end-point evaluation Gravimetric analysis: solubility and precipitation, factors affecting solubility, nucleation, practical size, crystal growth, colloidal state, ageing or digestion of ppt Co precipitation and post precipitation, washing, drying and ignition of precipitate</p> <p><b>Chemistry of Natural Products</b></p> <p>Terpenoids-Isoprene rule, structure determinations of citral. Natural Pigments- Carotenoids and their functions in Plants, structural details of chlorophyll. Alkaloids- Basic structure, classification with suitable examples.</p>	<b>15</b>

### 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*

## DSC-B -1332- BioChemistry (Credit-2)

	Units	Lectures (30)
<b>Credit - I</b>	<p><b>Protein:</b> Amino acid classification (Depending upon R group), structure of amino acids, single letter codes of amino acids, peptide bond, classification of protein based on composition - Simple, conjugate, derived. Determination of primary structure (Sanger's method, Edman's method, Dansylchloride), structural level organisation of proteins- Primary, Secondary- forces stabilizing secondary structure types - <math>\alpha</math> - helix, <math>\beta</math>-sheets, Tertiary structure (Describe different bonds), w.r.t. Myoglobin. Quaternary structure w.r.t. Hemoglobin. Biological functions of Proteins.</p> <p><b>Chromatography :</b> Introduction, Theory, Principle and applications of Thin layer chromatography, paper chromatography, column chromatography, size exclusion chromatography, Ion exchange chromatography, Affinity chromatography.</p>	<b>15</b>
<b>Credit - II</b>	<p><b>Enzymes:</b> 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</p> <p><b>Co-enzymes:</b> Thiamine, riboflavin, niacin, pyridoxol phosphate, (Introduction, structure, sources, daily requirement, biological functions deficiency)</p>	<b>15</b>

### **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.*

## DSC-B -1333- Animal Science (Credit 2)

	Units	Lectures (30)
<b>Credit - I</b>	<p>Six kingdom system Importance of Animal taxonomy <b>General Classification of Animal kingdom</b></p> <p><b>General characters</b> - Kingdom Protista (Phylum Protozoa), Phylum Porifera, Phylum Cnidaria, Phylum Platyhelminthes, Phylum Nematelminthes, Phylum Arthropoda, Phylum Mollusca &amp; Phylum Echinodermata</p> <p><b>General characters</b> - Chordates, class Pisces, class Amphibia, class Reptilia, class Aves &amp; class Mammalia</p> <p><b>Parental care in Amphibian</b></p> <p><b>Venomous and non-venomous snakes, Types of venoms and mode of action</b></p> <p><b>Flight adaptations in birds</b></p> <p><b>Host Parasite Relationship</b> <b>Protozoan parasite-</b> Plasmodium(Morphology, parasitic adaptations, Life cycle), <b>Nematode parasite</b> Ascaris (Morphology, parasitic adaptations, Life cycle)</p>	<b>15</b>
<b>Credit - II</b>	<p><b>Physiology of digestion</b> in the alimentary canal</p> <p><b>Physiology of Blood</b> - Composition, Properties and functions Haemorrhagic disorders, blood groups, Buffer systems in blood</p> <p><b>Physiology of heart-</b> Structure, cardiac cycle, heart sounds, heart-beat, electrocardiograms.</p> <p><b>Physiology of Respiration</b> - Mechanism of respiration, Transport and exchange of gases.</p> <p><b>Applied zoology</b> - Apiculture, Sericulture, Pearl culture, Fish farming</p>	<b>15</b>

