

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)	24ScBleU1101	Biology I (The Diversity of Life)	2		2		20	30	50
	24ScBleU1102	Lab Course on 24ScBleU1101		2		4	20	30	50
Subject 2 T(2)+(T/P) (2)orT(4)	24ScBleU1201	Introductory and Organic Chemistry	2		2		20	30	50
	24ScBleU1202	Lab Course on 24ScBleU1201		2		4	20	30	50
Subject 3 T(2)+(T/P) (2)orT(4)	24ScBleU1301	Introduction to Biochemistry	2		2		20	30	50
	24ScBleU1302	Lab Course on 24ScBleU1301		2		4	20	30	50
IKST(2)	24CpCopU1901	Generic IKS	2		2		20	30	50
GE/OE (T/P) (2)	24ScBleU1401	Applications of Biology I	2		2		20	30	50
SEC (P)(2)	24ScBleU1601	English Communication and Critical Thinking		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
Non CGPA credits	24ScBleU1291	Calculus	4		4		40	60	100
Non CGPA credits	24ScBleU1292	Introductory classical Physics +PhysicsPractical1	2	2	2	4	40	60	100

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) Or T(4)	24ScBleU 2101	Biology II (Biology of Cells)	2		2		20	30	50
	24ScBle U2102	Lab Course on 24ScBleU 2101		2		4	20	30	50
Subject 2 T(2)+P(2)	24ScBle U2201	Inorganic and Physical Chemistry	2		2		20	30	50
	24ScBle U2202	Lab Course on 24ScBleU2201		2		4	20	30	50
Subject 3 T(2)+P(2)	24ScBle U2301	Introduction to Microbiology	2		2		20	30	50
	24ScBle U2302	Lab course on 24ScBle U2301		2		4	20	30	50
GE/OE (T/P)(2)	24ScBle U2401	Applications of Biology II	2		2		20	30	50
SECT(2)	24ScBle U2601	Immunology	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)	24CpCopU2011/ 24CpCopU2021/ 24CpCopU2031/ 24CpCopU2041/ 24CpCopU2051/ 24CpCopU2061/ 24CpCopU2071	Cultural Activities/ NSS / NCC/ Fine Arts / Applied Arts/ Visual Arts / Performing Arts	2		2		20	30	50

Total			14	08	14	16			550
Non CGPA credits	24ScBle U2291	Algebra	4		4		40	60	100
Non CGPA credits	24ScBle U2292	Modern Physics	2		2		20	30	50
	24ScBle U2293	Lab Course Based on 24ScBleU 2292		2		4	20	30	50

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
First Year B. Sc. Blended (Biosciences)
Semester I
2024 Course under NEP 2020)

Course Code: 24ScBleU1101 Course Name: Biology I (The Diversity of Life)
Teaching Scheme: TH: 2 Hours/Week Credit: 2T
Examination Scheme: CIA: 20 Marks End-Sem : 30 Marks

Prerequisite Courses:

Basic knowledge of Biology (SSC grade and HSC grade) is required that will help to study in depth of its other divisions.

Course Objectives:

- This course will introduce the concepts of biological evolution and their contribution to the evolution of diversity of life forms.
- Students will learn different theories on the evolution of life, Earth's history, animals, plants and other organisms and the levels of the biological chain from molecules to organisms to their forms.
- It will also provide the basics of biological classification and introduction to major domains and kingdoms of biological diversity, and the structure and biology of these organisms.
- The course is contained with Laboratory Experiments and Field study too. The field study allows students to gain experience in incorporating the theoretical perspectives learned in the classroom with experiences gained in the field.

Course Outcomes:

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

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall need and basic concepts of IKS.	1
CO 2	Compare modern medical science with traditional medical practices and Ayurveda.	2
CO 3	Identify relation of humans with food and nourishment	3

	since ancient times.	
CO 4	Analyze relevance of traditional agriculture practices to face modern age challenges.	4
CO 5	Value significance of environment and biodiversity through understanding of ancient concepts like Devrai	5
CO 6	Build deeper sense of belonging to the Bharat and gratitude for our continuous parampara of knowledge.	6

