SHIVAJI UNIVERSITY, KOLHAPUR

Established: 1962

A^{++} Accredited by NAAC (2021) with CGPA 3.52

Structure and Syllabus in Accordance with

National Education Policy - 2020

with Multiple Entry and Multiple Exit

Bachelor of Science (Biotechnology- Entire)

Under

Faculty of Science and Technology

(To Be Implemented From Academic Year 2024-25)

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Shivaji University, Kolhapur
Syllabus For Bachelor of Science Part–I: Biotechnology (Entire)
(Revised Syllabus will be implemented from June, 2024 onwards.)

1. Preamble :

This syllabus is so designed to give a sound basis to the undergraduate students of B.Sc. Biotechnology (Entire).

It is known that Biotechnology is no doubt a youngest branch of life science but it is a very important interdisciplinary subject, where in subjects of Plant science, Animal science, Microbiology, Physics, Chemistry and other sciences are blended in such a way that the students are prepared with basic knowledge of Molecular biology, Biochemistry, Biophysics, Genetic engineering, Bioinformatics, Environmental sciences, Plant and Animal cell culture etc. and their technological applications.

Such students having multidisciplinary knowledge are in tremendous demand in industries, education and fundamental research, as trainee workforce. The career opportunities of these students are very wide in different sectors dealing with life sciences.

2. Duration: Four Year Full Time Course with 8 semesters.

3. Eligibility:

- 12^{th} Science pass

4. Medium of Instruction: English

5. Program structure

	SHIVAJI UNIVERSITY, KOLHAPUR NEP-2020: Credit Framework for UG (B.Sc. Biotechnology) Programme Under Faculty of Science and Technology								
Semester/ Level	**Courses**			**OE**	**VSC/ SEC**	**AEC/VEC/IKS**	**OJT/ FP/CEP/ CC/ RP**	**Total Credits**	**Degree/Cum. Cr.**
	Course I	**Course II**	**Course III**						
Semester I (4.5)	**DSC-BT- I(2)** Basics in Biotechnology	**DSC-BT- III (2)** Biomolecules	**DSC-BT - V(2)** Plant Developmental Biology	**OE-I (2) (T/P)**	----	**IKS-1 (2)**	----	**22**	UG Certificate 44
	DSC-BT- II(2) Basics in Microbiology	**DSC-BT- IV (2)** Chemical Science I	**DSC-BT - VI (2)** Biotechniques and Instrumentation						
	DSC-BT- Practical-I (2) Techniques in Microbiology	**DSC-BT Practical II (2)** Techniques in Chemistry	**DSC-BT - Practical III-(2)** Laboratory Exercises in Instrumentation						
Semester II (4.5)	**DSC BT-VII(2)** Basics in Cell Biology	**DSC-BT IX(2)** Proteomics	**DSC-BT - XI(2)** Animal Developmental Biology	**OE-II (2) (T/P)**		**VEC-I (2) (Democracy, Election and Constitution)**		**22**	
	DSC BT-VIII(2) Advances in Microbiology	**DSC-BT- X (2)** Chemical Science II	**DSC-BT-XII (2)** Basics in Computer Science and Biostatistics						
	DSC-BT Practical-IV(2) Techniques in Biological Sciences	**DSC-BT Practical V (2)** Techniques in Biochemistry	**DSC-BT- Practical- VI (2)** Laboratory Exercise in Computer Science and Biostatistics						
Credits	8+4=12	8+4=12	8+4=12	2+2 = 4 (T/P)		2+2 = 4		22 +22= 44	Exit Option: 4 Credits NSQF/Internship/ Skill courses

Note:

- University may decide to offer maximum of three subjects (Courses) in the first year. The student may select one subject out of combination of three subjects (Courses), (which a student has chosen in the first year) as a **MAJOR** subject (Course) and one subject (Course) as **MINOR** Subject in the second year. Thereby it is inferred that the remaining third subject (Course) shall stand discontinued.
- **DSC:** Discipline Specific Course
- **MAJOR:** Mandatory/Elective
- **MINOR:** Course may be from different disciplines of same faculty of DSC Major
- **OE(Open Elective):** Elective courses/**Open Elective to be chosen compulsorily from faculty other than that of the Major.**
- **VSC/SEC: Vocational Skill** Courses **(MAJOR related)**/**Skill Enhancement Courses**
- AEC/ VEC/ IKS: Ability Enhancement Courses (English, Modern Indian Language)/Value Education Courses/ Indian Knowledge System (Generic/Specific).
- OJT/FP/RP/CEP/CC: On-Job Training (Internship/Apprenticeship) / Field Project (Major related)/ Research Projects (Major related Community Engagement (**Major related)/ Co-Curricular courses(CC)** such as Health & Wellness, Yoga Education, Sport and Fitness, Cultural activities, NSS/NCC and Fine /applied/visual/performing Arts / Vivek Vahini etc.

6. Program Outcomes (POs)

1. **Domain Specific knowledge:** Apply the knowledge of Chemistry, Biochemistry, Microbiology, Plant science, Animal science, Cell biology, Genetics, Immunology, Molecular biology, Metabolic pathways, Enzymology, Plant and Animal Biotechnology, Ecology, Environmental Biotechnology, rDNA Technology, Industrial biotechnology, Medical Biotechnology, Bioinformatics, Nanotechnology, Biostatistics and Computer science to provide the solution to the Scientific and Technological and Social problems as well.
2. **Problem analysis:** Identification and formulation of the problems. Data analysis and Interpretation of the results with basic principles.
3. **Design/Development of solutions:** Design solutions for Scientific and Technological and Social problems of various disciplines that significantly realize domestic, agricultural, medical, pharmaceutical, industrial, societal, environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Making use of sophisticated tools, Sophisticated Instruments, Modern methodology, Microscopy, Chromatography, Spectroscopy, Electrophoresis, Thermal Cycler, Gel documentation, DNA Sequencer, Nanotechnology.
6. **The Science and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, industrial, agricultural issues.
7. **Environment and sustainability:** Application of the knowledge to ensure environmental sustainability
8. **Ethics:** Apply ethical principles in scientific Practices
9. **Individual and team work:** Function effectively as an Individual and as a Member or Leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on Scientific and Technological and problems with society at large. This includes ability to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions to realize outreach to the society.
11. **Life-long learning:** Recognize the need of study and ability to engage in independent and life-long learning in the broadest context of scientific change.
12. **Project management and finance:** Demonstrate knowledge and understanding of the Scientific, Technological and management principles and apply these to the project work, as a member or leader in a team.