**References :**

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

## DSC-B -1334- BioStatistics (Credit 2)

	<b>Units</b>	<b>Lectures (30)</b>
<b>Credit -I</b>	<p><b>Introduction to statistics and collection of data.</b> Meaning of statistics, Scope of statistics in Biological and medical sciences, Primary and Secondary data, Classification of data, Inclusive and Exclusive methods, Discrete, and Continuous frequency Distribution. Cumulative frequencies ,</p> <p><b>Graphical representation :-</b> Histogram ,bar chart, line diagram, pie chart&amp; ogive Curves Measures of central tendency</p> <p>and measures of dispersion, Concept of measures of central tendency, Definitions of A.M., Median, Mode, Quartiles, Examples on ungrouped and grouped data, Properties of A.M. (statement only), Methods of obtaining mode &amp; quartiles graphically, Concept of measures of dispersion . Absolute and Relative measures, of dispersion, Definitions of Range, Q.D, S.D and variance, coefficient of variation. Examples on grouped and ungrouped data</p>	<b>15</b>
<b>Credit II</b>	<p><b>Correlation and Regression, probability &amp; testing of Hypothesis</b> - 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.</p> <p>Examples on ungrouped data, Concept of regression, Lines of regression coefficients and properties without proof. Examples on ungrouped data, Probability and Sampling</p> <p>Definition of sample space, Outcomes, events, exhaustive events, Mutually exclusive events, Equally likely events, certain events impossible events. Definition of probability, Limits of probability. Probability of complementary event, Additive law of probability. Simple illustrative examples. Definition of conditional probability, Multiplicative law probability, Independent events, Simple illustrative examples. Idea of population and sample. Simple Random Sampling and Stratified Random sampling.</p> <p>Advantages and disadvantages of both the methods, Testing of hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, types of errors, Critical region, Acceptance region, level of significance. Tests of significance: Chi square tests, t tests and F test</p>	<b>15</b>

**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. Addison wesly.*
- 8) *Cochran, W.G.: Sampling Techniques, Wiley Estern Ltd., New Delhi.*
- 9) *Des Raj : Sampling theory*

## DSC-B -1335- Computer (Credit- 2)

	Units	Lectures (30)
<b>Credit - I</b>	<p><b>Database Management System</b> - Need of database, data models- Hierarcical, Network, Relational, Object Oriented, Main components of DBMS-DDL, DML.</p> <p>Introduction to Programming, Algorithm, Flowchart, Pseudocode Fundamentals of C, Character set, keywords, identifiers, data types, constants, symbolic, constants, escape sequences, variables. arithmetic, relational &amp; logical operators, type conversions in expressions.</p>	<b>15</b>
<b>Credit - II</b>	<p>Input/output Printf(), scanf(), getchar(), putchar(), gets(), puts(), enum, sizeof() operator Formatting input/output. Control Structures &amp; Array If, if..else, nested if, switch statement, while loop , do.. while loop , for loop, continue &amp; break statement Array- declaration, initialization of One dimensional &amp; two dimensional array, character array, strlen(), strepy(), strcmp(), strcat).</p>	<b>15</b>

### ***Reference Books***

- 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

## DSC-B -1336- Cell Biology (Credit 2)

	<b>Units</b>	<b>Lectures (30)</b>
<b>Credit -I</b>	<p style="text-align: center;"><b>Cell Structure</b> - Discovery of Cell, Cell theory -Definition, discovery, three assumptions of cell theory, exceptions, organismal theory, protoplasm theory, Organization of Prokaryotic cell, Organization of Eukaryotic cell (plant and animal cell), Ultra structure &amp; functions of cell organelles Mitochondria, Chloroplast, E.R., Golgi apparatus ,Lysosome, Peroxisome, Ribosomes.</p> <p>Cell membrane &amp; Membrane transport, Cell membrane – components, 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<sup>+</sup>-K<sup>+</sup> ATPase pump, Bulk transport-endocytosis and exocytosis</p>	<b>15</b>
<b>Credit - II</b>	<p><b>Nucleus</b> -Introduction, morphology, occurrence, shape, size, number, position Ultra structure of nucleus-Nuclear membrane, nucleoplasm, nucleopore complex, nucleus. Chromosome structure - introduction, General features of Prokaryotic chromosome. General features of Eukaryotic chromosome-. Chromosome number, size, Chromosomal nomenclature &amp; General structure</p> <p><b>Cytoskeleton assembly</b> Introduction, Cytoskeleton elements, Microtubules- occurrence, structure, chemical composition, microtubule associated proteins, functions, Microfilaments- occurrence, structure, chemical composition, functions, Intermediate filaments(IF) - occurrence, structure, chemical composition, types of IF, functions Organization of cilia and flagella</p>	<b>15</b>

