SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४,महाराष्ट्र

दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दूरध्वनी विभाग २३१—२६०९०९३/९४

Estd. 1962
"A++" Accredited by
NAAC(2021)
With CGPA 3.52

SU/BOS/Science/17   Date: 01/10/2022

To,
The Principal,
All Affiliated Concerned Science Colleges/Institutions
Shivaji University, Kolhapur.

Subject :- Regarding syllabi of M.Sc. & B.Sc. (NEP-2020) degree programme under the Faculty of Science and Technology as per National Education Policy 2020 .

Sir/Madam,

    With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi and Nature of question paper of **M.Sc. & B. Sc.** under the Faculty of Science and Technology **as per National Education Policy 2020 .**

Sr. No.	Faculty of Science and Technology	Programme/ Course
1	Biotechnology & Biochemistry	M. Sc. Part- I Biotechnology, M. Sc. Part- I Biochemistry, B. Sc. Part- I Biotechnology, (Entire) B. Sc. Part- I Biochemistry, (Optional)

    This syllabi and nature of question paper shall be implemented from the Academic Year 2022-2023 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in (students Online Syllabus)

    You are, therefore, requested to bring this to the notice of all students and teachers concerned.

    Thanking you,

Yours faithfully,

Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre (I.T.)
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

SHIVAJI UNIVERSITY, KOLHAPUR.

Accredited By NAAC with 'A' Grade

Syllabus For

B.Sc. Part - I
Biotechnology (Entire) (Level-5)

(NEP-2020 PATTERN)

SEMESTER I AND II

(Syllabus to be implemented from June, 2022 onwards.)

❖ Guidelines shall be as per B.Sc. Regular Program.

❖ Rules and Regulations shall be as per B.Sc. Regular Program except CBCS R. B. Sc. 3 Structure of Program and List of Courses.

❖ **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.

❖ **GENERAL OBJECTIVES OF THE PROGRAM**

➢ To introduce the concepts in various allied subjects.

➢ To enrich students' knowledge in basic and applied aspects of life sciences.

➢ To help the students to build interdisciplinary approach in teaching/ learning & in research.

➢ To inculcate the sense of scientific responsibilities and social awareness.

➢ To help students build-up a progressive and successful career in academia and industry.

➢ To make the students knowledgeable with respect to the subject and its practicable applicability.

➢ To promote understanding of basic and advanced concepts in

Biotechnology.

➢ To expose the students to various emerging areas of Biotechnology.

➢ To prepare students for further studies, helping in their bright career in the subject.

➢ To expose the students to different processes used in industries and in research field.

➢ To prepare the students to accept the challenges in life sciences.

➢ To develop skills required in various industries, research labs and in the field of human health.

❖ **PROGRAM SPECIFIC OUTCOMES:**

➢ The present course curriculum will generate skilled human resource required in academia and Industry.

➢ The student will be able to achieve basic and advance knowledge based proficiency in applied subjects of life sciences.

➢ It will create and develop students with interdisciplinary mind set for learning science.

➢ Student will improve problem solving aptitude using scientific methods in biotechnology and allied subjects.

➢ Student will adopt scientific approach for implications of biotechnology in society, environment and education.

➢ It will demonstrate knowledge and learn various biological processes at cellular and molecular level and get expertise in the different techniques used in the fields of Biotechnology.

➢ Student will learn to design and perform experiments in the labs to demonstrate the concepts, principles and theories learnt in the classroom.

❖ Structure of Program and List of Courses are as follows:

Choice Based Credit System with Multiple Entry and Multiple Exit Options
To be implemented from the Academic Year 2022-23

First Year Bachelor of Science Biotechnology (Entire) (Level-5) Programme Structure (NEP-2020 PATTERN)