Program Specific Outcomes (PSOs)

- **Professional Skills:** An ability to understand the basic concepts of various branches of Biotechnology like Agricultural Biotechnology, Food Biotechnology, Industrial Biotechnology, Medical Biotechnology, Pharmaceutical Biotechnology, Environmental Biotechnology, Microbial Biotechnology, Fermentation Biotechnology, Genetic Engineering, Bioinformatics, Nanotechnology, Plant- Animal Tissue culture, Immunology and to develop skills of respective disciplines.
- **Problem-Solving Skills:** An ability to solve Scientific and Technological and Social problems using latest technology and to arrive at cost effective and appropriate solutions.
- **Successful Career and Entrepreneurship:** An understanding of social awareness along with ethical responsibility to have a successful career and to sustain zeal for real-world applications using optimal resources as an Entrepreneur.

7. Syllabus

<table>
<tr><th colspan="3">Semester-I</th></tr>
<tr><th colspan="3">Course I: DSC BT-I : Basics in Biotechnology</th></tr>
<tr><td colspan="3">Course Objectives:
❖ To make students aware of Biotechnology
❖ To introduce different areas in Biotechnology
❖ To introduce students with the role of Biotechnology in Human welfare</td></tr>
<tr><td>Topic No.</td><td></td><td>Lectures 30</td></tr>
<tr><td></td><td>Credit-I</td><td></td></tr>
<tr><td>1.</td><td>Introduction to Biotechnology:
Introduction, Milestones in the History of Biotechnology, Traditional and Modern Biotechnology, Areas of Biotechnology (Red, Green, White, Blue), commercial potential of biotechnology, Biotechnology in India, Renounced Biotechnology institutes in India (IIT, IISER, NCL, NCCS, ARI, NIV, CCMB, CDFD etc.)
Agencies in India :
DBT, DDFSL, DFS, FSL, RFSL, MFSL, CFSL, GEQD, NFB, NCRB, CID, CBI, IB, RAW, NIA etc.</td><td>7</td></tr>
<tr><td>2.</td><td>Agricultural Biotechnology:
Introduction, Plant Tissue culture, Genetically modified crops, GMOs in Agriculture, Plant Based Vaccines
Biofertilizer - Definition, types with examples.
Biopesticide – Definition, types with examples.</td><td>8</td></tr>
<tr><td></td><td>Credit-II</td><td></td></tr>
<tr><td>3.</td><td>Health Biotechnology:
Pandemic diseases- definition, examples with causal organism, study of current pandemic COVID-19. Role of Biotechnology in pandemics.
Gene Therapy- concept, advantages and disadvantages.
Vaccines- concept, types with examples.
Disease diagnosis, detection of genetic diseases, disease treatment, stem cell technology.</td><td>7</td></tr>
<tr><td>4.</td><td>Food Biotechnology: Biotechnological applications in enhancement of Food Quality, food safety, Food Products, Microbial role in food products Yeast, Bacterial and other Microorganisms based process and products, Modern Biotechnological Regulatory Aspects in Food Industries Biotechnology and Food - Social Appraisal</td><td>8</td></tr>
<tr><td colspan="3">Course Outcomes:
Students will able to understand
❖ Basic concepts of biotechnology
❖ Biotechnology institute in India
❖ Different areas in biotechnology
❖ Role of Biotechnology in Human welfare</td></tr>
</table>

References:

- Biotechnology – U. Satyanarayana
- Medical biotechnology – S. N. Jogdand
- Advances in Biotechnology- S.N.Jogadand
- A textbook of Biotechnology - R. C. Dubey
- Pharmaceutical Biotechnology – S. P. Vyas ,V. K. Dixit
- Biotchnology – B. D. Singh
- Fundamentals of agriculture biotechnology – S. S. Purohit
- Agricultutre application of Microbiology- Neeelima Rajvaidya.
- Food Biotechnology- Varun Mehta.

Course I: DSC BT-II: Basics in Microbiology

Course Objectives:

- ❖ Define the science of microbiology and describe some of the general methods used in the study of microorganisms
- ❖ Discuss how Koch's postulates are used to establish the causal link between a suspected microorganism and a disease
- ❖ Describe some of the various activities of microorganisms that are beneficial to humans
- ❖ Discuss the importance of the field of microbiology to other areas of biology and to general human welfare
- ❖ Appropriate laboratory and techniques to the isolation, staining, identification and control of microorganisms.

Topic No.		Lectures 30
	Credit-I	
1.	**Microbiology:** Definition, History (Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, John Tyndall), Introduction to types of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses, Applied branches of Microbiology, major microbiological institutes in India. **Morphology and cytology of Bacteria** Morphology of Bacteria – Size, Shape, Arrangements. Cytology of Bacteria – Structure and functions of: Cell wall, Cell membrane, Capsule and slime, Flagella, Pilli, Nuclear material, Mesosome, Ribosome, Reserve food material and Endospore.	**7**
2.	**Bacterial Systematics:** Classification of living Organisms- Two kingdom, Three kingdom and five kingdom system. Criteria for bacterial classification- Morphological, cultural, biochemical, serological characters and Molecular characters. General principles of bacterial nomenclature- Taxonomic ranks, Common or Vernacular name, Scientific or International name, Concept of bacterial species & strain. General Characteristics of Certain Bacteria- Ache bacteria, Actinomycetes, Rickettsia, Chlamydia, Mycoplasma. **Introduction to Virology**- General characteristics, Principles of Cultivation, Classification, lytic cycle of T4 bacteriophage, Lysogenic cycle of Lambda phage**.**	**8**
	Credit-II	
3.	**Sterilization:-** Definitions of Sterilization, Disinfection, Antiseptic, Germicide, Microbiostasis, Asepsis, Sanitization. Methods of sterilization by- Physical agents**:** i) Temperature- dry heat, moist heat ii) Radiation- U.V, Gamma radiation iii) Bacteria proof filter- membrane filter.	**7**