### 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*

## DSC-B -1337- Microbiology (Credits-2)

	Units	Lectures (30)
<b>Credit -I</b>	<p><b>Culture media and pure culture techniques:</b> Common components of media and their functions Peptone, Yeast extract, NaCl, Agar and Sugar 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.</p> <p><b>Methods for isolation of pure culture</b> - i) Streak plate ii) Pour plate iii) Spread plate</p> <p><b>Microbial growth:</b> Definition of growth, phases &amp; 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, ultraviolet light.</p>	15
<b>Credit - II</b>	<p><b>Water Microbiology</b> – Sources of microorganisms in water, fecal pollution of water, Routine bacteriological analysis of water i)SPC ii) Tests for coliforms-Qualitative-detection of presence of coliforms by - Presumptive,confirmed,completed, differentiation of coliforms-IMViC Quantative: MPN technique.</p> <p><b>Air microbiology</b> - Sources of microorganism in air, definition of (i) infectious dust, (ii) droplets (iii) droplet nuclei Sampling methods for microbial examination air,(i) solid impaction-sieve device (ii) liquid impingement – bead bubbler divice Germ free and Gnotobiotic life- rearing greem free animals, vs normal animals ,uses of germ free animals</p> <p><b>Medical microbiology</b> 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.</p> <p>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, Vector borne transmissions.</p> <p>General principles of prevention and control of microbial diseases</p>	15



## ***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 & panikar*

## DSC- B -1338- Developmental Biology (Credit 2)

		Lectures 30
	<b>Credit I</b>	
<b>1</b>	<p><b>Plant Development:</b> Major phases of plant development Vegetative development: Meristem, shoot development, root development, leaf development. Reproductive development: ABC model. Model systems to understand plant development-Arabidopsis.</p> <p><b>Meristem organization:</b> Plant meristem, organization and differentiation, Organization of shoot apical meristem, Organization of root apical meristem.</p> <p><b>Plant Embryology</b></p> <p><b>Gametogenesis and Fertilization in plants:</b> Gametogenesis in Plants, Development of male and female Gametophyte, Process of fertilization in Angiosperm.</p> <p><b>Embryogenesis-</b> establishment. Development of Endosperm, Types of endosperm in Angiosperm.</p> <p><b>Apomixis:</b> Introduction, Definition, Types, Significance.</p> <p><b>Polyembryony:</b> Introduction, Definition, Types, Significance.</p> <p><b>Self incompatibility:</b> Definition, types and its genetic control.</p>	<b>15</b>
	<b>Credit II</b>	
<b>2</b>	<p><b>Animal embryology</b></p> <p><b>Gametogenesis, gametes and fertilization in Animals:</b> Gametogenesis in animals, Types of eggs and sperms in animals, Fertilization in animals.</p> <p><b>Early development in animals:</b> Types and patterns of cleavages in animals, Cell specification and axis formation, Blastulation, gastrulation in frog and chick up-to the formation of three germ layers, Embryonic induction, Foetal membranes, Types and significance of placentae.</p> <p><b>Differentiation and Regeneration :</b> Cell lineages, Determination, Commitment -specification and determination, Differentiation, Dedifferentiation, Redifferentiation, Transdifferentiation, Developmental Plasticity.</p> <p><b>Regeneration :</b> Definition, mechanism, factors affecting regeneration</p> <p><b>French flag anatomy-concept</b></p>	<b>15</b>

**References:-**

1. Development Biology, 9th edition, (2010), Gilbert S.F. (Sinauer Associates, USA).
2. Foundations of Embryology – Patten
3. Cell and Developmental Biotechnology – Raj Narian Desikar
4. Text book of Bryophytes, Pteridophytes , Gymnosperms and Paleobotany  
- Subramurti
5. Plant Anatomy and Embryology- S.N. Pandey, A. Chadha
6. David M. Hill, Craig Martiz and Barke Mable, Molecular systematics
7. Plant Anatomy – E.Cutter.
8. The Embryology of Angiosperm – Bhojawani .S.S and Bhatnagar.S.P (Vikas Publ House, New Delhi)
9. An Introduction to the Embryology of Angiosperm. – P. Maheswari.
10. Principles of Development, 4th edition (2010), Wolpert L and Tickle C, Publisher: Oxford University Press, USA.
11. Burgess J. (1985) An Introduction to Plant Cell Development (Cambridge Univ Press, UK)
12. Taiz L, Zeiger E (2010) – Plant physiology (Sinauer Associates, USA).
13. Sharma HP (2009) – Plant embryology: Classical and experimental (alpha sci)
14. Steeves TA & Sussex IM (2004) – Patterns in plant development. (Cambridge Univ Press, Cambridge, New York)