| | | | TEACHING SCHEME | | | | | | EXAMINATION SCHEME | | | | | | |
| | | | THEORY | | | PRACTICAL | | | THEORY | | | | PRACTICAL | | |
Courses	Sr. No.	Course Code	Credits	No. of lectures	Hours	Credits	No. of lectures	Hours	Hours	Max	Total Marks	Min	Hours	Max	Min
S E M E S T E R – I (Duration – 6 Months)															
CGPA COURSES	1	DSC-A	2	5	4	2	4	3.2	2	50	100	35			
	2	DSC-A	2						2	50					
	3	DSC-A	2	5	4	2	4	3.2	2	50	100	35			
	4	DSC-A	2						2	50					
	5	DSC-A	2	5	4	2	4	3.2	2	50	100	35			
	6	DSC-A	2						2	50			PRACTICAL EXAMINATION IS ANNUAL		
	7	DSC-A	2	5	4	2	4	3.2	2	50	100	35			
	8	DSC-A	2						2	50					
	9	AECC- A	2	4	3.2	-	-	-	2	50	50	18			
		TOTAL (A)	**18**			**8**	16				**450**				
Non CGPA	10	**SEC-1**	-	-	-	2	4	4							
	11	**VBC-1**				1	2	2							
S E M E S T E R – II (Duration – 6 Months)															
CGPA COURSES	1	DSC-B	2	5	4	2	4	3.2	2	50	100	35		50	18
	2	DSC-B	2						2	50					
	3	DSC-B	2	5	4	2	4	3.2	2	50	100	35		50	18
	4	DSC-B	2						2	50					
	5	DSC-B	2	5	4	2	4	3.2	2	50	100	35	As per BOS Guide-lines	50	18
	6	DSC-B	2						2	50					
	7	DSC-B	2	5	4	2	4	3.2	2	50	100	35		50	18
	8	DSC-B	2						2	50					
	9	AECC- B	2	4	3.2	--	--	--	2	50	50	18		200	18
		TOTAL (B)	**18**			**8**					**450**				
		TOTAL (A+B)	**36**			**16**					**900**				
Non CGPA	10	**SEC-2**	-	-	-	2	4	4							
	11	**VBC-2**				1	2	2							

- Student contact hours per week : 32 Hrs (Minimum) • Total Marks for B.Sc.- I : **1100**
- Theory and Practical Lecture Duration: 48 min each • Total Credits for B.Sc.-I (Sem I & II) : **52**
- Practical Examination will be conducted annually for 50 marks per course.
- **AECC:** Ability Enhancement Compulsory Course (A & B) : English for communication
- **SEC:** Skill Enhancement Course (Vocational Studies): Field Projects/ Internship/ Apprentiship/ Community Engagement and Service. Any one from pool of courses. For SEC courses there shall be only practical examination of 50 marks. **VBC:** Value Based Course (NSS/NCC/Sports/Cultural, etc.)
- **There shall be Separate passing for each theory courses of 50 marks each. i.e. minimum 18 marks are required for passing out of 50. There shall be separate passing for theory and practical.**
- *Exit option after Level 5: Students can exit with Certificate Course in Science (with the completion of courses equal to minimum of 52 credits).*

B. Sc. Biotechnology (Entire) Part-I: Sem-I : List of Courses

Discipline Specific Core (DSC) Courses

Course code	Name of the Course
DSC BT A1	Chemistry – I
DSC BT A2	Physics – I
DSC BT A3	Plant Science
DSC BT A4	Biotechnology in Human Welfare
DSC BT A5	Biomolecules
DSC BT A6	Biotechniques and Instrumentation
DSC BT A7	Microbiology – I
DSC BT A8	Computer Basics and applications
AECC – A	English Paper – I

DSC: Discipline Specific Core Course

AECC – Ability Enhancement Compulsory

Course AECC – A – English Paper– I

Link for the pool of SEC courses from
National Skills Qualification Framework (NSQF)

(You may add or delete any courses as per available facilities)
https://drive.google.com/file/d/176Vwvx4SC2ONrt69XADruzI2qnfBPI_o/view?usp=sharing

B.Sc. Biotechnology (Entire) Part-I: Sem-II: List of Courses

Discipline Specific Core (DSC) Courses

Course code	Name of the Course
DSC BT B1	Chemistry – II
DSC BT B2	Physics – II
DSC BT B3	Animal Science
DSC BT B4	Statistical Methods
DSC BT B5	Proteomics
DSC BT B6	Basics in Cell Biology
DSC BT B7	Microbiology – II
DSC BT B8	Ecology
AECC – B	English Paper – II

AECC – B – English Paper– II

Semester I

DSC BT A1: Chemistry- I

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

Topic No.		Lectures 30
	Credit-I	**15**
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. Catalysis- Definition, types of catalysis with example, characteristics ofcatalysis. Elementary enzyme catalyzed reactions- Meaning and examples. Numerical problem	**7**
2.	**Thermodynamics** Introduction- Reversible and irreversible processes, internal energy. Enthalpy, heat of reaction and its types, First Law- Statement and mathematical expression, Hess law. Measurement of ΔH, Trouton's rule, Kirchoff's equation. Second law- Statement, concept of entropy (Criteria for 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). Phase equillibria- Clapeyron-Clausis equation and its applications.	**8**