	Chemical agents: - Phenol & Phenolic compounds, Alcohol, Heavy metals (e.g.mercury). Gaseous agents- Ethylene oxide, formaldehyde.	
4.	**Microbial nutrition** Nutritional requirements of microorganisms: Water; Micronutrients; Macronutrients; Carbon, Energy source; Oxygen and Hydrogen; Nitrogen, Sulfer, Phosphorous and growth factors. Auxotroph, prototroph and fastidious organisms. Nutritional types of microorganism based on carbon and energy sources- Autotrophs , Heterotrophs, Phototrophs, Chemotrophs, Photoautotrophs, Chemoautotrophs, Photoheterotrophs, chemoheterotrophs.	**8**

Course Outcomes:

After completing the credits students should gain knowledge about:

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

References:

- General microbiology-Stanier
- Introduction to microbiology-Ingraham
- Brock biology of microorganisms-Madigan et al
- Fundamentals of microbiology-Frobisher
- Microbiology-Pelczar
- General microbiology –Pawar & Daginawala
- Text book of microbiology-Ananthanarayan

Course I: DSC BT Practical I: Techniques in Microbiology (2 Cr)

Sr. No.	Name of the Practical
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
2	Isolation, mounting and identification of Mold. a. *Aspergillus*b. *Penicillium c. Mucor d. Rhizopus*
3	Preparation of bacteriological culture media i) Peptone water. ii) Nutrient broth. iii) Nutrient agar. iv) Mac Conkey's agar.
4	Preparation of Fungal culture media i) Sabouraud's agar ii)PDA
5	Enumeration of bacteria by total viable count from soil by spread plate technique and pour plate technique.
6	Observation of motility by hanging drop technique.
7	Study of growth curve of bacteria.
8	Isolation, colony characters, Gram staining & motility of *E.coli, Bacillus* sp.
9	Blood slide Preparation and Identification of Blood cells.
10	Blood cell count i) Differential count of W. B. Cs. ii)Total count of W. B. Cs and R. B. Cs.
11	Preparation of Haemin Crystals.
12	Determination of Hemoglobin.

Course outcome:

- Student is expected to use independently various instruments with proper care.
- Student should get the knowledge of basic spectroscopic and chromatography techniques.
- Students know the various staining procedures and their applications.
- Students get the knowledge of culture media preparation, microbial cultivation and enumeration.
- Students know how to isolate bacteria and study their cultural and morphological characteristics.

References:

- Laboratory manual of microbiology and biotechnology by K.R.Aneja
- Microbiology : Laboratory theory and Application by Michael J. Leboffe and E.Pierce
- Laboratory Experiments in microbiology by Ted R. Johnson and Christine
- Practical Microbiology: a laboratory manual by B. Senthil Kumar, Zothansanga, D. Senbagam, N. Senthil Kumar and G. Gurusubramanian.
- Textbook of biophysical chemistry- Nath upadhyay Nath.
- Bio-instrumentation – B. Nagamani

- Bio-instrumentation – Veerakumari
- Principles and techniques of Biochemistry and Molecular Biology - Wilson and walker.
- Practical handbook of Biochemistry and Molecular Biology- Gerald D.Fasman
- Experimental Microbiology – Patel & Patel
- 11.Bacteriological techniques by F. J. Baker.
- 12. Stains and Staining procedures by Desai and Desai.

Course II: DSC BT-III: Biomolecules

Course Objectives:

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

Topic No.		Lectures 30
	Credit-I	
1.	**Origin of life:** Basic concept, Theory of spontaneous generation, 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^H, P^K value definition, H-H Equation, Biological buffer systems e.g. Phosphate, Bicarbonate, Hemoglobin buffer system, Protein buffer system.	**7**
2.	**Nucleic acids:** Nucleosides, nucleotides, polynucleotide, DNA and its different forms with properties. (A, B, C, D and Z). RNA and its types- m-RNA, t-RNA, r-RNA, hnRNA, snRNA, snoRNA, Forces Stabilizing nucleic acid structure.	**8**
	Credit-II	
3.	**Carbohydrates:** Biological importance of carbohydrates, Classification. Monosaccharide- Glyceraldehydes, simple aldoses & ketoses, conformation of D-glucose, reactions of monosaccharide (Oxidation, reduction, osazone), glycosidic bond. Oligosaccharides- disaccharides (Sucrose, maltose, lactose) Polysaccharides- homo polysaccharides (Starch, glycogen, Cellulose.)	**7**
4.	**Lipids :** Fatty acids Physical properties- state, color, odour, melting point, solubility, specific gravity, geometric isomerism, insulation, emulsification, surface tension. Chemical properties- sap value, acid value, iodine no., rancidity; Classification of Lipids- A) Simple lipid- Triacylglycerol & waxes. B)Compound lipid- 1) Phospholipid e.g- Phosphotidyl choline, ethanolamine Glyserolipid, 2) Sphingolipids- Sphingomycelin, cerebrosides, gangliosides; C) Derived lipid- Cholestrol lipoprotein- LDL, VLDL, HDL, Chylomicrons. Liposome.	**8**

Course Outcome:

Student should understand**:**

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

References:-

- Biochemistry – Nelson & Cox
- Biochemistry - Stryer
- Enzymes - Trevor Palmer

- Biochemistry - Voiet & Voiet
- Biochemistry - J. L. Jain
- Basic Biophysics- M. Daniel
- Biochemistry - Powar and Chatwal
- Protein Purification- Harris and Angel
- Principles of Biochemistry - T. N. Pattabriraman.
- Biochemistry 3rd Edition – Hames & Hopper.
- General Biochemistry – J. H. Well.
- Biochemistry – J. H. Ottaway & D. K. Apps
- Biochemistry – Trchan
- Text Book of Biochemistry- R. A. Joshi.
- Biochemistry – U. Satyanarayanan
- Biochemistry a Functional Approach – Robert W McGilvery & Goldstein
- Text Book of Biochemistry – A.V. S. S. Rama Rao
- Clinical Biochemistry –Praful B. Godkar.

Course II: DSC BT-IV: Chemical Science I

Course Objectives:

- ❖ To make students aware of fundamentals of chemistry.
- ❖ To make the student aware of basics of chemical science in relevance to biological systems.
- ❖ To make the student aware of structure, bonding and basics of organic reaction.