Course Contents

Unit	Title	Lectures 30 Lectures
Unit 1	Unifying themes in Biology	12
	• Theory of evolution: understanding life's diversity	2
	• Evolutionary relationships (phylogenies) are summarized in classifications	2
	• Chemical evolution of life – Molecules to cells	2
	• Cell theory and the origin of life	2
	• Prokaryotic Cells: Bacteria and Archaea	2
	• Evolution of the eukaryotic cell	2
	• Endosymbiosis	1
Unit 2	Diversity, structure and biology of major groups	18
	• Protists 1 - Red and Green algae	1
	• Protists 2 - Chromists	
	• Protists 3 - Dinoflagellates and apicomplexans, flagellates, ciliates, amoebae	
	• Evolution of sex, life cycles	1
	• Origins of multicellularity	1
	• Slime moulds and fungi	1
	• Fungi 2	
	• Introduction to Land Plants	1
	• Bryophytes	
	• Evolution of vascular tissue, Lycophytes, fern allies, early fossil land plants	
	• Ferns	1
	• Seed plants, the seed and secondary growth, Cycads and Ginkgo	1
	• Conifer diversity and biology	1
	• Angiosperm structure, biology and diversity,	

	the flower, double fertilization.	
	• Angiosperm phylogeny and evolution	
	• Introduction to animals (Metazoa)	1
	• Simple animals	1
	• Protostomes-Flatworms and annelids	1
	• Molluscs	1
	• Arthropods	1
	• Deuterostomes, Echinoderms-Chordates	1
	• Fishes –sharks/rays, teleosts, coelacanth, lungfish	1
	• Amphibians	1
	• Reptiles	1
	• Birds	
	• Mammals	1
	• The Primate story	

References:

1. Reece, Taylor, Simon and Dickey - Campbell Biology: concepts and connections, 7th Edition, Pearson Education (Singapore) Pvt. Ltd.
2. General Zoology - By Goodnight and others, IBH Publishing Co.,
3. R.L. Kotpal, 10th Edition.,2009 - Modern text book of Zoology, Invertebrates, Rastogi publications, Meerut.
4. Parker J. and Haswell, W., - Text-Book of Zoology, ELBS Edition.
5. Cleveland Hickman Jr., Larry Roberts, Susan Keen, Allan Larson and David Eisenhour - Animal Diversity, 8th Edition, McGraw Hill Publication.
6. Das, Datta and Gangulee - College Botany (Vol I), Published by New Central Books Agency (P). Ltd.
7. V. Verma - Botany, 2010, Ane Books Pvt Ltd.
8. A.C. Dutta - Botany for Degree Students, 6th Edition, Oxford University Press, New York.
9. Richard S.K. Barnes - The Diversity of Living Organisms, John Wiley and Sons Ltd., Oxford, United Kingdom.
10. Lynn Margulis and Michael J. Chapman - Kingdoms and Domains:An Illustrated Guide to the Phyla of Life on Earth, 4th edition,Academic Press; (1st edition in January 26, 2009).
11. Brian K. Hall; BenediktHallgrímsson - Strickberger's Evolution, Fourth Edition, Jones and Bartlett Publishers, Inc.
12. Mark Ridley, 2004, 3rd Edition - Evolution, Blackwell Publishing.
13. Carl T. Bergstrom & Lee Alan Dugatkin - Evolution (second edition), W. W. Norton & Company; Second edition.
14. Douglas J. Futuyma - Evolution, 2nd/ 3rd Edition,Sinauer Associates.

Progressive Education Society's

Shivajinagar, Pune - 5

(2024 Course under NEP 2020)

Teaching Scheme: TH: 4 Hours/Week

Credit: 2P

End-Sem : 30 Marks

Course Objectives:

- Course Outcomes:**

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall need and basic concepts of IKS.	1
CO 2	Compare modern medical science with traditional medical practices and Ayurveda.	2
CO 3	Identify relation of humans with food and nourishment since ancient times.	3
CO 4	Analyze relevance of traditional agriculture practices to face modern age challenges.	4
CO 5	Value significance of environment and biodiversity through understanding of ancient concepts like Devrai	5
CO 6	Build deeper sense of belonging to the Bharat and gratitude for our continuous parampara of knowledge.	6