		Numerical problems	
	Credit-II		**15**
3.	**Structure and Bonding.** Introduction- types of bonds. Ionic covalent bond, Co-ordinate bond, Metallic bond, hydrogen bond, Vanderwaal's forces. Formation of ionic and covalent bond with examples, e.g. NaCl, KCl, HCl, CH_4, Cl_2, H_2. VBT- Postulates, Concept of Hybridization, sp, sp2, sp3 hybridization with respect to $BeCl_2$, BF_3, $SiCl_4$ (Along with consequences with respect to bond length, bond angle, bond energy and shape of the molecule.) Dipole moment- Definition and significance. Hydrogen bonding- Definition, intra and intermolecular hydrogen bonding with suitable example (Proteins, alcohols, Hydroxy acids, Phenols). Ionic solids- Definition and general characteristics, comparison between, ionic and covalent compounds.		**8**
4.	**Coordination Complexes** Definition and formation of Co-ordinate bond in BF_3, NH_3 & NH_4^+ Distinction between double salt and complex salt Description of terms Ligand, Co-ordination number (CN), Co-ordination sphere. Essential and trace elements in biological process, Metallo porphyrins w.r.t. Hemoglobin and Myoglobin.		**7**
Course Outcomes:			

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

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

DSC BT A2: Physics – I

Course Objectives :-
- ❖ To understand basic concepts in Physics
- ❖ To learn applicability of physics in biology

Topic No.		Lectures 30
	Credit-I	**15**
1.	**Elasticity:** Introduction, definitions of stress and strain in solids, types of strain and stress, Hooke's law, definition of Young's modulus (Y), bulk modulus (K) and modulus of rigidity ($\square$), relation between Y, $\square$, and K (without derivation), stress strain curve, importance of elasticity .	7
2.	**Viscosity and Surface Tension** Introduction, streamline and turbulent flows, concept of viscosity, Basics of Newton's law of viscosity, coefficient of viscosity, effect of temperature and pressure on viscosity of liquids, concept of pressure energy and Bernoulli's theorem (without proof), Application of Bernoulli's eoremventurimeter, Pitots tube (working only), review of surface tension, surface energy, capillary action, angle of contact, wetability, relation between surface tension, excess pressure and curvature (without derivation), factors affecting surface tension, methods of measurement of surface tension- Jaeger's method (formula and working only), applications of surface tension.	8
	Credit-II	**15**
3.	**Sound waves:** Introduction, mechanical and electromagnetic waves, transverse and longitudinal waves with characteristics, principle of superposition of waves (Statement only), phenomenon of beats and expression for frequency of beats, application of beats, audible, ultrasonic and infrasonic waves, properties of ultrasonic waves and their applications, Doppler effect and its applications	8
4.	**Thermodynamics and Thermometry:** Introduction, various temperature scales (Kelvin, Celsius, Fahrenheit, Reaumer and Rankin), thermal energy, platinum resistance thermometer- principle, construction and working.	7

Course Outcomes:
- ❖ Student should be able to understand basic concepts of physics like elasticity, sound waves, thermodynamics.

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

DSC BT A3 : Plant Science

Course Objectives :
- ❖ To understand diversity of plant kingdom.
- ❖ To understand morphology and anatomy of plants.
- ❖ To study basic knowledge of Developmental and reproduction plant biology.

Topic No.		Lectures 30
	Credit-I	**15**
1.	**Plant Diversity** Outline of General Classification of Plant Kingdom. General characters and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms. **Taxonomy of Angiosperms** Taxonomy :- Definition, Aims, objectives and functions, Binomial nomenclature and its significance, Principles of ICBN, Study of outline of Bentham and Hooker's system of Classification of plants.	8
2.	**Plant Development:** Major phases of plant development Vegetative development: Meristem- Organization of shoot apical meristem, Organization of root apical meristem, shoot development, root development, leaf development. Reproductive development: Shift from vegetative to reproductive phase- juvenility, floral signals and floral meristem identity- ABC model. **Plant Anatomy** Primary structure of monocotyledon and dicotyledon root, stem and leaf.	7
	Credit-II	**15**
3.	**Sexual Reproduction in Angiosperms:-** Gametogenesis and Fertilization in plants: Gametogenesis in Plants, Development of male and female Gametophyte. Process of fertilization in Angiosperm, post fertilization changes. 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.	7
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.	8

	Parthenocarpy- Definition and significance. **Self incompatibility:** Definition, types and its genetic Control **Seed**: Definition, Formation, structure of Monocot and Dicot seed Seed germination: Seed germination types, Factors affecting Seed germination. Seed Dormancy: Definition, Causes of dormancy, methods of breaking of Seed dormancy, significance.	
Course outcome:- Students should be able to understand: ❖ The terminology used in Anatomy. ❖ Diversity in plant kingdom and need of classification. ❖ The Basic knowledge of Angiosperms . ❖ The basic and advanced knowledge of developmental plant biology.		