Topic No.		Lectures 30
	Credit-I	
1.	**Electrochemistry** (Reduction potentials 4. to be used) Introduction, Conductance- Definition and types. Kohlrausch law- Statement and its applications. Galvanic cells, half-cell potentials, emf- Meaning and definition. Thermodynamics of electrode potentials, Nernst equation and its derivation, K from cell emf, determination of ΔG, ΔH and ΔS. Types of electrodes, construction and working of calomel and glass electrodes. Numerical problems. **Reaction Kinetics** Introduction- Meaning and definitions of- rate constant, order and molecularity of reaction, activation energy. Integrated rate expressions for zero, 1st and 2nd order reactions. Characteristics of 1st order reactions.	**15**
	Credit-II	
2.	**Thermodynamics** Introduction- Reversible and irreversible processes, internal energy. Enthalpy, heat of reaction and its types, First Law-Statement and mathematical expression. Measurement of ΔH. Second law- Statement, concept of entropy (Criteria for spontaneousand non-spontaneous processes). Third law-Absolute entropies and their uses. Gibbs and Helmholtz free energy functions-Criteria for thermodynamic equilibrium and spontaneity. ΔG and K, ΔG and work function. Relation between ΔH and ΔG (Gibbs-Helmholtz equation).	**15**

Course Outcome:

Student should understand**:**

- ❖ Basic concepts and experiments about chemistry.
- ❖ Concept of electrochemistry and thermodynamics.
- ❖ Structure and bonding.
- ❖ Basics of coordination complex and organic reaction.

References:-

- University General Chemistry - C. N. R. Rao, Macmillan.
- Physical Chemistry - R. A. Alberty, Wiley Eastern Ltd.
- Quantum Chemistry Including Molecular Spectroscopy- B. K. Sen.
- Organic Chemistry - D. J. Cram and G. S. Hammond (Mcgraw-Hill).
- A Guide-book to Mechanism of Organic Chemistry-Peter Sykes-6th Edition.
- Theoretical Principles of Inorganic Chemistry- G.S. Manku
- Physical Chemistry by Sharma and Puri
- Instrumental methods of chemical analysis- Chatwal & Anand
- Instrumental methods of chemical analysis- B. K. Sharma
- Organic Chemistry VOL-II 5th Edition- I. L. Finar
- An introduction to electrochemistry- Samuel Glassstone

- The elements of physical chemistry – P.W. Atkins.
- Essential of physical chemistry- B .S. Bahel. & G. D.Tuli.
- Principels of Physical Chemistry – S.H Maron & Pruton
- 15) Concisein Inorganic chemistry – J.D. Lee

Course II: DSC BT Practical II: Techniques in Chemistry (2 Cr)	
Sr. No.	**Name of the Practical's**
1	Determination of dissociation constant of a weak acid and study of effect of substituent on dissociation constant of weak acid.
2	Conductometric titration- Strong acid, strong base.
3	Acid catalyzed hydrolysis of methyl acetate.
4	Activation energy for an acid catalyzed hydrolysis of methyl acetate.
5	Determination of P^H of fruit juice and soil sample.
6	Organic Preparations 1. Phthalimide 2. Methyl salicylate
7	Estimation of Vit. C
8	Estimation of sap value of given oil sample.
9	Preparation of standard potassium dichromate solution and determination of strength of ferrous ammonium sulphate solution.
10	Preparation of dilute solution from given stock solution.
11	Inorganic preparations-1. Ferrous ammonium sulphate 2. Hexammine Nickel (II) Chloride.
12	Inorganic Estimation :- Estimation of amount of magnesium from talcum powder by complexometric titration.
13	Verification of Beer-Lambert's Law using copper ammonia complex.

Course outcome:

- At the end of this module, student is expected to know simple chemistry techniques .
- Models should bring clarity in concepts of titration.
- Organic and inorganic preparations.
- Process of estimations.

Reference:-

1. ChemistryText book of practical organic chemistry (4th Edition, Longman) – A .I. Vogel.
2. Organic Chemistry – Morrison & Boyd

Course III: DSC BT-V Plant Developmental Biology

Course Objectives :--

- To understand plant and animal development.
- To understand embryology of plants and animals.
- To study the differentiation and regeneration.

Topic No.		Lectures 30
	Credit-I	
1.	**Vegetative development**: Meristem- Organization of shoot apical meristem, Organization of root apical meristem, shoot development, root development, leaf development.	**7**
2.	**Reproductive development**: Shift from vegetative to reproductive phase- juvenility, floral signals and floral meristem identity- ABC model.	**8**
	Credit-II	
3.	**Gametogenesis in Plants, Development of male and female Gametophyte. Fertilization in Angiosperm (Process and significance) Embryogenesis:** Structure and development of embryo in Monocotyledons Structure and development of embryo in dicotyledons. Endosperm: Development of endosperm, Types of endosperm- Nuclear, Helobial and Cellular.	**8**
4.	**Apomixis:** Introduction, Causes of apomixes and Types: Gametophytic and Sporophytic, Significance of apomixes. **Polyembryony:** Introduction, Types of polyembryony- True polyembryony (Cleavage and Adventive), False polyembryony. Causes of Polyembryony, Significance of Polyembryony. **Parthenocarpy**- Definition and significance	**7**

Course Outcomes: Students should be able to understand

- Plant and animal development.
- Embryology of plants and animals.
- Differentiation and regeneration.

References-

- Fundamentals of plant physiology (MacMillan)Devlin R.M.
- An Introduction to embryophyta (Central book depot)Parihar N.S.

Development Biology, 9th edition, (2010), Gilbert S.F. (Sinauer Associates, USA).
Foundations of Embryology – Patten
Cell and Developmental Biotechnology – Raj Narian D esikar
Cell and Developmental Biotechnology – Raj Narian D esikar
Plant Anatomy and Embryology- S.N. Pandey, A. Chadha
The Embryology of Angiosperm – Bhojawani .S .S and Bhatnagar.S.P (Vikas Publ House, New Delhi)
An Introduction to the Embryology of Angiosperm. – P. Maheswari.
An Introduction to Plant Cell Development (Cambridge Univ Press, UK)Burgess J. (1985)
Plant embryology: Classic al and experimenta Sharma HP (2009) –l (alpha sci)

Course III: DSC BT-VI Biotechniques and Instrumentation

Course Objective:

- ❖ To study working and instrumentation of instruments.
- ❖ To learn applicability of instruments in biology
- ❖ To understand concepts of bioinstrumentation
- ❖ To study use and applications of biophysics
- ❖ TO study different stains and staining techniques in biology.

