

Level: - 4.5 (First Year) Sem:I

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Subject 1 T(2)+(T/P) (2)orT(4)	24ScBioU1101	Plant Science	2		2		20	30	50
	24ScBioU1102	Lab Course on 1101		2		4	20	30	50
Subject 2 T(2)+(T/P) (2)orT(4)	24ScBioU1201	Chemistry	2		2		20	30	50
	24ScBioU1202	Lab Course on 1201		2		4	20	30	50
Subject 3 T(2)+(T/P) (2)orT(4)	24ScBioU1301	Biochemistry	2		2		20	30	50
	24ScBioU1302	Lab Course on 1301		2		4	20	30	50
IKST(2)	24CpCopU1901	Generic IKS	2		2		20	30	50
GE/OE (T/P) (2)	24ScBioU1401	Biotechnology and Human welfare I	2		2		20	30	50
SEC (P)(2)	24ScBioU1601	Modern Physics		2		2	20	30	50
AECT(2)	24CpCopU1701/ 24CpCopU1702	MIL-I(Hindi)/MIL-I(Marathi)	2		2		20	30	50
VECT(2)	24CpCopU1801	Environmental Science	2		2		20	30	50
Total			14	08	14	16			550

Level:- 4.5 (First Year) Sem: II

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Subject 1 T(2)+T/P(2) orT(4)	24ScBioU2101	Animal Sciences	2		2		20	30	50
	24ScBioU2102	Lab Course on Animal Sciences		2		4	20	30	50
Subject 2 T(2)+P(2)	24ScBioU2201	Microbiology	2		2		20	30	50
	24ScBioU2202	Lab Course on Microbiology		2		4	20	30	50
Subject 3 T(2)+P(2)	24ScBioU2301	Biophysics and Instrumentation	2		2		20	30	50
	24ScBioU2302	Lab Course on Biophysics and Instrumentation		2		4	20	30	50
GE/OE (T/P)(2)	24ScBioU2401	Biotechnology and Human welfare II	2		2		20	30	50
SECT(2)	24ScBioU2601	Basics of Mathematics and Statistics	2		2		20	30	50
AECT(2)	24CpCopU2703	English Communication Skills I	2		2		20	30	50
VECT(2)	24CpCopU2801	Democracy, Election and Governance	2		2		20	30	50
CC(2)	24CpCopU2001/	Physical Education/	2		2		20	30	50

	24CpCopU2011/ 24CpCopU2021/ 24CpCopU2031/ 24CpCopU2041/ 24CpCopU2051/ 24CpCopU2061/ 24CpCopU2071	Cultural Activities/ NSS / NCC/ Fine Arts / Applied Arts / Visual Arts / Performing Arts					
Total			14	08	14	16	550

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First Year of B.Sc. Biotechnology
(2024 Course Under NEP 2020)
Semester I

Course Code: 24ScBIOU1101

Teaching Scheme: TH: 2 Hours/Week

Examination Scheme: CIA: 20 Marks

Prerequisite:

Course Name: Plant Science

Credit: 2C (2T)

End-Sem: 30 Marks

- To know Basic botany in 11th and 12th Std.

Course Objectives:

- To Study morphology and anatomy different classes of plant group and also identification of plants on the basics of their morphology.
- To learn plant taxonomy and plant identification

Course Outcomes:

On completion of the course, students will be able to:

CO. No.	Course Outcomes (Cos)	Blooms Cognitive Level
CO 1	How to understand plant groups and unique features of plants	1
CO 2	Demonstrate and sketch the diagrams of different plant groups	2
CO3	Identify various structure of morphological characters of plant species	3
CO4	Distinguishing between various cellular structure	4
CO5	Explain internal structure of Root ,Stem, and Leaf	5
CO6	Discuss fundamental components of taxonomy	6

Course Contents

Unit	Title	30 Lectures
Unit1	Plant as a life form:	2 lecture
	• Introduction to plant world and life form- • General & Unique features of plants	
Unit2	Introduction to plant groups:	10 lecture
	• Algae, • Fungi, • Bryophytes, • Pteridophytes, • Gymnosperms, • Angiosperms with examples	
Unit3	Morphology and Anatomy of vegetative and reproductive plant organs :	10 lecture
	• Leaf • Shoot, • Root • Flower • Inflorescence • Fruit	
Unit4	Introduction to plant taxonomy and Plant Tissues:	8 lectures
	• Fundamental components of taxonomy identification, nomenclature, Classification • Tissues – Meristematic and permanent tissues (simple and complex)	

References:

- 1, A textbook of Botany (Algae, Fungi, Virus, Microbiology, Plant pathology, Bryophytes, Pteridophytes and Gymnosperms) V. Singh, Pandey and Jain , Rastogi Publications, Shivaji Road, Meerut.
- 2., Botany for Degree Students, B.R Vashista, Sinha ,S. Chand and Company Ltd, Ramnagar, New Delhi.
- 3.College Botany Vol - I.B.P. Pandey Chand and Company Ltd, Ram Nagar, New Delhi.
4. College Botany, Vol II,S.Sundarajan, Himalaya publishing House, New Delhi.
5. College Botany (For degree students), AC Datta,Manzar Khan Oxford University, Press Kolkatta.
6. College Botany Vol- I ,Gangulee Das and Dutta, New central Book Agency, Kolkatta.
7. A.Text Book of Botany Vol II, Pandey and Ajanta Chaddha,Vikas Publication Pvt. Ltd, New Delhi