## Practical-I Techniques in Chemistry

### *Techniques in Chemistry:-*

Sr No	Name of the Practical	Practicals
<b>Physical Chemistry- Major experiments</b>		
1	To study the specific reaction rate of hydrolysis of methyl acetate in presence of HCl.	1
2	To study the reaction between potassium per sulphate ( $K_2S_2O_8$ ) and potassium iodide (KI) in solution with equal concentration of reactants.	1
3	Paper Chromatography Radical detection of Cu, Co and Ni	1
4	Determination of Hardness of Water.	1
5	Analysis of commercial Vinegar Sample.	
<b>Physical Chemistry Minor Experiments</b>		
1	To determine the Heat of ionisation ( $\Delta H_i$ ) of weak acid.	1
2	To prepare and standardise HCl/ $H_2SO_4$ of commercial sample.	1
<b>Inorganic Chemistry Major Experiments</b>		
1	Estimation of amount of magnesium from talcum powder by complexometric titration.	1
2	To determine the percentage purity of given sample of soda ash.	1
3	Preparation of standard potassium dichromate ( $K_2Cr_2O_7$ ) solution and determination of strength of ferrous ammonium sulphate solution $(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$ .	1
<b>Inorganic Chemistry Minor Experiments</b>		
1	Preparation of Ferrous ammonium sulphate $(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$ .	1
2	To prepare buffer solution and to measure their pH using pH meter.	1
<b>Organic Chemistry Major Experiments</b>		
1	Estimation of Vitamin-C.	1
2	Estimation of sap value of given oil sample.	1
3	To determine the strength in terms of g/lit or $kg/dm^3$ of given solution of aniline.	1
4	To determine the acetamide in given solution.	1
<b>Organic Chemistry Minor Experiments</b>		
1	Preparation of phthalimide from phthalic anhydride.	1
2	Preparation of p-Nitro acetanilide from acetanilide.	1

### *References:*

1. *Textbook of practical organic chemistry (4<sup>th</sup> Edition, Longman) - A. I. Vogen*
2. *Organic Chemistry - Morrison & Boyd*

## Techniques in Biochemistry

Sr. No.	Name of the Practical	Practical
	Biochemistry- Major experiments	
1	Estimation of Glucose(500 ug/ml) by DNSA method 6 tubes- Graphical)	1
2	Estimation of Protein by Biuret Method 6 tubes- Graphical) e.g- Casein - 5mg/ml	1
3	Estimation of Amino acid by Ninhydrin Method, 6 tubes- Graphical) e.g- Leucine - 65ug/ml	1
4	Estimation of Cholesterol by Iron reagent 6 tubes- Graphical)	1
5	Estimation of Reducing sugar from apple juice by Benedict' method - Quantitatively.	1
6	Separation & purification of Lysozyme from egg yolk by Ion Exchange chromatography	1
	<b>Biochemistry Minor Experiments</b>	<b>1</b>
1	Preparation of Buffers- Phosphate, Acetate, and determination of pH with pH meter	1
2	General -Qualitative tests for carbohydrates and detection of carbohydrate from given mixture(Glucose, fructose, maltose, xylose, sucrose, starch )	1
3	General -Qualitative tests for Amino acids and detection of Amino acid from given mixture (Arginine, methionine, cystine, tyrosine, tryptophan, histidine )	1
4	Isolation and characterisation of Casein from Milk	1
5	Isolation and characterisation of Starch from Potato.	1
6	Qualitative assay of $\alpha$ -amylase using starch as a substrate (use of Iodine- visual detection by varying the time of enzyme substrate reaction. )	1
7	Separation and detection of Amino acid by Paper/ Thin layer chromatography	1
8	Separation of Biomolecules by Gel filtration Chromatography	1

### References:

1. *Practical Biochemistry - J. Jayaraman,*
2. *Practical Biochemistry - David Plummer*

## Practical-II

### Laboratory Exercises in Microbiology & Instrumentation

#### *Practicals in Microbiology:-*

Sr. No.	Name of the Practical	Practicals
1)	Microscopic examination of bacteria by a. Monochrome staining.   b. Gram staining   c. Negative staining. d. Capsule staining.   e. Cell wall staining.   f. Endospore staining	6
2)	Mounting and identification of Mold. a) Aspergillus   b) Penicillium	2
3)	Preparation of bacteriological culture media i) Peptone water.   ii) Nutrient broth. iii) Nutrient agar.   iv) Mac Conkey's agar.	2
4)	Preparation of Fungal culture media i) Sabouraud's agar   ii) PDA	2
5)	Enumeration of bacteria by total viable count from soil by spread plate technique and pour plate technique	2
6)	Observation of motility by hanging drop technique.	1
7)	Study of growth curve of bacteria	1
8)	Isolation, colony characters, Gram staining & motility of <i>E.coli</i> , <i>Bacillus sp.</i>	2
9)	Differentiation of fecal & non-fecal coliforms by IMViC Test	1
10)	Isolation, colony characters, Gram's staining and motility of Bacteria isolated from- Air (solid impaction technique)	1
11)	Study of Sugar (Glucose/Lactose) Fermentation ability of Microorganisms	1