Topic No.		Lectures 30
	Credit-I	
1.	**Basic Laboratory Instruments:** Principle, working and application of P^H meter, Conductometer, Colorimeter, Refractometer, Autoclave, Laminar Air Flow, Incubator, Water bath, Centrifuge - types of Centrifugation (Desktop, High speed and Ultracentrifuge, Differential and Density gradient)	**7**
2.	**Chromatography:** Introduction, Theory, Principle and applications of paper chromatography and Thin layer chromatography. **Electrophoresis-** Introduction, Principle, theory and applications of paper electrophoresis, Agarose gel Electrophoresis, PAGE. **UV-Visible Spectroscopy** Introduction of spectroscopy, properties of electromagnetic radiation, Electromagnetic spectrum, Electronic Transitions and designation of UV-bands. General applications, spectrum, isolated double bonds, conjugated dienes, carbonyl compounds, aromatics. Analytical uses. Lambert-Beer's law Principle, Instrumentation with respect to colorimeter and single beam spectrophotometer. Principle, Instrumentation, Applications of UV and Visible spectroscopy.	**8**
	Credit-II	
3.	**Microscopy** General principles of microscopy- Image formation, magnification, numerical aperture (Uses of oil immersion objective), resolving power of microscope and working distance. Ray diagram, special features, applications and comparative study of compound microscope and Electron Microscope (Scanning and Transmission Electron Microscope).	**7**
4.	**Stains and staining procedures -** Definition of dye and stain, Classification of stains – Acidic, Basic and Neutral. Principles, Procedure, Mechanism and application of staining procedures in Prokaryotes. Simple staining, Negative staining, Differential staining: Gram staining and Acid fast staining, Special staining: Capsule staining, cell wall staining, endospore staining, metachromatic granule staining. Principles, Procedure, Mechanism and application of staining procedures in Eukaryotes- Nuclear, Mitochondrial and chloroplast, Nucleic acid and protein	**8**

	staining.	

Course outcome:-

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

References:-

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

Course III: DSC BT Practical III: Laboratory Exercises in Instrumentation (2 Cr)	
Sr. No.	**Name of the Practical's**
1	Use, care and study of compound microscopy.
2	Demonstration (Principle, working, construction) of Colorimeter and Determination of λ max of a dye solution.
3	Demonstration (Principle, working, construction) of PH meter and Conductivity meter.
4	Demonstration (Principle, working, construction) of Autoclave and Centrifuge.
5	Demonstration (Principle, working, construction) of Hot air oven and microbial Incubator.
6	Demonstration (Principle, working, construction) of Laminar Air Flow and Refractometer.
7	Spectrophotometric determination of nucleic acid purity and concentration.
8	Study of UV absorption spectra of macromolecules. (protein and nucleic acid)
9	Separation and identification of plant pigments using Ascending paper Chromatography.
10	Separation and identification of amino acids using TLC.
11	Separation of amino acid by Paper Electrophoresis.

Course outcome:

- ❖ Student is expected to use independently various instruments with proper care.
- ❖ Student should get the knowledge of basic spectroscopic and chromatography techniques.

Reference:-

- Textbook of biophysical chemistry- Nath upadhyay Nath.
- Bio-instrumentation – B. Nagamani
- Bio-instrumentation – Veerakumari
- Principles and techniques of Biochemistry and Molecular Biology - Wilson and walker.
- Practical handbook of Biochemistry and Molecular Biology- Gerald D.Fasman

Semester-II

Course I: DSC BT-VII: Basics in Cell Biology

Course Objectives:

- To make the student aware of basic concepts of Cell, Cell organelles.
- To make the student aware of basic concepts cytoskeleton
- To make the student aware of basics of Cell membrane and membrane transport .

Topic No.		Lectures 30
	Credit-I	
1.	**Cell structure** 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 & functions of cell organelles Mitochondria, Chloroplast, E.R., Golgi apparatus, Lysosome, Peroxisome, Ribosomes.	**7**
2.	**Nucleus** Introduction, morphology, occurrence, shape, size, number, position Ultra structure of nucleus- Nuclear membrane, nucleoplasm, nucleopore complex, nucleolus. Chromosome structure- introduction, General features of Prokaryotic chromosome. General features of Eukaryotic chromosome- Chromosome number, size, Chromosomal nomenclature & General structure.	**8**
	Credit-II	
3.	**Cytoskeletal assembly** Introduction, Cytoskeletal elements. Microtubules- occurrence, structure, chemical composition, Microtubule associated proteins, HMW proteins, DAU proteins, MTOC, assembly and disassembly of microtubules, functions. Microfilaments- occurrence, structure, chemical composition, functions. Intermediate filaments- occurrence, structure, chemical composition, types of IF, functions. Organization of cilia and flagella.	**8**
4.	**Cell membrane & 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^+-K^+ ATPase pump, Calcium channel. Bulk transport- endocytosis and exocytosis	**7**

Course Outcome:

After completing the credits students should gain knowledge about:

- Basic concepts of Cell and sub cellular structures

- ❖ Basic Concept of Cytoskeletal assembly.
- ❖ Basic Concept of Cell membrane and membrane transport.

References:-

- Molecular biology of cell-Albert
- Molecular biology & cell biology – Loddish etal
- Cell biology –De Robertis
- Cell biology-Genetics, molecular biology-P.S. Warma & Agarwal
- Genes Lewin
- Cell biology –Geral karp
- Practical biochemistry – Keith, Wilson and Walker
- Cell Biology- C.B.Pawar

Course I: DSC BT-VIII: Advances in Microbiology

Course Objectives:

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

Topic No.		Lectures 30
	Credit-I	
1.	**Culture media and pure culture techniques:** Common components of media and their functions, Peptone, Tryptone Yeast extract, NaCl, Agar and Sugar. Culture media Living Media- Lab animals, plants, bacteria, embryonated eggs, tissue cultures. Non-living media– i) Natural, ii) Synthetic, iii) Semi-synthetic, iv) Differential, v) Enriched, vi) Enrichment, vii) Selective. Methods for isolation of pure culture- i) Streak plate ii) Pour plate iii) Spread plate	**7**
2.	**Microbial growth:** Definition of growth, phases & growth curve a] Continuous culture b] Synchronous growth c] Diauxic growth. Effect of environmental factors on growth- Temperature, P^H, osmotic pressure, hydrostatic pressure, surface tension, heavy metals, ultra violet light.	**8**
	Credit-II	
3.	**Water Microbiology –** Sources of microorganisms in water, fecal pollution of water, Routine bacteriological analysis of water i) SPC, ii) Tests for coliforms- Qualitative: detection and differentiation of coliforms, Quantative: MPN technique. **Soil microbiology:** Types of microorganisms in soil and their role in soil fertility. Microbial interactions in soil- symbiosis, commensalism, amensalism, parasitism and predation.	**07**
4.	**Medical microbiology** Definition, Host, parasite, Saprophytes, Commensals, Infection, Etiological agent, Disease, Pathogen, Opportunistic pathogen, True	**08**