8. A Classbook of Botany, Dutta A.C., (Oxford University Press, UK)(2000)
9. Taxonomy of vascular plants (Scientific Publ,), Lawrence G.H. (2012)
10. Anatomy of seed plants (Wiley, USA), Esau K. (1977)
11. Plant anatomy: an applied approach (Blackwell Sci, USA), Cutler, Botha & Stevenson (2007)
12. College Botany Vol I, II and III (New Central Book Agency, Kolkata), Ganguli, Das Dutta (2011)
13. The Morphology of Gymnosperms (The Structure and Evolution of Primitive seed Plants), Sporne K.R. (1971), Hutchinson University Library, London.
14. Vascular Differentiation in Plants. Esau, K. (1965), Holt, Rinehart and Winston, N.Y., Chicago, San Francisco, Toronto, London.
- 15.: An Introduction to Plant anatomy, Eames, A.J., and Mc Daniels, L.H. (1979) Tata-McGraw Hill Publishing Co., (P) Ltd. Bombay, New Delhi.
16. Plant Anatomy, (2nd Edition) Esau. K. (1980), Wiley Eastern Ltd., New Delhi

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First Year of B.Sc. Biotechnology
(2024 Course Under NEP 2020)
Semester I

Course Code: 24ScBioU 1102

Teaching Scheme: TH: 4 Hours/ Week

Examination Scheme: CIA: 20 Marks

Course Name: Lab on 24ScBioU1101

Credit: 2C (15 P)

End-Sem : 30 Marks

Prerequisite:

- Basic knowledge of Plants.

Course Objectives:

- To Study Anatomy of Plants and family of Plants
- To study Plant morphology

Course Contents

Practical	Title	15 Practicals
Practical -1	To Study of characteristics features of the following:	3 Practical

	• Algae • Fungi • Bryophytes • Pteridophytes • Gymnosperms • Angiosperms	
Practical -2	Anatomical Study of Plants:	6 Practical
	• Study the Anatomy of Monocot Root Dicot Root, • Study the Anatomy of Monocot Stem Dicot Stem, • Study the Anatomy of Monocot Leaf Dicot Leaf, • Taking Transverse sections of Root, Stem and leaf with staining Media .	
Practical- 3	Study of plant cell types:	1 Practical
	• Study of plant cell types using squash techniques and Maceration.	
Practical -4	Studies of families:	3 Practical
	• To study of Plant taxonomy of any Three family.	
Practical- 5	Study of Different Types of Inflorescences:	2 Practical

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Semester I

Course Code: 24ScBioU1201**Course Name: Chemistry****Teaching Scheme: TH: 2 Hours/Week****Credit: 2C (2T)****Examination Scheme: CIA: 20 Marks****End-Sem: 30 Marks****Prerequisite: Basics of chemistry from std XI & XII science****Course Objectives:**

- To Study Basics of chemistry
- Important reactions which will help various processes in biological system.
- To study importance of pH and buffer in chemical and biochemical reactions
- To understand chemical kinetics of chemical and biochemical reactions
- To expertize students in biochemical calculations

Course Outcomes:

On completion of the course, student will be able to–

Course Contents

Unit	Title	Lectures
Unit 1	Ionic equilibria	7 Lectures
	• pH, buffer, dissociation constant, pK values Solubility Product, indicators in titration. Equilibrium constant, Le Chatelier's principle, Acid and bases • Strength of acid & bases, pH of aqueous solutions, Acid–base titrations, Titration curves, Solubility product & Applications • Ionic product • Condition for precipitation, Buffers, buffer action, Henderson equation & related problems • Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure	
Unit 2	Chemical kinetics	5 Lectures

	- Rates of reactions, order & molecularity, zero, first & second order reactions, - Differential and integrated rate equation, half life periods, Arrhenius equation, collision theory of reaction rate, temperature dependent reaction rates	
Unit 3	Electrochemistry	5 Lectures
	- Electrochemical cell, half cell, reaction, reduction potential, electrochemical series, - Thermodynamic potential function from cell potential measurement, - Liquid junction potential, Huckel theory, overvoltage/ overpotential	
Unit 4	Basics of mole concept	7 Lectures
	- Mole concept, Determination of molecular weight by gram molecular volume relationship, - Problems based on mole concept, Solutions, colligative properties - Methods of expressing concentrations, strength, Normality, Molarity and Molality, ppm, Standardization of solutions, pH, buffer systems, dissociation constant, pK value, - Preparation of standard solution of acids and bases, Problems related to acid base titrations, volumetric experiments, acidimetry, alkalimetry	
Unit 5	Chemical bonding & molecules	6 Lectures
	- Types of bond covalent, ionic, hydrogen bonding, inter and intra molecular hydrogen bonding - Dipole- dipole, dipole-induced dipole interaction, Structure of water molecule, oxidation state. - Hydrophobic & hydrophilic interaction - Diatomic molecules, Valence bond theory, VSEPR theory, hybridization involving s, p, d orbitals (sp, sp^2, sp^3, dsp^2, sp^2d, sp^3d, sp^3d^2) - Homo and heteronuclear diatomic molecules, Bond order, Magnetic properties	

References-

- Stereochemistry: Conformation and mechanism by P.S.Kalsi
- Organic chemistry by Jonathan clayden, nick greeves and stuart warren
- University General Chemistry by C.N. Rao, 1st edition (2000), Macmillan Publishers, India ,
- Principles of Physical Chemistry, S.H. Maron and C.F. Prutton, Collier, 4th edition (1965) Macmillan Ltd 3.
- The elements of Physical Chemistry, Atkins P, de Paula J. W. H. Freeman Publication, 5th edition (2009),USA
- An Introduction to Electrochemistry, Samuel Glasstone, BiblioBazaar, USA edition reprint, 2011,
- Physical Chemistry for biological sciences, Chang R , 1st edition, (2005), University Science Books, USA
- Physical Chemistry, David Ball, Thoson Learning, 1st edition, (2003), USA.
- Essentials of Physical Chemistry, B S Bahl, G D Tuli, ArunBahl, S. Chand Limited, 24th edition (2000) India.
- Concise Inorganic Chemistry, Author: J. D. Lee, John Wiley & Sons, USA, 5th edition (2008),
- Organic Chemistry, Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.), 6 th edition
- Guide book to Mechanism in Organic Chemistry by Peter Sykes, 6 th edition, (1996), Prentice Hall, India.