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

DSC BT A4 : Biotechnology and Human Welfare

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

Topic No.		Lectures 30
	Credit-I	
1.	**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.	7
2.	**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.	8
	Credit-II	
3.	**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.	7
4.	**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	8

Course Outcomes:
Students should be able to understand
- ❖ What is biotechnology?
- ❖ About the biotechnology institute in India
- ❖ Different areas in biotechnology
- ❖ Role of Biotechnology in Human welfare

References:
1. Biotechnology – U. Satyanarayana
2. Medical biotechnology – S. N. Jogdand
3. Advances in Biotechnology- S.N.Jogadand
4. A textbook of Biotechnology - R. C. Dubey
5. Pharmaceutical Biotechnology – S. P. Vyas ,V. K. Dixit
6. Biotchnology – B. D. Singh
7. Fundamentals of agriculture biotechnology – S. S. Purohit
8. Agricultutre application of Microbiology- Neeelima Rajvaidya.
9. Food Biotechnology- Varun Mehta.

DSC BT A5 : 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
- ❖ Classification, structure and function of lipids
- ❖ Basics of chemical science in relevance to biological systems

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

DSC BT A6: 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.	8

	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 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:-

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

DSC BT A7 : Microbiology – I

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

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,	8

	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**.**		
	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. Chemical agents: - Phenol & Phenolic compounds, Alcohol, Heavy metals (e.g.mercury). Gaseous agents**-** Ethylene oxide, formaldehyde.	**7**	
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
- ❖ Nutritional requirement of micro organism
- ❖ Basic components of Nutrient medium and their role
- ❖ Principles of sterilization
- ❖ The Principles and procedures of staining microorganisms

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

DSC BT A8 : Computer Basics and Applications

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
	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	
4.	**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.	7
	Presentation with Power-Point: Power-point basics, creating presentation, working with graphics, show time, sound effects and animation effects.	8

| | Internet, E-mail, Discussion groups, Search tools, Web utilities, concept of E commerce, Application of E commerce.
Database Management System:Need of database, data models-Hierarchical, Network, Relational, Object Oriented, SQL Commands DBMS-DDL, DML, DCL. | |

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

Semester II

DSC BT B1 : Chemistry – II

Course Objectives:

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

Topic No.		Lectures 30
	Credit-I	
1.	**Fundamentals and Mechanistic Basis of Organic Reaction** Introduction, Reaction mechanism-Definition, curved arrow notation, substrate, Reagents, Types of reagents, types of reactions, 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– NO_2, OH functional groups.	7
2.	**Stereochemistry** Geometrical isomerism in alkenes. Optical activity-Plane polarized light (PPL), Polarimeter, specificrotation, 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	8
	Credit-II	
3.	**Radioactivity** Introduction, properties of alpha, beta and gamma radiation, Neutron-proton ratio and nuclear Stability, Process of radioactive decay, radioactive decay energy, rate of radioactive decay, units of radioactivity, Dosimeter: Absorbed dose(D), Dose equivalent(H) and	7

	effective dose equivalent Radioactivity detecting techniques: Ionization chamber, Geiger Muller counter, Scintillation counter, Hazards biological effect of radiation, Biological Applications of Radioisotope.	
4.	**Chemistry of Natural Products** 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.	**8**

Course Outcomes:

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

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

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

DSC BT B2: Physics – II

Course Objectives:
- ❖ To make students aware of fundamentals of Bioelectricity.
- ❖ To make the student aware of basics of electronic devices.

Topic No.		Lectures 30
	Credit-I	
1.	**Optics correlated with microscopy:** Concept of interference and diffraction, Diffraction gratin (Description only), concept of polarization and plane polarized light, production of polarized light by absorption, reflection, refraction and scattering, Nicol prism, definition of optical activity, LASER- LASER action (Energy level diagram), properties of LASER, applications of LASER.	7
2.	**Bioelectricity** Introduction, electricity observed in living systems-examples, origin of bioelectricity, resting potential and action potential, Nernst equation, conduction velocity, origin of compound action potential, Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electroculogram(EOG)	8
	Credit-II	
3.	**Semiconductor Devices and Digital Electronics** Light Emitting Diode (LED), seven segment display, photodiode, optocoupler, spectral distribution of solar energy, solar cellconstruction, working efficiency and fill factor, applications of solar cell. Binary and BCD number system, Basic logic gates OR, NOR, and NANA and NOT, Demorgans theorem	7
4.	**Atomic structures and X-rays** Introduction, J. J. Thomson atomic model, Rutheford atomic model and Bohr model, Limitations of Bohr atomic model, Energy level diagram of Hydrogen atom, Quantum numbers, Nuclear models and forces(Liquid drop modem and shell model), production of x-rays and its properties, Continuous and characteristics X ray spectrum, Brags law, Applications of X-rays	8

Course Outcomes:

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

References:
1. Physics by Devid Hallday Roberet Resnik, (Vol-I and Vol-II) Wiley Eastern limited
2. Fundamental of Mechanics, S.K.Saxena,Himalaya Publications
3. Perspectives of modern physics, Aurthur Beiser, McGrawHill Publication
4. Heat and Thermodynamics,Zemansky, McGrawHill Publication
5. Fundamentals of optics,Jenkins white, McGrawHill Publication
6. Text book of optics, N.Subrahmanyan Brijlal, S.chand and Company Limited
7. Optics by Ajoy Ghatak ,Tata McGrawHill Publication
8. Properties of Matter, D.S.Mathur,Sha,alal Charetible trust
9. Solar Energy, Suhas Sukatme,Tata McGrawHill Publication

10. Principle of electronics, V.K.Mehta, S.chand and Company Limited
11. Digital Principles and application, Malvino and Leach,Tata McGrawHill Publication
12. Elements of Spectroscopy, Gupta,Kumar,Sharma, Pragati Prakashan
13. Introduction to Atomic spectra, H.E.White ,McGrawHill Publication
14. Biophysics, Vastala Piramal, Dominent Publishers and Distributor

DSC BT B3: Animal Science

Course Objectives :--
- ❖ To study the general concept of classification system of Animal kingdom.
- ❖ Application of animal science to study the Host and parasite relationship
- ❖ To study Animal tissue system.
- ❖ To study the Animal embryology and developmental Zoology

Topic No.		Lectures 30
	Credit-I	
1.	**Taxonomy** General classification of animal kingdom.(General characteristics and one representative example) Non-chordates –Study of phylum Porifera, Ceolenterata, Platyhelminthes, Nemathelmenthes, Arthropoda, Mollusca & Echinodermata – General characters with representative examples- Sycon, Hydra, Liver fluke/Taenia, Earthwarm / Nereis, Cockroach, Pearl oister / Pila, Starfish Chordates:-Study of class Pisces, Amphibia, Reptilia & Mammalia – General characters with representative examples – Lebeo, Frog, Cobra, Alligator, Fowl and Rat.	7
2.	**Tissues:** Definition and types of tissues (Epithelial, Muscular, Nervous, Connective tissue). Blood Plasma, Serum, Corpuscles, Bone, Cartilage. Histological Architecture of Skin, Stomach/Intestine, Uterus **Applied zoology :** Vermiculture: species/types of earthworms, stages of vermiculture, various models/methods, economic importance. Apiculture : Types/ species of Honey bees, castes of Honey bees, Economic Importance. Sericulture: Types of Silkworms, Life cycle, economic importance., Pisciculture: History, Inland, Marine and culture fisheries, Economic importance	8
	Credit-II	
3.	**Animal embryology** **Gametogenesis, gametes and fertilization in Animals:** Gametogenesis in animals, Types of eggs and sperms in animals, Fertilization in animals. **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.	7
4.	**Differentiation and Regeneration :** Cell lineages, Determination, Commitment -specification and determination, Differentiation, Dedifferentiation, Rediffrentitation, Transdifferentiation, Developmental Plasticity. **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	8

Course Outcomes:

- ❖ Animal Science is a multidisciplinary course in learning Classification , Parasitology animal physiology, Anotomy , etc. along with fundamental principles of animal life.
- ❖ Students should be able to understand basic knowledge of classification of animal kingdom.
- ❖ Students should be able to understand basic concepts of host and parasite relationship which may useful to develop an interest in diagnosis and modern reasarch in parasitology.
- ❖ Professional education in Animal Science prepares the students for career opportunities in the field of diagnostic parasitology .
- ❖ Students should be able to understand basic knowledge of developmental zoology.

References-
1. Kotpal – Invertebrates
2. Kotpal – Chordates
3. Development Biology, 9th edition, (2010), Gilbert S.F. (Sinauer Associates, USA).
4. Foundations of Embryology – Patten
5. Cell and Developmental Biotechnology – Raj Narian D esikar

DSC BT B4: Statistical Methods

Course Objectives:

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

Topic No.		Lectures 30
	Credit-I	
1.	**Introduction to statistics and collection of data**. 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 Graphical representation: Histogram and give Curves.	7
2.	**Measures of central tendency and measures of dispersion** Concept of measures of central tendency Definitions of A.M., Median, Mode, Quartiles, Weighted mean, Examples on ungrouped and grouped data. Properties of A.M. (statement only) Methods of obtaining mean& quartiles graphically;- in place of mean mode is expected. 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.	8
	Credit-II	
3.	**Correlation and Regression** Concept of correlation between two variables and types of correlation. Method of obtaining correlation (i) by scattar diagram method ii) By Karl Pearson. Correlation coefficient Properties of correlation coefficient. Examples on ungrouped data. Concept of regression, Lines of regression, Regression coefficients and properties without proof. Examples on ungrouped data.	7
4.	**Probability and Sampling** Definition of representative sample and 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 of probability, Independentevents, Simple illustrative examples. Idea of population and sample. Simple Random Sampling and Stratified Random sampling. Advantages and disadvantages of both the methods. Testing of hypothesis, Simple and composite hypothesis, Null and	8

	alternative hypothesis, types of errors, Critical region, Acceptance region, level of significance. Tests of significance: Chi square tests, t tests and F test	