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

Course Outcome:

After completing the credits students should gain knowledge about:

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

References:

- General microbiology-Stanier
- Introduction to microbiology-Ingraham
- Brock biology of microorganisms-Madigan etal
- Fundamentals of microbiology-Frobisher
- Microbiology-Pelczar
- General microbiology –Pawar &Daginawala
- Text book of microbiology-Ananthanarayan

Course I: DSC BT Practical-IV: Techniques in Biological Sciences (2 Cr)	
Sr. No.	**Name of the Practical**
1.	Study of pollen germination.
2.	Detection of pollen fertility by staining technique.
3.	Dissection of embryo / endosperm from developing seeds.
4.	Whole mount of chick embryo – 18, 24, 33, 48 and 72 hours.
5.	T.S. of chick embryo – 18, 24, 33, 48 and 72 hours
6.	Measurement of size of cell structure/cell organelle/spore by micrometry.
7.	Isolation of nucleus.
8.	Isolation of chloroplast.
9.	Isolation of mitochondria.
10.	Use of dialysis to separate smaller molecules than larger molecules.
11.	Effect of temperature and organic solvent on membrane permeability of cells.
12.	Study of plasmolysis
	Study tour: Visit to Biodiversity spot, Sericulture, Apiculture ,Vermicomposting, Biotech Industry.

Course Outcome:

Students should be able to acquaint:-

- The basic and advanced knowledge of plant and animal embryo.
- Basic knowledge of pollen germination.
- Develop the skill isolation of organelles.

Course II: DSC BT-IX- Proteomics

Course Objectives:

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

Topic No.		Lectures 30
	Credit-I	
1.	**Amino acids** Structure and classification, proteinogenic and non proteinogenic amino acids, Essential and non essential amino acids. physical, chemical and optical properties of amino acids Uses of amino acids Detection of amino acid– Ninhydrin, o-phthalaldehyde reaction	**7**
2.	**Basics of Proteomics:** Definition, Formation and characteristics of peptide bond, structural level of proteins, primary structure (oxytocin), secondary structure (alpha helix and beta plates e.g. keratin) tertiary structure (myoglobin), quaternary structure (hemoglobin) Forces involved in stabilization of protein structure (covalent – disulphide, non-covalent- hydrogen bonds, wander wall, ionic, hydrophobic) Types of proteins on the basis of structure– fibrous, Globular and Membrane proteins.	**8**
	Credit-II	
3.	**Ramchandran plot**: Discovery, phi and psi angles, applications, (Importance of glycine and proline) **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.	**7**
4.	**Determination of amino acid composition:** Acid hydrolysis, alkaline hydrolysis, enzymatic hydrolysis. **Sequencing of proteins:** End group analysis **N-terminal**- Sanger's method, Edman's method, Dansyl chloride, mass spectroscopy (MALDI TOF). **C-terminal:** Akabori method, By carboxy peptidase **Determination of secondary structure**: CD method, X ray crystallography.	**8**

Course Outcomes:

Student should be able to

- Understand fundamentals of biochemistry.
- Understand basics of chemical science in relevance to biological systems.
- Learn basic concepts of amino acids, proteins.
- Understand the basic methods to determine structure of protein and protein purification.
- Should be able to relate it to day today life.

References:-

- Biochemistry – Nelson & Cox
- Biochemistry - Stryer
- Enzymes - Trevor Palmer

- Biochemistry - Voiet & Voiet
- Biochemistry - J.L.Jain
- Basic Biophysics- M. Daniel
- Biochemistry - Powar and Chatwal
- Protein Purification- Harris and Angel
- Practical biochemistry – Keith Wilson And Walker
- Principles of Biochemistry - T. N. Pattabriraman.
- Biochemistry 3rd Edition – Hames & Hopper.
- General Biochemistry – J. H. Well.
- Biochemistry – J. H. Ottaway & D. K. Apps
- Biochemistry – Trchan
- Text Book of Biochemistry- R.A. Joshi.
- Biochemistry – U. Satyanarayanan
- Biochemistry a Functional Approach – Robert W McGilvery & Goldstein
- Text Book of Biochemistry – A.V.S.S. Rama Rao
- Clinical Biochemistry –Praful B. Godkar.

Course II: DSC BT-X: Chemical Science II

Course Objectives:

- ❖ To make students aware of fundamentals of chemistry.
- ❖ To make the student aware of basics of chemical science in relevance to biological systems.
- ❖ To make the student aware of structure, bonding and basics of organic reaction.

Topic No.		Lectures 30
	Credit-I	
1.	**Structure and Bonding**. Introduction- types of bonds. Ionic covalent bond, Co-ordinate bond, Metallic bond, hydrogen bond, Vanderwaal's forces. Formation of ionic and covalent bond with examples, e.g. NaCl, KCl, HCl, CH4, Cl2, H2. VBT- Postulates, Concept of Hybridization, sp, sp2, sp3 hybridization with respect to BeCl2, BF3, SiCl4 (Along with consequences with respect to bond length, bond angle, bond energy and shape of the molecule.)	**15**
	Credit-II	
2.	**Coordination Complexes** Definition and formation of Co-ordinate bond in BF3, NH3 & NH4 + 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. **Fundamentals and Mechanistic Basis of Organic Reaction** Introduction, Reaction mechanism-Definition, curved arrow notation, substrate, Reagents, Types of reagents, types of reactions, Reactiveintermediate Carbocataion, Carbanion, Carbon Free radicals SN1 and SN2 mechanisms (Hydrolysis of t-butyl halide and primary alkyl halide) with energy profile diagram. Elimination reactions- E1 and E2 mechanisms (Dehydration of alcohol), Hoffman's and Saytzeff's rules- statements and justifications. Addition reactions- Electrophilic addition reactions in alkenes (Markovnikoff and anti-Markovnikoff additions), nucleophilic addition reactions of carbonyl compounds (cyanohydrin formation). Concept of an aromaticity. Mechanism of SE reactions in benzene- Nitration, sulphonation, halogenation, diazotization, Friedel-Craft's alkylation and acylation reactions. Orientation effects as exemplified by– NO2, OH functional groups.	**15**

Course Outcome:

Student should understand**:**

- ❖ Basic concepts and experiments about chemistry.
- ❖ Concept of electrochemistry and thermodynamics.
- ❖ Structure and bonding.
- ❖ Basics of coordination complex and organic reaction.