*Progressive Education Society's***Modern College of Arts, Science and Commerce (Autonomous)****Shivajinagar, Pune - 5****First Year of B.Sc. Biotechnology****(2024 Course under NEP 2020)****Semester I****Course Code: 24ScBioU1202****Course Name: Lab on 24ScBioU1201****Teaching Scheme: TH: 4 Hours/Week****Credit 2C (15 P)****Examination Scheme: CIA: 20 Marks****End-Sem : 30 Marks****Prerequisite:** Basic chemistry from XI & XII Science.**Course Objectives:**

- To Study Basics of chemistry and important reactions which will help various processes in biological system
- To study estimation methods of important biomolecules.

Course Contents

Practical	Title	Practical 15P
Practical-1	Preparation of solutions	1 Practical
	To prepare buffer solutions having different concentrations	
Practical -2	Titration	1 Practical
	a. To study Acid base titration based by conductivity measurement. b. To determine alkali content in antacid tablet using HCl	
Practical -3	Chemical Kinetics	1 Practical
	To study kinetics of ester hydrolysis	
Practical -4	Thermochemistry	1 Practical
	To determine enthalpy and entropy change of a reaction. $2\text{FeCl}_3 + 3\text{Mg} \longrightarrow 2\text{Fe} + 3\text{MgCl}_2$	
Practical -5	Qualitative analysis	1 Practical
	To perform qualitative test for – Hydrocarbons, alcohols, aldehyde, ketones, aniline, amide	
Practical -6	Titration	1 Practical
	To determine content of acetic acid in vinegar using NaOH	
Practical -7	Titration	1 Practical
	To determine normality/molarity using acid base volumetric titration	
Practical -8	Stereochemistry	1 Practical
	To study different conformations of biomolecules using models	
Practical- 9	Separation technique 1	1 Practical
	Recrystallization	
Practical -10	Separation technique 2	1 Practical
	Steam distillation	
Practical- 11	Separation technique 3	1 Practical
	Sublimation	
Practical- 12	TLC-1	1 Practical
	To understand basic principle of TLC	
Practical- 13	TLC-2	1 Practical

	To find Rf values of given samples A & B	
Practical- 14	Introduction to chemicals and glasswares	1 Practical
Practical- 15	Viscometry	1 Practical
	To determine viscosity of a given liquid by Ostwald's viscometer	

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Course Code: 24ScBioU1301 **Course Name: Biochemistry**
Teaching Scheme: TH: 2 Hours/Week **Credit: 2C (2T)**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite: Basic chemistry from XI & XII Science.

Course Objectives:

- To Study Basics of biochemistry and important reactions which will help to understand various processes in biological system
- To study chemistry of biomolecules
- To understand structure and functions of biomolecules

Course Outcomes:

On completion of the course, student will be able to–

- Study all basic fundamentals of chemistry and biomolecules.

- Understand structure and functions of biomolecules.

Course Contents

Unit	Unit	30 lectures
Unit 1	Biological chemistry	2 lectures
	• Introduction to biochemistry • Historical perspective- cellular and chemical foundation • Genetic and evolutionary foundations • origin of life, • Abiotic production of biomolecules	
Unit 2	Water	3 lectures
	• Water as biological medium • Properties of water • Anomalous behaviour, weak interactions in water • interaction of biological molecules in water, Hydrogen bonding • ionization of water, osmosis, • concept of pH • titration of weak acids • buffers • Biological buffers • Types of bond • Covalent and noncovalent interactions in biomolecules with suitable example • functional groups and modification of functional group relevant to biomolecules.	
Unit 3	Basic Biomolecules	6 lectures
	• Basic Biomolecules: Carbohydrates: sugars and nonsugars • classification of carbohydrates- mono, oligo, dextrins and polysaccharide. Monosaccharides: classifications of monosaccharide based on functional group (ketoses and aldoses) based on number of carbon atoms • D and L configuration • conformations • mutarotation	

	• epimers • anomers, • chemical and physical properties ; alpha, beta glycosidic linkage • oligosaccharides • reducing and non reducing sugars • inversion of sugar • polysaccharides- its classification based on function (1. Storage polysaccharide eg starch, glycogen and inulin 2.structural polysaccharides eg. cellulose, chitin) mucopolysaccharide • functions of Carbohydrate	
Unit 4	Lipids	3 lectures
	• Function of lipids, • classification of lipids, • Simple lipids- its structure and classes, • fatty acids, • saturation and unsaturation of fatty acids with examples, • its significance, • fatty indices, • chemical and physical properties, • complex lipids: Phospholipids, sphingo lipids, cerebrosides, gangliosides, prostaglandin • cholesterol (good and bad) Steroids.	
Unit 5	Proteins	5 lectures
	• Proteins: introduction, • Polymer of amino acids, • Classification of amino acids, • essential amino acids, • Configuration, properties, zwitterion , titration of amino acid, isoelectric point pI, • properties of peptide bond, • primary structure, • reactions of oligopeptide with trypsin and chymotrypsin, • secondary structure (alpha helix, beta pleated sheets, pitch value) • Secondary repeats tertiary and quaternary structure with example. Denaturation and renaturation	
Unit 6	Vitamins	3 Lectures

	- fat soluble (A,D,E,K) and water soluble Vit. C, - Thiamine , - riboflavin, - niacin, - PLP, - CoenzymeA, - lipoic acid , - Folic acid and B12	
Unit 7	Enzymes	5 lectures
	- Biocatalyst, - Specificity, - active site, - Energy of activation, - Lock and key, - Induced fit hypothesis , - prosthetic groups, - cofactors, - coenzyme, - holoenzyme, - apoenzyme, - IUB system of enzymes classification. - Enzyme inhibition, - Basics of enzyme kinetics, - Parameters affecting enzyme activity (temp, pH, substrate, cofactor,enzyme con.)	
Unit 8	Nucleic acids	3 Lectures
	- chemical names and structures of nitrogen bases, - Nucleosides, - nucleotides, - Polynucleotide, - DNA and - RNA, - Forces stabilizing nucleic acid structure, concept of reannealing of DNA	