Course Outcomes:

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

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, NiraliPublication, Pune.
4) Waiker and Lev: Elementary Statistical methods.
 5) Rohatgi V. K. and Sauh A. K. Md E. (2002) An Introduction to probability and statistics (John Wiley & Sons-Asia).
6) Thigale T. K. and Dixit P. G. (2003): A text book Of paper II for B.Sc. I.
7) Meyer P. L. (1970): Introductoryto probability and statistical Application.Addision wesly.
8) Cochran, W.G.: Sampling Techiniques, Wiley Estern Ltd., New Delhi.
9) Des Raj : Sampling theory

DSC BT B5: 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:-
1) Biochemistry – Nelson & Cox
2) Biochemistry - Stryer
3) Enzymes - Trevor Palmer

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

DSC BT B6: 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:-
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 BT B7: Microbiology – II

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:	07

	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.		
4.	**Medical microbiology** Definition, Host, parasite, Saprophytes, Commensals, Infection, Etiological agent, Disease, Pathogen, Opportunistic pathogen, True pathogen, Virulence, Pathogenicity, Fomites, Incubation period, Carriers, Morbidity rate, Mortality rate, Epidemiology, Etiology, Prophylaxis, Antigen, Antibody, Hapten, Vaccine, Immunity. Virulence factor: Production of endotoxin, exotoxin, enzymes, escaping of phagocytosis. Types of diseases: Epidemic, Endemic, Pandemic, Sporadic. Types of infections: Chronic, Acute, Primary, Secondary, Reinfection, Iatrogenic, Congenital, Local, Generalized, Covert, Simple, Mixed, Endogenous, Exogenous, Latent, Pyogenic, Nasocomial. Mode of transmission of diseases: Air borne transmissions, Vehicle transmissions, Contact transmissions, Vector borne transmissions. General principles of prevention and control of microbial diseases.	**08**	

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:
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

DSC BT B8: Ecology

Course Objectives:
- ❖ To make the student aware of basic concepts of Ecology
- ❖ To make the student aware of Population Ecology and Evolution .

Topic No.		Lectures 30
	Credit-I	
1.	Ecosystem- Concept, structure, function. Productivity- Kinds of productivity. Food chain- types of food chain, food web, concept of tropic level, Ecological pyramids- concepts and types. Energy flow in ecosystem –concept of energy, unit of energy, ecological energetics, laws governing energy transformation, ecological efficiency, Lindeman's atrophic dynamic concept.	8
2.	**Biogeochemical cycle** Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorus cycle. **Biodiversity** Types of biodiversity, causes of loss of biodiversity, conservation of biodiversity, importance of biodiversity, Hot Spots.	7
	Credit-II	
3.	**Population Ecology-** Introduction, population characteristics, Natality, Mortality, survivor ship curves, age structure, age pyramid. Population growth- Exponential and logistic, r and k strategists.	7
4.	**Evolution :-** Theories of evolution-Lamarckism, Darwinism, Modern synthetic theory & mutational theory. Evidences of evolution and Adaptive radiation. Concept of species and speciation. Hardy-Weinberg law	8

Course Outcomes:
Student should be able to
- ❖ Understand fundamentals of Ecology.
- ❖ Learn Biogeochemical cycles.
- ❖ Understand the Population Ecology.
- ❖ Learn Evolution.

References:
1. Fundamentals of ecology ; E.P Odum.
2. Concept of ecology ; Dash.
3. Enviornmental Biology,Verma & Agarwal
4. Enviornmental Science., Saigo, Canninhham
5. General ecology., H.D.Kumar

Practical

DSC BT P1 : Techniques in Chemistry and Biochemistry

Sr. No.	Name of the Practicals
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.
14	Preparation of buffers (Phosphate buffer, acetate buffer) and determination of pH with pH meter.
15	General test for carbohydrates and detection of unknown Carbohydrate from mixture. (Glucose, fructose, maltose, sucrose, xylose and starch)
16	Estimation of reducing sugar from apple juice by Benedict's method.
17	General test for Amino acids and detection of unknown Amino acid from mixture. (Arginine, methionine, cystine, tyrosine, histidine,proline, tryptophan)
18	Protein estimation (Biuret method)
19	Isolation and characterization of casein from milk.
20	Qualitative assay of α- amylase using starch as substrate.
21	Isolation and characterization of starch from potatoes.
22	Estimation of Glucose by 3,5 Dinitro salicylic acid method.
23	Estimation of Cholesterol by iron reagent.
24	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.