References:-

- University General Chemistry - C. N. R. Rao, Macmillan.
- Physical Chemistry - R. A. Alberty, Wiley Eastern Ltd.
- Quantum Chemistry Including Molecular Spectroscopy- B. K. Sen.
- Organic Chemistry - D. J. Cram and G. S. Hammond (Mcgraw-Hill).
- A Guide-book to Mechanism of Organic Chemistry-Peter Sykes-6th Edition.
- Theoretical Principles of Inorganic Chemistry- G.S. Manku
- Physical Chemistry by Sharma and Puri

- Instrumental methods of chemical analysis- Chatwal & Anand
- Instrumental methods of chemical analysis- B. K. Sharma
- Organic Chemistry VOL-II 5th Edition- I. L. Finar
- An introduction to electrochemistry- Samuel Glassstone
- The elements of physical chemistry – P.W. Atkins.
- Essential of physical chemistry- B .S. Bahel. & G. D.Tuli.
- Principels of Physical Chemistry – S.H Maron & Pruton
- 15) Concisein Inorganic chemistry – J.D. Lee

Course II: DSC BT Practical-V : Techniques in Biochemistry (2 Cr)

Sr. No.	Name of the Practical's
1)	Preparation of buffers (Phosphate buffer, acetate buffer) and determination of pH with pH meter.
2)	General test for carbohydrates and detection of unknown Carbohydrate from mixture. (Glucose, fructose, maltose, sucrose, xylose and starch)
3)	Estimation of reducing sugar from apple juice by Benedict's method.
4)	General test for Amino acids and detection of unknown Amino acid from mixture. (Arginine, methionine, cystine, tyrosine, histidine,proline, tryptophan)
5)	Protein estimation (Biuret method)
6)	Isolation and characterization of casein from milk.
7)	Qualitative assay of α- amylase using starch as substrate.
8)	Isolation and characterization of starch from potatoes.
9)	Estimation of Glucose by 3,5 Dinitro salicylic acid method.
10)	Estimation of Cholesterol by iron reagent.
11)	Estimation of amino acid by Ninhydrin method.

Course outcome:

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

Course III: DSC BT-XI Animal Developmental Biology

Course Objectives :--

- To understand plant and animal development.
- To understand embryology of plants and animals.
- To study the differentiation and regeneration.

Topic No.		Lectures 30
	Credit-I	
1.	**Animal Embryology** **Gametogenesis, gametes and fertilization in Animals:** Gametogenesis in animals, Types of eggs and sperms in animals, Fertilization in animals.	**7**
2.	**Early development in animals:** 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, Fetal membranes, Types and significance of placentae.	**8**
	Credit-II	
3.	**Differentiation and Regeneration :** Cell lineages, Determination, Commitment -specification and determination, Differentiation, Dedifferentiation, Rediffrentitation, Transdifferentiation, Developmental Plasticity.	**8**
4.	**French flag anatomy** Role of gene/s in patterning and development (anterior, posterior and dorsal ventral axis) of *Drosophila.* **Regeneration :** Definition, mechanism, factors affecting regeneration	**7**

Course Outcomes: Students should be able to understand

- Plant and animal development.
- Embryology of plants and animals.
- Differentiation and regeneration.

References-

- Fundamentals of plant physiology (MacMillan)Devlin R.M.
- An Introduction to embryophyta (Central book depot)Parihar N.S.

Development Biology, 9th edition, (2010), Gilbert S.F. (Sinauer Associates, USA).
Foundations of Embryology – Patten
Cell and Developmental Biotechnology – Raj Narian D esikar
Cell and Developmental Biotechnology – Raj Narian D esikar
Plant Anatomy and Embryology- S.N. Pandey, A. Chadha
The Embryology of Angiosperm – Bhojawani .S .S and Bhatnagar.S.P (Vikas Publ House, New Delhi)
An Introduction to the Embryology of Angiosperm. – P. Maheswari.
An Introduction to Plant Cell Development (Cambridge Univ Press, UK)Burgess J. (1985)
Plant embryology: Classic al and experimenta Sharma HP (2009) –l (alpha sci)

Course III: DSC BT -XII Basics in Computer Science and Biostatistics

Course Objectives:

- ❖ To study the computer basics and operating system.
- ❖ To understand the Office operations like Microsoft Word, Microsoft Excel and power point presentation.
- ❖ To study the Database management and their importance.

Topic No.		Lectures 30
	Credit-I	
1.	**Computer basics & Operating System:** **Computer basics:** Definition, Block Dig. (I/O/Secondary storage), Applications, Generations, Types of computer, functions of a computer Input and output device, storage devise, Numbering system (binary to decimal & decimal to binary), Personal Computers- PC and its main components, hardware configuration, Computer Memory – Concept, Internal and External Memory, Factors influencing on PC performance. Computer networks – LAN, WAN, MAN, Internet and Intranet Computer viruses: An overview of Computer viruses, What is a virus? Virus symptoms, How do they get transmitted? What are the dangers? General Precautions	**7**
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.	**8**
	Credit-II	
3.	**Data processing & presentation**: Word Processing : Introduction to MS Office components, Introduction and working with MS Word , Word basic commands, Formatting- text and documents, sorting and tables, introduction to mail-merge. Spread Sheets: Working with EXCEL- formatting, functions, chart features, Working with graphics in Excel, Excel functions, table operations. Presentation with Power-Point: Power-point basics, creating presentation, working with graphics, show time, sound effects and animation effects. Internet, E-mail, Discussion groups, Search tools, Web utilities, concept of E commerce, Application of E commerce.	**7**
4.	**Biostatistics** Introduction, definition, terminology. Collection and presentation of data: Types of data, techniques of data collection- Census method, sampling method- simple random, stratified and systematic sampling. Classification, tabulation, graphical representation- Histogram and polygon. Measures of central tendency and Dispersion: Arithmetic mean, Mode, Median, Range, Deviation, Mean deviation, Standard Deviation, Coefficient of Variation. Statistical methods for testing the hypothesis') Students' T-test ii) Chi-square test.	**8**

Course Outcomes:

- ❖ Student should be able to understand basics of computer & Operating System.
- ❖ Student should get Knowledge of Data processing and presentation.
- ❖ Student should be able to understand database management.