References:

- Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf ; John Wiley and Sons, USA
- Fundamentals of Biochemistry. 3rd Edition, (2008), Donald Voet& Judith Voet , John Wiley and Sons, Inc. USA

- Principles of Biochemistry, 4th edition (1997), Jeffery Zubey, McGraw-Hill College, USA
- Biochemistry: 7th Edition, (2012), Jeremy Berg, Lubert Stryer, W.H. Freeman and company, NY
- Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY.
- Biochemistry. 5th Edition, (copyright 2013), Reginald Garrett and Charles Grisham, Brooks/Cole, Cengage Learning, Boston, USA.
- An Introduction to Practical Biochemistry. 3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu. Pvt. Ltd. New Delhi, India
- Biochemical Methods. 1st, (1995), S. Sadashivam, A. Manickam, New Age International Publishers, India

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Semester I

Course Code: 24ScBioU1302 **Course Name: Lab on 24ScBioU1301**
Teaching Scheme: TH: 4 Hours/Week **Credit: 2C (15 P)**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite: Basic chemistry from XI & XII Science.

Course Objectives:

- To Study Basics of chemistry and important reactions which will help various processes in biological system
- To study estimation methods of important biomolecules.

Course Contents

Practical	Title	15 practicals
Practical -1	Biological Buffers	1 Practical
	Preparation of solutions and buffers.	
Practical -2	Estimations	2 Practical
	a. To estimate concentration of lipids in given sample. b. To estimate concentration of reducing sugar in given sample by DNSA	

	method.	
Practical- 3	Saponification number	1 Practical
	To find out saponification number of given lipid	
Practical -4	Qualitative test for sugar	2 Practical
	To perform Spot tests for sugar and cholesterol	
Practical- 5	Isoelectric point	2 Practical
	To find out isoelectric point p^I of amino acid glycine.	
Practical-6	Estimations	2 Practical
	- Estimation of concentration of protein by Biuret method - Estimation of concentration of protein by Lowery's method	
Practical-7	Melting temperature of nucleic acid	1 Practical
	To determine T_m of DNA	
Practical-8	Thin layer chromatography	2 Practical
	To separate amino acids by thin layer chromatography (TLC)	
Practical-9	Enzyme activity	2 Practical
	To find out enzyme activity (amylase)	

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First Year of B.Sc.Biotechnology (NEP)
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Semester I

Course Code: 24ScBIOU1401 Course Name: Biotechnology and Human welfare I

Teaching Scheme: TH: 2 Hours/Week

Credit: 2C (2T)

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite:

- Basics of Science till 10th Standard.

Course Objectives:

CO Number	Course Outcomes	Bloom's Cognitive level
CO 1	Understand applications of Biotechnology in detergent and food industry.	1
CO 2	Environmental and medical applications of biotechnology.	2
CO 3	Different applications of nanotechnology and biopolymer production.	3
CO 4	Alcohol and antibiotic fermentation techniques	4
CO 5	Introduction to biofertilizers, GM crops, plant tissue culture techniques	5
CO 6	Introduction to livestock improvement methods	6

- To popularize Biotechnology among non- science students.

Course Outcomes:

After learning the course, students will be able to –

Course Contents

Unit	Title	30 Lectures
Unit 1	Industrial Biotechnology : Protein Engineering: Introduction, Protein engineering applications	8 L
	• In Food Industry (Amylases, Lipases, Proteases) • In Detergent Industry (Bacterial alkaline proteases, Lipases, Proteases) • Environmental Applications (environmental biosensors, bioremediation and biotransformation, petroleum bio-refining, bioplastics) • Medical Applications (recombinant protein production, immunotherapy, gene therapy, antibody engineering) • Biopolymer production (elastin-like polypeptides, silk-like polymers) • Nanotechnology applications (synthesis of biocompatible nanomaterials like nanowire construction, nanodevices, transducers)	
Unit 2	Alcohol and antibiotic fermentation	7L
	• Alcohol fermentation: Introduction, Basics of Alcohol fermentation. • Wine, beer, rice wine production. • Antibiotic fermentation: Introduction, Antibiotic fermentation in Penicillin, Streptomycin, Tetracycline.	
Unit 3	Agricultural Biotechnology	10L
	Introduction to N₂ fixation • N₂ fixation and biofertilizers (<i>Rhizobium</i>, <i>Azotobacter</i>, <i>Anabaena</i>, <i>Azolla</i>, <i>Mycorrhizae</i>). • Pest resistant plants and insect resistant plants by gene transfer method. • Bio-pesticides and bio-insecticides: Tricardes. • Characterizations of genetic resources and genetic enhancement of plants with	

	suitable example(Micropropagation and plant tissue culture techniques). • GM crops with suitable example.	
Unit 4	Qualitative improvement of livestock: Introduction to livestock improvement methods	5L
	a. Artificial insemination b. Embryo transfer c. Somatic cell nuclear transfer d. Marker assisted breeding.	