Semester I

Practicals	Title	15 practicals
Practical-1	Study of Bryophytes.	1

	To study characteristics of bryophytes.	
Practical-2	Study of Pteridophytes.	1
	To Study characteristics of Pteridophytes.	
Practical-3	Study of Red and Green Algae.	1
	To Study characteristics of Red and Green Algae.	
Practical-4	Study of Gymnosperms.	1
	To Study characteristics of Gymnosperms.	
Practical-5	Study of Fungi.	1
	To Study characteristics of Fungi.	
Practical-6	Study of Angiosperms.	2
	To Study characteristics and reproductive parts of Angiosperm flower with examples.	
Practical-7	Study of Phylum Porifera, Cnidaria and Platyhelminthes.	1
	To Study characteristics of Porifera, Cnidaria and Platyhelminthes with examples.	
Practical-8	Study of Phylum Aschelminthes, Annelida and Arthropoda.	2
	To study characteristics of Aschelminthes, Annelida and Arthropoda with examples.	
Practical-9	Study of Phylum Mollusca and Echinodermata.	1
	To study characteristics of Mollusca and Echinodermata with examples.	
Practical-10	Study of Phylum Hemichordata and Chordata (Pisces and Amphibians).	1
	To study characteristics of Hemichordata and Chordata (Pisces and Amphibians) with examples.	
Practical-11	Study of Phylum Chordata (Reptilia, Aves and Mammalia).	2
	To study characteristics of Chordata (Reptilia, Aves and Mammalia) with examples.	
Practical-12	Primates	1
	Comparative study of Primates. (Skulls etc.)	

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5
First Year of B.Sc. Blended (Bioscience)
(Semester I)
(2024 Course under NEP 2020)

Course Code: 24ScBioU1201	Course Name: Introductory and organic chemistry
Teaching Scheme: TH: 2 Hours/Week	Credit: 2T
Examination Scheme: CIA: 20 Marks	End- Sem: 30 Marks

Prerequisite Courses: Knowledge of Basic chemistry from 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—

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall need and basic concepts of IKS.	1
CO 2	Compare modern medical science with traditional medical practices and Ayurveda.	2
CO 3	Identify relation of humans with food and nourishment since ancient times.	3
CO 4	Analyze relevance of traditional agriculture practices to face modern age challenges.	4
CO 5	Value significance of environment and biodiversity through understanding of ancient concepts like Devrai	5
CO 6	Build deeper sense of belonging to the Bharat and gratitude for our continuous parampara of knowledge.	6

Course Contents:

General Chemistry		
Units	Title	30 lectures
Unit 1	The Periodic Table	1
	• General Introduction • Groups • Rows • Modern periodic law	
Unit 2	Molecular Structure and Bonding	2
	• Lewis structures Formal charge Resonance • VSEPR – predicting the shapes of molecules Polarity of molecules • Covalent Bonding valence bond theory (Localized Electron model) • Molecular orbital theory • Intermolecular forces	
Unit 3	Acids and Bases	3
	• The Nature of Acids and Bases • Lowry Bronsted Theory • Lewis Acids/Bases • Dissociation of Carboxylic Acids • Amine Basicity • Acid Strength • The pH Scale • Calculating the pH of Strong Acid Solutions • Calculating the pH of Weak Acid Solutions • Bases • Strategy for Solving Acid-Base Problems: A Summary • Buffers • Polyprotic acids	
Organic Chemistry		
Unit 1	Carbon – the basis of life	2
Unit 2	Structure and Bonding Alkanes (sp ³ Hybridisation)	2
	• Covalent bonding - H 2 • S-bonding and sp³ hybridisation in methane and ethane • Structural isomerism • Methane, ethane, nomenclature of saturated	

	hydrocarbons - Conformational isomerism: ethane, butane - Stereochemistry, Optical activity, enantiomers and their physical/chemical properties. Racemates. - Designation of absolute configuration - Diastereoisomers - Meso compounds - Cycloalkanes - Conformational isomerism of cyclohexanes	
Unit 3	Structure and Bonding Alkenes (sp^2 Hybridisation)	1
	sp^2 hybridisation, s and p bonding in ethene - Nomenclature of alkenes - Geometrical isomerism - Conjugated alkenes	
Unit 4	Structure and Bonding of Alkynes (sp hybridisation)	1
	sp hybridization, s and p bonding in ethyne - Nomenclature of alkynes	
Unit 5	Functional Groups	1
	- Haloalkanes - Alcohols - Ethers - Amines - Carbonyl compounds - Carboxylic acids and derivatives	
Unit 5	Electrophiles and Nucleophiles	2
	- Arrow conventions - Organic acids and bases - Strengths of acids and bases: electronegativity, - Hybridization, resonance	
Unit 6	Nucleophilic substitution reactions	2
	- Nucleophiles and electrophiles SN_1 and SN_2 reactions - Determination of mechanism by stereochemical and kinetic methods - Properties of good leaving groups - Properties of good nucleophiles	
Unit 7	Elimination reactions	2
	E_1 and E_2 reactions - Determination of mechanism by	