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

DSCBT P2 : Laboratory Exercises in Microbiology and Instrumentation

Sr. No.	Name of the Practical
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 P^H 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.
12	Microscopic examination of bacteria by a. Monochrome staining. b. Gram staining c. Negative staining. d. Capsule staining. e. Cell wall staining. f. Endospore staining
13	Isolation, mounting and identification of Mold. a. *Aspergillus* b. *Penicillium c. Mucor d. Rhizopus*
14	Preparation of bacteriological culture media i) Peptone water. ii) Nutrient broth. iii) Nutrient agar. iv) Mac Conkey's agar.
15	Preparation of Fungal culture media i) Sabouraud's agar ii)PDA
16	Enumeration of bacteria by total viable count from soil by spread plate technique and pour plate technique.
17	Observation of motility by hanging drop technique.
18	Study of growth curve of bacteria.
19	Isolation, colony characters, Gram staining & motility of *E.coli, Bacillus* sp.

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:

1. Laboratory manual of microbiology and biotechnology by K.R.Aneja

2. Microbiology : Laboratory theory and Application by Michael J. Leboffe and E.Pierce

3. Laboratory Experiments in microbiology by Ted R. Johnson and Christine

4. Practical Microbiology: a laboratory manual by B. Senthil Kumar, Zothansanga, D. Senbagam, N. Senthil Kumar and G. Gurusubramanian.

5. Textbook of biophysical chemistry- Nath upadhyay Nath.

6. Bio-instrumentation – B. Nagamani

7. Bio-instrumentation – Veerakumari

8. Principles and techniques of Biochemistry and Molecular Biology - Wilson and walker.

9. Practical handbook of Biochemistry and Molecular Biology- Gerald D.Fasman

10. Experimental Microbiology – Patel & Patel

11. Bacteriological techniques by F. J. Baker.

12. Stains and Staining procedures by Desai and Desai.

DSC BT P3: Laboratory Exercises in Plant Science and Animal Science

Sr. No.	Name of the Practical
1	Study of Algae (*Nostoc, Sargassum*)
2	Study of Bryophyte (Riccia / Anthoceros) and Pteridophyte (Selaginella)
3	Study of Gymnosperms (Pinus) and Angiosperms (Sunflower,Maize)
4	Study of apical meristem (Stem and root)
5	Study of primary structure of Dicot root and stem
6	Study of primary structure of monocot root and stem.
7	Study of pollen germination.
8	Detection of pollen fertility by staining technique.
9	Study of dicotyledon and monocotyledon embryo (by permanent slide or photograph).
10	Dissection of embryo / endosperm from developing seeds.
11	Study of breaking of Seed dormancy.
12	Determination of seed viability.
13	Study tour-field visit to study Plant diversity.
14	Classification and Identification of Non-chordates &Chordates. (One animal each) Non- chordates- Sycon, Hydra, Liver fluke/ Earthwarm / Nereis,Cockroach, Pearl oister/Pila, Starfish.
15	Chordates- Lebeo, Frog, Cobra, Alligator, Fowl and Rat.
16	Earthworm Dissection (Digestive system, Nervous system)
17	Blood slide Preparation and Identification of Blood cells.
18	Blood cell count i) Differential count of W. B. Cs. ii)Total count of W. B. Cs and R. B. Cs.
19	Preparation of Haemin Crystals.
20	Determination of Hemoglobin.
21	Study of Bone Marrow cells.
22	Study of *Drosophila* Larva, and Adult morphology.
23	Demonstration of – ii) Bee Keeping- Study of Instruments. iii) Sericulture - Study of different Stages.
24	Study tour: Visit to Biodiversity spot, Sericulture, Apiculture ,Vermicomposting

Course Outcome:

Students should be able to acquaint:-

- ❖ The Identification and classification of various plant material
- ❖ Use and handle the microscopy for basic and advanced research in applied Biosciences.
- ❖ The basic and advanced knowledge of branches of plant science.
- ❖ Basic knowledge of plant Anatomy and Physiology.
- ❖ Basic knowledge of plant germination and seed
- ❖ Develop the skill in dessection and microscopy which is highly needed for any type of

research work in animal sciences.
- ❖ Able to aquire Basics of Parasitology.
- ❖ Able to aquire practical knowledge related to Blood.
- ❖ Able to aquire practical knowledge in apllied zoology like –Sericulture, Apiculture, Vermiculture .