References:

1. Principles of Immunology and Immunodiagnostics, Ralph Michael Aloisi. Lippincott Williams and Wilkins
2. Immunology and Immuno-biotechnology Ashim K Chakravarty, Oxford University Press, 2006
3. Molecular Cell Biology, (6th edition) Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky, and James Darnell. WH Freeman Publications
4. Letovsky, S.I. 1999 Bioinformatics. Kluwer Academic Publishers. 3. Baldi, P. and Brunak, S. 2001 5. Bioinformatics: The machine learning approach, The MIT Press.
6. Mount, D.W., Bioinformatics: 2001, Sequence and Genome Analysis. CSHL Press.
7. Glick, B. R., Pasternak, J. J., & Patten, C. L. (2010). Molecular biotechnology: principles and applications of recombinant DNA. Washington, DC: ASM Press.
8. Tramontano, A. (2006). Protein structure prediction: concepts and applications. In Protein Structure Prediction: concepts and applications.
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10. Mathuriya A. S. Industrial Biotechnology (2009) Ane Books Pvt. Ltd.
11. New Products and New Areas of Bioprocess Engineering (Advances in Biochemical Engineering/Biotechnology, 68) by T. Scheper. Publisher : Springer Verlag.
12. Prescott's Microbiology, Joanne M. Willey , Linda M. Sherwood , Christopher J. Woolverton 8th Edition McGraw-Hill Publishers Eight edition- 2010.

**First Year of B.Sc. Biotechnology
(2024 course under NEP 2020)**

Course Code: 24ScBioU1601

Course Name: Modern Physics

Teaching Scheme: PR: 4 Hours/Week

Credit: 2C (2P)

Prerequisite Courses: Knowledge of Basic physics and language Programming

Course Objectives:

- Students will be given the concept of C-programing language and basic physics

Course Contents

Practical	Title	15 Practicals
Practical-1	Use of Computer- Trigonometric Functions	1 practical
Practical-2	Use of Computer- Geometrical Functions	1 practical
Practical-3	Write a C program to compare two peptides and determines the type of the peptide. i.e small or poly based on the values inputted peptides. Amino acid range for small peptide is < 1 - 8> whereas it is < 9 – 50 > for a poly peptide	1 practical
Practical-4	Write a c program to identify the glucose level in a blood The glucose level is identified by 180 diabetics. Write a C program to find the anemic level Anemic level is identified by the hemoglobin value. If the hemoglobin level is 9.6 – 13, mild; 8 – 9.5 , moderate; < 8 severe; > 13 and <=17 Normal	1 practical
Practical-5	Write a C program to determine the type of DNA depending on the base number.	1 practical
Practical -6	Write a C program to find the number of purines and pyrimidines	1 practical
Practical-7	Convert Fahrenheit to Celsius Write a C program to find the Body Mass Index (BMI) of a person [BMI = weight in kgs / height in metres ²]	1 practical
Practical-8	Write a C program to calculate the average base count	1 practical
Practical-9	- Write a C program to find the pH of a given solution for any given hydrogen ion concentration. [pH = - log[H]] - Write a C program to find the pH value for a given [OH-] concentration [pH = 14.0 – pOH and pOH = - log₁₀(pOH)] - Write a C program to find the nature of any given solution The nature of any solution is decided by its pH value. If the pH value is greater than 0 and less than 7, then the solution is acidic. If pH value is 7, then it is neutral. If pH is more than 7 and less than	1 practical

	equal to 14, then the solution is basic	
Practical-10	Measurements using various instruments (Vernier callipers,)	1 practical
Practical-11	Measurements using various instruments (Micrometer screw gauge)	1 practical
Practical-12	Frequency of A. C.	1 practical
Practical-13	Study of Digital Multimeter	1 practical
Practical-14	Study of Thermocouple	1 practical
Practical-15	Calculate g by using Simple Pendulum	1practical

References:

1. Advanced Practical Physics for Students by B. I. Worsnop And H. T. Flint.
2. Practical Physics by Dr. S. L. Gupta and Dr. V. Kumar, Pragati Prakashan.
3. Let Us C by Y. Kanitkar
4. C for Biologists by Ms. G. Jeyakodi

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First Year of B.Sc. Biotechnology (NEP)
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Semester II

Course Code: 24ScBIOU2101**Course Name: Animal Sciences****Teaching Scheme: TH: 2Hours/ Week****Credit: 02 (2T)****Examination Scheme: CIA: 20 Marks****End-Sem: 30 Marks****Prerequisite Courses:**

- Basics of biology from 11th and 12th science.

Course Objectives:

- To study animal classification, tissue types, respiratory pigments and oxygen dissociation curve, chemical communication through hormones in humans and economic applications of Zoology.

Course Outcomes:

On completion of the course, student will be able to—

Course Contents

Unit	Title	30 lectures
Unit 1	Animal Classification	5 lectures
	- Outline of classification of kingdom Animalia. - Non-chordates (characteristic features and representative examples). - Chordates (characteristic features and representative examples).	
Unit 2	Animal Tissue types	7 lectures
	- Tissue types and subtypes with suitable examples. - Epithelial tissue. - Muscle tissue. - Nervous tissue. - Connective tissue.	
Unit 3	Blood pigments and oxygen transport	4 lectures
	- Different types of respiratory pigments: hemoglobin, hemocyanin, erythrocrurin-chlorocruorin, hemerythrin. - Oxygen dissociation curve and effect of temperature, pH, CO₂, organic phosphate compounds and altitude on it.	
Unit 4	Hormones	4 lectures
	- Endocrine, Paracrine and Autocrine systems. - Hormones released by Pituitary and Adrenal gland	
Unit 5	Introduction to model organisms	2 lectures
	- What are model organisms, need and characteristics of model organisms - Hydra <i>Drosophila</i>	
Unit 6	Economic Zoology	8 lectures
	- Aquaculture - Sericulture - Vermiculture& Vermicomposting - Apiculture	

References:

1. Chordate Zoology S. Chand & Company Ltd. Ram Nagar. New Delhi. Jordan, E.L. and Verma P.S. 1978.
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5. Introduction to general Zoology Vol 1; K. Chaki, G. Kundu, S. Sarkar.
6. Principles of Animal Physiology; Pearson publications; 2nd edition; C. Moyes & P. Schulte.
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11. General Microbiology - Stanier R.Y., 5th edition, (1987) Macmillan Publication, UK.
12. Brock Biology of Microorganisms 9th ed. (2000), John M. Martinko, Jack Parker. Prentice hall, Upper Saddle River, New Jersey.
13. Prescott's Microbiology, 8th edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGrawHill Science Engineering, USA.