#### *References:*

1. *Experimental Microbiology* - Patel
2. *Media Preparation* - Dr. A.M. Deshmukh
3. *Bacteriological Techniques* - F. J. Baker

**Practicals in Instrumentation:-**

Sr. No.	Name of the Practical	Practicals
1)	Use, care and study of Compound Microscope	1
2)	Demonstration (Principle, working, construction) of Colorimeter	1
3)	Determination of $\lambda$ - max of a dye solution (Any dye)	1
4)	Demonstration (Principle, working, construction) of PH meter	1
5)	Demonstration (Principle, working, construction) of Autoclave	1
6)	Demonstration (Principle, working, construction) of Centrifuge	1
7)	Demonstration (Principle, working, construction) of Hot air oven & Incubator	1
8)	Demonstration (Principle, working, construction) of Laminar Air Flow	1
9)	Study of UV absorption spectra of macromolecules (protein and nucleic acid) & determination of Purity	1
10)	Separation of Amino Acids by Paper Electrophoresis	1
11)	Separation of Small & Large Biomolecules by Dialysis technique	1

**References:**

1. *Practical Biochemistry - J. Jayaraman*
2. *Practical Biochemistry - David Plummer*

## Practical-III

### Laboratory Exercises in Plant Science & Animal Science

#### *Practicals in Plant Science:-*

Sr. No.	Name of the Practical	Practicals
1)	Study of algae (Nostoc, Sargassum)	1
2)	Study of bryophyte (Riccia / Anthoceros)	1
3)	Study of Pteridophyte (Selaginella)	1
4)	Study of gymnosperms (Pinus)	1
5)	Study of Angiosperms (Sunflower, Maize)	1
6)	Plant anatomy – Dicot and monocot root, stem, leaf	2
7)	Study of apical meristem (Stem and root)	1
8)	Study of typical flower	1
9)	Study of types of inflorescence	1
10)	Study of fruit types as per theory	1
11)	Study of morphology of seed (Monocot & dicot)	1
12)	Breaking of seed dormancy	1

#### *References:*

1. *Vikas Handbook of Botany - Shrivastava K. C., B.S. Dattatray, A. B. Raizada (1977)*



**Practicals in Animal Science :-**

<b>Sr. No.</b>	<b>Name of the Practical</b>	<b>Practicals</b>
1	Key for Identification of Venomous and non-venomous snakes	1
2	Blood slide Preparation and Identification of Blood cells	1
3	Blood cell count i) Differential count of W. B. Cs. ii) Total count of W. B. Cs and R. B. Cs	2
4	Preparation of Haemin Crystals	1
5	Detection of blood groups	1
6	Detection of bleeding and clotting time of own blood	2
7	Interpretation of ECG.	1
8	Measurement of human blood pressure	1
9	Study of Bone Marrow cells	1
10	Histology of Skin, Tooth, Liver, Kidney, Uterus.	2
11	Demonstration of – i) Bee Keeping- Study of Instruments ii) Sericulture - Study of different Stages.	2
12	Study of aquarium construction and Maintenance	
13	Visit to any water body / Natural history museum and submission of report	2

Activity for students – Preparation of an “animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa (Any 10)