	stereochemical and kinetic methods Dehydration of alcohols	
Unit 8	Addition reactions	2
	- Markovnikov's rule - Hydration of alkenes	
Unit 9	Electrophilic aromatic substitution reactions	2
	Substitution reactions of benzene: halogenation, nitration, sulfonation, Friedel-Crafts acylation and alkylation	
Unit 10	Nucleophilic addition reactions	2
	- Addition to carbonyl groups by cyanide, Grignard reagents, acetylide anions - Synthesis and chemistry of acids, amides, esters, acyl chlorides and anhydrides	
Unit 11	Organic redox reactions	3
	- Reductions: Catalytic hydrogenation, hydride reagents - Oxidations: Benzylic oxidation - Oxidation of primary alcohols to aldehydes then carboxylic acids by Cr(VI) reagents - Oxidation of secondary alcohols to ketones by Cr(VI) reagents	
Unit 12	Thermal physics, physical chemistry, and the environment (Narrative)	5L
	Zeroth Law of Thermodynamics	
	Thermal expansion and absorption of heat	
	Heat transfer, conduction, emission, absorption	
	Second Law of Thermodynamics, Irreversible processes, entropy, free energy	
	Real world examples - eg solar energy, geothermal, wind power	
Unit 13	Elasticity, fluids and gases (Narrative)	5 L
	Equilibrium and elasticity	

	Density and Pressure, Pascal's and Archimedes' Principles	
	Continuity and Bernoulli's Equation	
	Ideal gases (Kinetic theory of gases)	
	Mean free path, molecular speed distribution	
	Specific heat, adiabatic expansion	
	Real world examples - eg wind power, hydro, blood circulation, water in plants, materials, osmosis, wind and atmosphere	
Unit 14	Elasticity, fluids and gases (Narrative)	10L
	Equilibrium and elasticity	
	Density and Pressure, Pascal's and Archimedes' Principles	
	Continuity and Bernoulli's Equation	
	Ideal gases (Kinetic theory of gases)	
	Mean free path, molecular speed distribution	
	Specific heat, adiabatic expansion	
	Real world examples - eg wind power, hydro, blood circulation, water in plants, materials, osmosis, wind and atmosphere	
	Ordinary differential equations: definition of ODE, order, general solution, initial conditions; separable ODEs	
	Solving linear ODE using integrating factor	
	Applications of 1st order ODEs: ecology models	
	Applications of 1st order ODEs: chemical reaction rates, Newton's law of cooling	
	Particular solutions of inhomogeneous constant coefficient linear ODEs using method of undetermined coefficients; principle of superposition	
	Applications of 2nd order ODEs: Springs	
	Applications of 2nd order ODEs: LRC series electrical circuits	
	Real world contextual examples in physics and chemistry and the application of ODEs (selection of examples depending on student cohort)	

References:

- Stereochemistry: Conformation and mechanism by P.S.Kalsi
- Organic chemistry by Jonathan clayden, nick greeves and stuart warren
- University General Chemistry , 1st edition (2000), C.N. R. Rao, Macmillan Publishers, India ,
- Principles of Physical Chemistry, 4th edition (1965), S.H. Maron and C.F. Prutton, Collier Macmillan Ltd 3. The elements of Physical Chemistry, 5th edition (2009), Atkins P, de Paula J. , W. H. Freeman Publication, USA
- An Introduction to Electrochemistry , edition reprint, 2011, Samuel Glasstone, BiblioBazaar, USA
- Physical Chemistry for biological sciences, 1st edition, (2005), Chang R., University Science Books, USA 6. Physical Chemistry, 1st edition, (2003) David Ball, Thoson Learning, USA.
- Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, ArunBahl, S. Chand Limited, India.
- Concise Inorganic Chemistry . 5th edition (2008), Author: J. D. Lee, John Wiley & Sons, USA.
- Organic Chemistry, 6 th edition, (1992), Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.)
- Guide book to Mechanism in Organic chemistry
- organic Chemistry by Peter Sykes, 6 th edition, (1996), Prentice Hall, India.

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5
First Year of B.Sc. Blended (Biosciences)
(Semester I)
(2024 Course under NEP 2020)

Course Code: 24ScBioU1202

Course Name: Lab Course on 24ScBioU1201

Teaching Scheme: TH: 4 Hours/Week

Credit: 2P

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses: Knowledge of Basic chemistry from XI & XII Science.