Progressive Education Society's**Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar,****Pune- 5****First Year of B.Sc. Biotechnology****(2024 Course under NEP 2020)****Semester II****Course Code: 24ScBioU2102****Course Name: Lab Course on 24ScBioU2101****Teaching Scheme: PR: 4 Hours/ Week****Credit: 02 (15P)****Examination Scheme: CIA: 20 Marks****End-Sem: 30 Marks****Prerequisite Courses:**

- Basics biology from 11th and 12th science.

Course Objectives:

- To study in detail about *Paramecium*, Honeybee, *Hydra*, *Drosophila*, frog sense organs and circulatory and reproductive system, *Plasmodium* and *Fasciola* sps.
- *Fasciola* sps.
- Understand sense organs, circulatory and reproductive system of frog

Course Contents

Practical	Title	15 practicals
Practical -1	Study of <i>Paramecium</i>	2 practicals
	Morphology and sexual, asexual mode of reproduction in <i>Paramecium</i>.	
Practical --2	Study of Honeybee	3 practicals
	Dissection and mounting of: - Mouth parts - Pollen basket - Antenna Cleaner - Sting Apparatus - Legs and wings - Visit to Honey bee research centre	
Practical -3	Study of <i>Hydra</i>	2 practical
	Morphology and sexual, asexual mode of reproduction in <i>Hydra sp.</i>	
Practical- 4	Study of <i>Drosophila</i>	2 practicals
	- Morphology - Sexual dimorphism - Lifecycle (temporary mounts of developmental stages: larva, pupa and adult stage) - Eye and wing mutants	
Practical -5	Study of frog	1 practical
	- Sense organs. - Circulatory system - Reproductive system	
Practical -6	Study of Parasitology	2 practicals
	Morphology and lifecycle of: <i>Plasmodium sp.</i> <i>Fasciola sp.</i>	
Practical -7	Study of Earthworm	1Practical
Practical -8	Study of Amphioxus	1 Practical
Practical -9	Vital Staining	1 Practical

References:

1. A Manual of Practical Zoology- Invertebrates (2010), P.S. Verma , S. Chand Publishing.

2. A Manual of Practical Zoology- Chordates (2007), P.S. Verma, S. Chand Publishing.

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First Year of B.Sc. Biotechnology

(2024 Course under NEP 2020)

Semester II

Course Code24ScBIOU2201

Course Name: Microbiology

Teaching Scheme: TH: 2Hours/ Week

Credit: 02(2T)

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses:

- Basics of biology from 11th and 12th science.

Course Objectives:

- To study classification, replication and control of microorganisms.

Course Outcomes:

On completion of the course, student will be able to–

Course Contents

Unit	Title	30 Lectures
Unit 1	Introduction to Microbial World	2 lectures
	• Important developments leading to path breaking discoveries.	
Unit 2	Classification of microorganisms	3 lectures
	• Five major groups of microorganisms: Bacteria, Fungi, Cyanobacteria, Archaea and viruses.	
Unit 3	Prokaryotic Cell structure:	7 lectures
	• Function and ultra-structure of - cell wall (Gram positive and negative), cell membrane, flagella, etc.	

Unit 4	Handling of microorganisms and biosafety measures	4 lectures
	• Sterilization: Physical Agents and Chemical agents and their mode of action. • Microbial disease control.	
Unit 5	Techniques in Microbiology	6 lectures
	• Cell Enumeration and quantification of growth. • Total Count- Breeds count, direct microscopic count, hemocytometer, turbidity. • Microscopy: Wet mount and dry mount. • Staining techniques: Monochrome, Negative, Differential (Gram, Acid fast, blood staining). • Structural features and special staining of Spore, flagella, cell wall, nucleic acid, capsule.	
Unit 6	Microbial Growth	4 lectures
	• Growth curve, introduction to kinetics of growth, generation time, growth rate. • Reproduction in microorganisms: Binary fission, asexual, sexual, Lytic, Lysogenic Cycle.	
Unit 7	Design of media and growth requirements	4 lectures
	• Basic Considerations – Nutritional, hydrogen ion concentration, temperature and oxygen. • Nutritional classification of bacteria. • Concept of Pure culture, co-culture and mixed culture, Colony characteristics and Biofilm formation. • Preservation and Maintenance methods for microbial cultures.	

References:

14. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY
15. General Microbiology - Stanier R.Y., 5th edition, (1987) Macmillan Publication, UK.
16. Brock Biology of Microorganisms 9th ed. (2000), John M. Martinko, Jack Parker. Prentice hall, Upper Saddle River, New Jersey.
17. Prescott's Microbiology, 8th edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGrawHil Science Engineering, USA.

Progressive Education Society's**Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar,****Pune- 5****First Year of B.Sc. Biotechnology****(2024 Course under NEP 2020)****Semester II****Course Code: 24ScBIOU2202****Course Name: Lab Course on 24ScBIOU2201****Teaching Scheme: PR: 4Hours/ Week****Credit: 02(15P)****Examination Scheme: CIA: 20 Marks****End-Sem: 30 Marks****Prerequisite Courses:**

- Basics of biology from 11th and 12th science.

Course Objectives:

- To learn in detail about microbiology laboratory and isolation, identification and control of microorganisms.