**References:**

1. *Practical Zoology by Lal.*

**Practical-IV****Methods in Bio Statistics, Computer Applications in Biotechnology and Biotech for Human Welfare**

Sr. No.	Name of the Practical	Practicals
<b><i>Practicals in Bio Statistics</i></b>		
1)	Frequency distribution – Graphical, Histogram, ogive curve [less & greater than].	2
2)	Measures of central tendency (Grouped and ungrouped) A. M., Median, Mode.	2
3)	Measures of Dispersion – Range, s. d., C. V. combined s. d.	2
4)	Correlation, Regression. Scattered diagram, Karl Pearson's correlation coefficient, eqn of Regression line.	2
5)	Testing of Hypothesis: Large sample test: Normal, proportion. Small sample test.: $\chi^2$ , t, f.	2
<b><i>Practicals in Computer Applications</i></b>		
1)	Study of commands of word.	1
2)	Creation of worksheet with graphs	1
3)	Power Point presentation.	2
4)	Write program to convert temperature in Celsius into Fahrenheit.	1
5)	Write program to find given number is even or odd.	1
6)	Write program to display Fibonacci series	1
7)	Write program to display number, square & cube upto given number.	1
8)	Introduction to biological database	1

***Biotechnology for Human Welfare Practicals***

<b>9)</b>	Demonstration of commercial Biofertilizer –liquid and solid	<b>1</b>
<b>10)</b>	Standard Plate Count of commercial biofertilizer eg – <i>Azotobacter</i> , <i>Rhizobium</i> and PSB	<b>1</b>
<b>11)</b>	Study of the Finger Print sample and matching	<b>1</b>
<b>12)</b>	Protoplast fusion in Plants	<b>1</b>
<b>13)</b>	Identification of Human Blood by Haemin Crystal formation	<b>1</b>
<b>14)</b>	Identification of Human Blood Group	<b>1</b>
<b>15)</b>	Demonstration of Agarose Gel Electrophoresis for separation DNA Sample	<b>1</b>

## List of minimum equipment's-for Biotechnology-Entire

- 1) Hot air oven - 1
- 2) Incubator - 1
- 3) Autoclave - 1
- 4) Refrigerator - 1
- 5) Students microscopes (oil immersion) - 10 nos. for one batch
- 6) Digital balance - 2
- 7) pH meter - 1
- 8) Centrifuge - 1
- 9) Colorimeter - 1
- 10) Distilled Water Plant - 1
- 11) Laminar air flow cabinet - 1
- 12) Colony counter - 1
- 13) Water bath - 1
- 14) Arrangements for gas supply and fitting of two burners per table.
- 15) One working table of 6' x 2½' for two students.
- 16) One separate sterilization room attach to the laboratory (10' x 15')
- 17) At least one wash basin for a group of five students
- 18) One separate instrument room attached to lab (10' x 15')
- 19) One laboratory for one batch including working tables (6' x 2½') per two students for one batch
- 20) Store room (10' x 15')

## Practical Examination

(A) The practical examination will be conducted on two consecutive days for three hours per day per batch of the practical examination.

(B) Each candidate must produce a certificate from the Head of the Department in her/his college, stating that he/she has completed in a satisfactory manner the practical course on lines laid down from time to time by Academic Council on the recommendations of Board of Studies and that the journal has been properly maintained. Every candidate must have recorded his/her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the year. Candidates must produce their journals at the time of practical examinations.

**Note:- At least 90% Practical's should be covered in practical examination.**



"Education for Knowledge, Science and Culture"  
-Shikshanmaharshi Dr. Bapuji Salunkhe  
**Shri Swami Vivekanand Shikshan Sanstha's**  
**Vivekanand College Kolhapur, (Autonomous).**  
**New course structure to be implemented after sanction(Draft)**  
**For B.Sc-I Biotechnology -Entire 2021-2022**

**Nature of Internal and SEE(Semester End Examination)Examination**

Sr. No	Internal Examination DSC Course		Total = I (a + b)	Conversion of 30 marks in Total (I) (c)	SEE (Semester End Examination) DSC Course (d)	Total (II) (c + d)
	Two tests each of 10 marks (a)	Home assignment (b)				
1	20	10	30	15	35	<b>50</b>

- 1) For internal examination, there shall be two tests (online/offline) of ten marks and one home assignment of 10 marks for each paper per semester.
- 2) For internal examination there shall be conversion of 30 marks in 10 marks and for passing 4 marks is required out of 10.
- 3) For SEE (Semester End Examination), there shall be examination of 40 marks of each course per semester, and for passing 14 marks is required out of 40.
- 5) There shall be separate passing is mandatory for both internal and SEE (Semester End Examination).

**Practical Examination B.Sc.I-Biotechnology -Entire fr 2021-2022 ( as per BoS guidelines)**

Sr.No.	Lab work	Journal (Punctuality, Neatness)	Attendance, and participation in the practical's, motivation	Total
1	40	5	5	50

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