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

DSC BTP4 : Statistics and Computer Applications in Biology

Sr. No.	Name of the Practical	
1	Frequency distribution – Graphical, Histogram, give curve [less & greater than].	
2	Measures of central tendency - I (Grouped data)	
3	Measures of central tendency - II (Ungrouped data)	
4	Measures of Dispersion – I (Grouped data)	
5	Measures of Dispersion – I (Ungrouped data)	
6	Correlation coefficient – I (Grouped data)	
7	Correlation coefficient – II (Ungrouped data)	
8	Correlation, Regression. Scattered diagram, Karl Pearson's correlation coefficient, eq^n of Regression line.	
9	Testing of Hypothesis: Large sample test: Normal, proportion. Small sample test.: x2, t, f.	
10	Searching for a web site / application / text documents viewing and downloading.	
11	Create an E-mail account, Retrieving messages from inbox, replying, attaching files, filtering and forwarding.	
12	Preparing Resume using MS word formatting commands.	
13	Preparing a newsletter: To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.	
14	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.	
15	Create employee Payment sheet using Excel.	
16	Prepare a graph using biological data related to biological experiment in MS-Excel.	
17	Creating a new Presentation based on a template – using Auto content wizard, design template and Plain blank presentation.	
18	Creating a Presentation with Slide Transition – Automatic and Manual with different effects.	
19	Creating a Presentation applying Custom Animation effects – Applying multiple effects to the same object and changing to a different effect and removing effects.	

Course outcome:
- ❖ At the end of this module, student is expected to know simple applied statistics
- ❖ It should give basic knowledge about Frequency distribution.
- ❖ They should be able to test hypothesis.
- ❖ 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.

References:

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

2.Meyer P. L. (1970): Introduction, probability and statistical Application. Addisionwesly.

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

4. Waiker and Lev: Elementary Statistical methods. (Unit I II III IV)

5. Rohatgi V. K. and Sauh A. K. Md E. (2002) An Introduction to probability and statistics. (Unit I II III IV)

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	

Equivalence of the Pre-revised (CBCS) and revised course (CBCS)

Pre-revised Course		Revised Course	
Course code	**Name of Course**	**Course code**	**Name of Course**
Sem I		**Sem I**	
DSC BT1	Chemistry – I	**DSC BT A1**	Chemistry – I
DSC BT2	Physics – I	**DSC BT A2**	Physics – I
DSC BT3	Plant Science	**DSC BT A3**	Plant Science
DSC BT4	Mathematical Methods	**DSC BT A4**	Biotechnology in Human Welfare
DSC BT5	Biomolecules	**DSC BT A5**	Biomolecules
DSC BT6	Biotechniques and Instrumentation	**DSC BT A6**	Biotechniques and Instrumentation
DSC BT7	Microbiology – I	**DSC BT A7**	Microbiology – I
DSC BT8	Computer Basics and Bioinformatics	**DSC BT A8**	Computer Basics and Applications
AECC – A	English – I	**AECC – A**	English – I
Sem II		**Sem II**	
DSC BT9	Chemistry – II	**DSC BT B1**	Chemistry – II
DSC BT10	Physics – II	**DSC BT B2**	Physics – II
DSC BT11	Animal Science	**DSC BT B3**	Animal Science
DSC BT12	Statistical Methods	**DSC BT B4**	Statistical Methods
DSC BT13	Proteins and Enzymes	**DSC BT B5**	Proteomics
DSC BT14	Basics in Cell Biology	**DSC BT B6**	Basics in Cell Biology
DSC BT15	Microbiology – II	**DSC BT B7**	Microbiology – II
DSC BT16	Computer Programming	**DSC BT B8**	Ecology
AECC – B	English – II	**AECC – B**	English – II
Practicals (Annual practical examination)			
DSC BT P1	Techniques in Chemistry and Biochemistry	**DSC BT P1**	Techniques in Chemistry and Biochemistry
DSC BT P2	Laboratory Exercises in Microbiology and Instrumentation	**DSC BT P2**	Laboratory Exercises in Microbiology and Instrumentation

DSC BT P3	Laboratory Exercises in Plant Science and Animal Science	**DSC BT P3**	Laboratory Exercises in Plant Science and Animal Science
DSC BT P4	Methods in Mathematics, Statistics and Computer Applications in Biology	**DSC BT P4**	Laboratory Exercises in Statistics and Computer Applications in Biology

Nature of Question Paper

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

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

Nature of question paper:

Annual Practical Examination

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

B) The practical examination will be of 6 hours duration and conducted in one day for DSC BTP1 DSC BTP3 DSC BTP4 and for DSC BTP2 on two successive days (3 hours per day)

Distribution of Marks for Practical Examination:
1. A) Major experiment   15 marks
   B) Major experiment   10 marks
2. Minor experiment 10 marks
3. Spotting   10 marks
5. A) Journal   05 marks
   B) Viva-voce   05 marks
Total Marks: 50 marks
Note: Experiments may be arranged as per convenience of the examiner.