References :-

- Computer Fundamentals by P. K. Sinha
- C Application programs and Projects by Pramod Vasambekar
- Use of Computer from Vision Publication
- Let Us C by Kanetkar
- Ansi C by Balgurusami

Course III: DSC BT Practical-VI: Laboratory Exercise in Computer Science and Biostatistics (2 Cr)

Sr. No.	Name of the Practical
1)	Searching for a web site / application / text documents viewing and downloading.
2)	Create an E-mail account, Retrieving messages from inbox, replying, attaching files, filtering and forwarding.
3)	Preparing Resume using MS word formatting commands.
4)	Preparing a newsletter: To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.
5)	Printing envelopes and mail merge. To print envelopes with from addresses and to addresses, To use mail merge facility for sending a circular letter to many persons, To use mail merge facility for printing mailing labels.
6)	Create employee Payment sheet using Excel.
7)	Prepare a graph using biological data related to biological experiment in MS-Excel.
8)	Creating a new Presentation based on a template – using Auto content wizard, design template and Plain blank presentation.
9)	Creating a Presentation with Slide Transition – Automatic and Manual with different effects.
10)	Creating a Presentation applying Custom Animation effects – Applying multiple effects to the same object and changing to a different effect and removing effects.
11)	Measures of central tendency of given data.
12)	Study of frequency distribution and its graphical representation
13)	Determination of Standard deviation of the given data.

Course outcome:

- Students get the basic knowledge about the handling of various computer tools and software.
- Students get knowledge to handle Microsoft Word and Microsoft Excel.
- Students use and prepare presentation by using Microsoft power poit presentation tool.
- At the end of this module, student is expected to know simple applied statistics
- It should give basic knowledge about Frequency distribution.

References:

- Computer Fundamentals by P. K. Sinha
- C Application programs and Projects by Pramod Vasambekar
- Use of Computer from Vision Publication
- Let Us C by Kanetkar
- Meyer P. L. (1970): Introduction, probability and statistical Application. Addisionwesly.
- Cochran, W.G.: Sampling Techiniques, Wiley Estern Ltd., New Delhi.
- Waiker and Lev: Elementary Statistical methods. (Unit I II III IV)
- Rohatgi V. K. and Sauh A. K. Md E. (2002) An Introduction to probability and statistics. (Unit I II III IV)

9. Scheme of Teaching- As per University/BOS guidelines

10. Examination Pattern

- The standard of passing Examination Ordinances and Rules will be applicable as per the existing system.
- The examination will be conducted as per the rules and regulations of Shivaji University which are applicable at that time.

A) Theory:-

- There shall be 40 marks for each course (paper). For each course 40:10 pattern shall be applicable, wherein 40 marks shall be for University Assessment (UA) (Time duration: 2 hrs.) and 10 marks for internal assessment (IA).
- There shall be separate passing for theory as well as internal examinations. Minimum 14 marks out of 40 required for passing UA and minimum 4 marks out of 10 required for passing

B) Internal Assessment:-

- As per UGC guidelines there shall be continuous internal assessment for B.Sc. Programme.
- Internal Examination will be compulsory for all students. If a student fails/remains absent in internal Examination then he / she will have to clear the internal Examination in subsequent attempt/s.
- The internal examination of 10 Marks shall be conducted at the mid of the each semester. The nature of questions shall be MCQ / true / false /one sentence answer type question/ short answer type questions/Home assignments (Time duration: 30 minutes).

C) Practical Examination: -

- Practical exam will be conducted after theory exam.
- The practical examination shall be conducted as per respective BOS guidelines.

	List of minimum Equipments	
Sr. No.	Name Of Equipment	Minimum quantity
1)	Hot air oven	1
2)	Incubator	1
3)	Autoclave	1
4)	Refrigerator	1
5)	Compound microscopes (10, 40 &100X))	10/ batch
6)	Digital balance	2
7)	pH meter	1
8)	Centrifuge	1
9)	Conductivity meter	1
10)	Colorimeter	1
11)	Distilled Water Plant	1
12)	Laminar air flow cabinet	1
13)	Colony counter	1
14)	Water bath	2
15)	Refractometer	1
16)	Spectrophotometer	1
17)	Paper Electrophoresis unit	1
18)	Haemocytometer	1
19)	U.V. chamber	1

	Laboratory Facility	
1)	Arrangements for gas supply and fitting of two burners per table.	
2)	One working table of 6’ x 2½’ for two students.	
3)	One separate sterilization room attach to the laboratory (10’ x 15’)	
4)	At least one wash basin for a group of five students	
5)	One separate instrument room attached to lab (10’ x 15’)	
6)	One laboratory for one batch including working tables (6’ x 2½’) per two students for one batch	
7)	Store room (10’ x 15’)	
8)	Computer laboratory min 20 computers with required configuration to conduct	
	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.	

11. Nature of Question Paper-Theory (40 + 10)

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

B.Sc. Part – I/Sem. – I Examination – 2024 (NEP - 2023)

Biotechnology

Title of the Subject

(Subject Code)

Day & Date: **Total Marks: 40**

Time:

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks
3) Draw neat labeled diagrams wherever necessary.

Q. 1 Objective (8 Marks)

Q.2 Attempt any two of the following (out of three) (16 Marks)

Q.3 Short notes (4 out of 6) (16 Marks)

Nature of question paper: Practical

Practical Examination (As per guidelines of BOS)

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.
Note:-At least 80% Practicals should be covered in practical examination.

B) The practical examination will be of 6 hours duration and conducted in one day for DSC BT Practical II to DSC BT Practical VI and for DSC BT Practical I on two successive days (4 hours per day).

Distribution of Marks for Practical Examination:

1. A) Major experiment	20 marks
B) Minor experiment	10 marks
2. Spotting	10 marks
3. A) Journal	05 marks
B) Viva-voce	05 marks

Total Marks: 50 marks
Note: Experiments may be arranged as per convenience of the examiner.