Course Content

Practical	Title	15 Practicals
Practical -1	Introduction to Microbiology laboratory	2 Practical
	• Introduction to Microbiology Laboratory and Aseptic Transfer Techniques, Sterility testing.	
Practical -2	Preparation of media	1 Practical
	• Preparations of media for bacterial/fungal culture.	
Practical -3	Isolation of microorganisms	2 Practical
	• Isolation of bacteria by streak plate technique and preservation of microorganisms	
Practical -4	Enumeration techniques	3 Practical
	• Pour plate method • Spread plate method	
Practical -5	Observation of microorganisms	4 Practical
	• Wet mount • Monochrome staining • Gram staining • Spore staining • Fungal staining	
Practical -6	Enrichment techniques	2 Practical
	• By using Winogradsky's Column	
Practical -7	Growth Curve	1 Practical
	• Study of bacterial growth curve	

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(2024 Course under NEP 2020)
Semester II****Course Code: 24ScBioU2301****Course Name: Biophysics and instrumentation****Teaching Scheme: TH: 2 Hours/Week****Credit: 02 C (2T)****Examination Scheme: CIA: 20 Marks****End-Sem: 30 Marks****Prerequisite Courses:**

- Basic Biology and Physics from XI and XII Science

Course Objectives:

- To study different models of atomic structure, Radioactivity concept and measurement, Biophysical properties of membrane
- To learn Separation techniques, Evaporation, Distillation, Chromatography, Electrophoresis and Microscopy
- To Study basics of instrumentations: Spectroscopy, Centrifugation, pH meter, Refrigeration
- To learn applications and use of various equipments

Course Outcomes:

On completion of the course, student will be able to–

Course Content

	Title	Lectures
Unit 1	Atomic structure	3
	• Significance of second and third postulate of Bohr's model. • Derivation of Radius and Energy value. • Bohr – Sommerfeld Model. • Vector Atom Model. • Quantum Numbers. • Electronic Configuration.	
Unit 2	Radioactivity	3
	• Atomic number, Mass number, Isotopes, Isotones, Isobars. • Alpha, Beta & Gamma radiation. • Biological Applications of Radioactivity. • Measurement of Radioactivity	
Unit 3	Biophysical properties of Membrane	3
	• Membrane structure and Membrane transport: active	

	and passive transport, Co-transport (Uniport, Symport and Antiport) Osmosis, Diffusion. • Electrical properties of Membrane • Membrane potential and Action potential (Depolarization, Hyperpolarization and repolarization of Neuronal membrane). • Nernst Equation.	
Unit 4	Introduction to Separation Techniques	2
	• Basics of Evaporation and Distillation • Chromatography, Electrophoresis, Types & Application	
Unit 5	Microscopy	4
	• Resolving Power, Numerical Aperture, Image formation • Types- light field & dark field microscopy • Working and Construction of Simple, Compound & Stereo microscope, Inverted microscope, Phase Contrast microscope, Fluorescence microscope, Electron microscope.	
Unit 6	Spectroscopy	3
	• Absorption spectroscopy, Beers & Lambert's Law • Construction, working principle and applications (Biomolecules) of Colorimeter, Spectrophotometer, Fluorometer	
Unit 7	Centrifugation	3
	• Sedimentation • Centrifugation – principle, components and RCF • Types of centrifuge • Types of centrifugation	
Unit 8	pH meter	3
	• pH scale, isoelectric pH • pH meter – electrodes • pH indicators • buffers • applications of pH in biology	
Unit 9	Thermoregulation	3
	• Temperature measurement • Different types of thermometers • Homeostasis	
Unit 10	Refrigeration	3
	• Adiabatic and Isothermal Processes • Critical temperature and Critical pressure • Refrigeration – components, principle, Carnot Cycle and	

	Reverse Carnot cycle • Conditions for good refrigerant • Cryopreservation	
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References:

1. Biophysics, an introduction. 1st edition. (2002) Cotteril R. John Willey and Sons Ltd., USA
2. Biophysics. 1st edition (2002), Pattabhi V and Gautham N. Kluwer Academic Publisher, USA.
3. Textbook of optics and atomic physics, 8th edition (1989) P.P. Khandelwal, Himlaya Publishing House, India.
4. Instrumentation measurements and analysis – 2nd edition (2003). Nakra and Choudhari, Tata McGraw Hill, India.
5. Nuclear Physics: An Introduction. 2nd edition (2011). S. B. Patel. Anshan Publication, India

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**First Year B.Sc. Biotechnology
(2024 Course under NEP 2020)
Semester II**

Course Code: 24ScBioU2302**Course Name: Lab Course on 24ScBioU2301 (Biophysics and Instrumentation)****Teaching Scheme: TH: 4 Hours/Week****Credit: 02 C (15P)****Examination Scheme: CIA: 20 Marks****End-Sem: 30 Marks****Prerequisite Courses:**

- Basic concepts of physics from XI&XII

Course Objectives:

- To learn separation techniques, evaporation, distillation, chromatography, electrophoresis and microscopy
- To learn the functioning and calibration of few biophysical instruments
- To Study basics of instrumentations: Spectroscopy, Centrifugation, pH meter, Refrigeration
- To learn applications and use of various equipments

Course Content

Practical	Title	15 Practical
Practical -1	Working and Calibration	2 practical
	• Electronic Balance • Micropipette	
Practical --2	Microscopy	2 practical
	• Components and working of Bright field, Compound and Inverted microscope	
Practical -3	Electrophoresis	1 practical
	Components and working of Electrophoresis	
Practical -4	Chromatography	1 practical
	Components and working of Chromatography	
Practical- 5	Distillation Unit	1 practical
	Components and working of Distillation unit	
Practical -6	Soxhlet unit	1 practical
	Components and working of Soxhlet unit	
Practical- 7	To study quantitative assay using	1 practical
	• Colorimeter	
Practical -8	To study Absorption Spectrum using Spectrophotometer of:	2 practical
	• Protein • DNA	
Practical- 9	pH meter	1 practical
	• Working and standardization of pH meter	
Practical -10	Centrifugation	1 practical
	• Types of rotors • Types of centrifugations • Applications of centrifugation	
Practical- 11	Vortex mixer and Magnetic Stirrer	1 practical

	- Working Principle - Applications	
Practical -12	Laboratory Incubator	1 practical
	- Types of Incubator: Bacterial, BOD, CO₂ and shaker incubator - Working Principle - Advantages - Applications	

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First Year of B.Sc. Biotechnology

(2024 Course under NEP 2020)

Semester II

Course Code: 24ScBIOU2401 Course Name: Biotechnology and Human welfare II

Teaching Scheme: TH: 2 Hours/Week

Credit: 4C= 2 C (2T)

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite:

- Basics of Science till 10th Standard.

Course Objectives:

- Topopularize Biotechnology among non- science students.

Course Outcomes:

After learning the course, students will be able to –

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Course Contents

Unit	Title	30 Lectures
Unit 1	Forensic science: Application of Biotechnology in forensic science	8 lectures
	DNA fingerprinting - Solving violent crimes such as murder and rape. - Solving claims of paternity and other family relations. - Identify endangered and protected species as	

	an aid to wildlife protection. Determine pedigree for seed or livestock breeds for identification of food adulteration.	
Unit 2	Health Industry: Application of Biotechnology in health industry	7 lectures
	Development of non-toxic therapeutic agents: - Insulin. - Human Growth Factors. - Factor VIII. - Monoclonal antibodies. - Biosimilars. Recombinant live vaccines: - HIV - Botulism - Influenza - Hepatitis Diagnosis of diseases using Biotechnology: - Various types of cancers. - Hepatitis. - Viral Infections. - Bacterial Infectious diseases.	
Unit 3	Introduction to Bioethics in Biotechnology	15 lectures
	- Ethics in Agriculture and food. - Biopiracy, biowarfare. - Animal cloning and applications. Ethics in Humans: - Artificial insemination. - In vitro fertilization and embryotransplants. - Surrogacy. - Organ Transplants. - Gene therapy. - Eugenics. - Stem cell therapy. - Crisper Technology. - Ethics in Human genome project. - Human cloning. - Public education of producing transgenic organism. - Legal and important socioeconomic impacts of Biotechnology.	

References:

1. Molecular biotechnology: principles and applications of recombinant DNA (2010). Glick, B. R., Pasternak, J. J., & Patten, C. L. Washington, DC: ASM Press.
2. Protein structure prediction: concepts and applications (2006) Tramontano, A
3. Principles of gene manipulation and genomics, (2013) Primrose, S. B., & Twyman, R. John Wiley & Sons.

4. Industrial Biotechnology (2009), Mathuriya A. S, Ane Books Pvt. Ltd.
5. New Products and New Areas of Bioprocess Engineering (Advances in Biochemical Engineering/Biotechnology, 68) by T. Scheper. Publisher : Springer Verlag
6. Prescott's Microbiology (2010), Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton 8th Edition McGraw-Hill Publishers Eight edition.
7. Biotechnology and Safety Assessment, (2002), Thomas J.A., Fuch R.L Academic Press 3rd Edition.
8. Biological safety Principles and practices (2000) Fleming D.A., Hunt D. ASM Press 3rd. ed.
9. Bioethics Ben Mephram Oxford University Press 2008.
10. Bioethics & Biosafety (2007) R Rallapalli &Geetha Bali APH Publication.

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First Year of B.Sc. Biotechnology

(2024 pattern under NEP 2020)

Semester II

Course Code: 24ScBIOU2601 Course Name: Basic of Mathematics & Biostatistics

Teaching Scheme: TH: 2 Hours/ Week

Credit: 02C (2T)

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses:

- Basic Mathematics from 11th and 12th Science.

Course Objectives:

- To study Set theory, Differential equation, Calculus, Matrices.
- To study Introduction to Statistics, Descriptive Biostatistics, Probability and Probability distribution.

Course Outcomes:

On completion of the course, student will be able to—

- Solve differential equations, integration, set system-based problems etc.
- Know about biological data collection, sampling and analysis.
- Find Probability and Probability distribution.

Course Content

Unit	Title	30 lectures
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Unit 1	Sets	2 lectures
	• Definition. • Types of sets with Venn diagram. • Subset. • Operations on sets. • Cartesian Product and Relations.	
Unit 2	Calculus	5 lectures
	• Function. • Limit of a function. • Continuity of function. • Differentiation of Function. • Integration. • Area under the curve.	
Unit 3	Differential Equation	5 lectures
	• Ordinary and Partial differential equation. • Order and degree of differential equation. • Homogeneous differential equation. • Variable separable form. • Exact differential equation. • Linear differential equation. • Applications: growth and decay, law of cooling.	
Unit 4	Matrices	3 lectures
	• Definition. • Types of matrices. • Addition of matrices. • Multiplication of matrices. • Determinant of matrices. • Minor, cofactor, adjoint and inverse of a matrix. • System of linear equations. • Cramer's Method.	
Unit 5	Introduction to statistics	2 lectures
	• Need of Statistics in biology. • Various types of data. • Population, sample and sampling method. • Representation of data using frequency distribution diagram.	
Unit 6	Descriptive Biostatistics	4 lectures
	• Measures of central tendency. • Measures of dispersion. • Correlation.	

	Scatter diagram.	
Unit 7	Probability and Probability distribution	4lectures
	- Basics of Probability theory. - Probability distribution. - Binomial distribution. - Poisson distribution. - Normaldistribution.	
Unit-8	Inferential Statistics	5 lectures
	- Hypothesis. - Significant level. - Test Statistics (t and z test). - Chi square test. - ANOVA (One way and Two way).	

References:

1. Ordinary and Partial Differential Equations, 19th Edition, Dr. M.D. Raisinghanian
2. Matrices: ShantiNarayana S.CHAND& Co. New Delhi,1957
3. Mathematics Analysis, 5th Edition, S.C.Malik and SavitaArora
4. Fundamentals of Mathematical Statistics by S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons.
5. Fundamental of Biostatistics, 7th Edition, Barnard Rosener,