Course Objectives:

- To Study Basics of chemistry
- To study extraction method
- To study importance of pH and buffer in chemical and biochemical reactions
- To understand chemical kinetics of ester hydrolysis reaction
- To expertize students in biochemical calculations

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

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall need and basic concepts of IKS.	1
CO 2	Compare modern medical science with traditional medical practices and Ayurveda.	2
CO 3	Identify relation of humans with food and nourishment since ancient times.	3
CO 4	Analyze relevance of traditional agriculture practices to face modern age challenges.	4
CO 5	Value significance of environment and biodiversity through understanding of ancient concepts like Devrai	5
CO 6	Build deeper sense of belonging to the Bharat and gratitude for our continuous parampara of knowledge.	6

Course Contents

Practicals	Title	15 practicals
Practical-1	Acid base titration	1 Practical
	- To standardize given NaOH using oxalic acid - To find normality and molarity of given HCl and H_2SO_4	
Practical-2	Glass electrode	2 practical
	- To find normality of given HCl using Na_2CO_3 solution - To investigate pH of strong acid and weak base	
Practical-3	Synthesis and analysis of polyiodide salt	1 practical
	To synthesize a polyiodide salt To determine the chemical formula of the polyiodide salt using analytical methods	
Practical-4	Buffer solutions	1 practical
	To prepare standard strong acid and strong base solution and using them to prepare buffer solutions	
Practical-5	Phmetry of buffer solutions	1 practical
	- To determine pH_{of} the solution using pHmeter and using Henderson Hasselbalch equation to find out pK_a value of the solution - To determine pH_{of} unknown buffer solution	
Practical-6	Chemical Kinetics	2 practical
	To study the hydrolysis of an ester using two concentrations and hence to find the rate constant of reaction	
Practical-7	Phmetry	1 practical
	To find pK_a using Ph metric titration of weak acid against strong base	
Practical-8	Isolation and purification of curcumin from turmeric	1 practical
	To isolate and purify the curcumin from given turmeric powder sample	
Practical-9	Preparation of solution	1 practical
	To prepare acid and base solution having different concentrations	

Practical-10	Introduction to Glasswares and chemicals	1 practical
Practical-11	Basic techniques used in synthesis	2 practical
	• Recrystallization • TLC	
Practical-12	Simple titration methods	1 practical
	• Simple titration between acid and base	

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous)
Shivajinagar, Pune - 5
First Year of B.Sc.Blended biosciences (NEP)
(2024 Course under NEP 2020)

Course Code: 24ScBLU1301 Course Name: Introduction to Biochemistry
Teaching Scheme: TH: 2 Hours/Week Credit: 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–

CO No	Course Outcomes (COs)	Blooms Cognitive level
CO 1	Recall need and basic concepts of IKS.	1
CO 2	Compare modern medical science with traditional medical practices and Ayurveda.	2
CO 3	Identify relation of humans with food and nourishment since ancient times.	3
CO 4	Analyze relevance of traditional agriculture practices to face modern age challenges.	4
CO 5	Value significance of environment and biodiversity through understanding of ancient concepts like Devrai	5
CO 6	Build deeper sense of belonging to the Bharat and gratitude for our continuous parampara of knowledge.	6

Unit -	Unit	30 lectures
Unit -1	Biological chemistry	2
	• Introduction to biochemistry • Historical perspective- cellular and chemical foundation • origin of life, • Abiotic production of biomolecules	
Unit -2	Water	3

	• 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 • 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
	• Basic Biomolecules: Carbohydrates: sugars and nonsugars • classification of carbohydrates- mono, oligo, dextrans 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
	• Function of lipids, • classification of lipids,	

	• Simple lipids- its structure and classes, • fatty acids, • saturation and unsaturation of fatty acids with examples, • its significance, • Triacylglycerols • chemical and physical properties, • complex lipids: Phospholipids, sphingo lipids, cerebroside, gangliosides, prostaglandin • cholesterol (good and bad) Steroids.	
Unit -5	Proteins	5
	• Proteins: introduction, • Polymer of amino acids, • Classification of amino acids, • essential amino acids, • Configuration, properties, zwitterion, isoelectric point pI, • properties of peptide bond, • primary structure • secondary structure (alpha helix, beta pleated sheets, pitch value) • Ramachandran plot • Secondary repeats - tertiary and quaternary structure with example. Denaturation and renaturation	
Unit -6	Vitamins	3
	• fat soluble (A,D,E,K) and water soluble Vit. C, • Thiamine , • riboflavin, • niacin, • PIP, • CoenzymeA, • lipoic acid , • Folic acid and B12	
Unit -7	Enzymes	5
	• 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
	• chemical names and structures of nitrogen bases, • Nucleosides, • nucleotides, • Polynucleotide, • DNA and • RNA, • Forces stabilizing nucleic acid structure	

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, Brook/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

Progressive Education Society's
Modern College of Arts, Science and Commerce(Autonomous),
Shivajinagar, Pune – 5
First Year of B.Sc. Blended Bioscience
(2024 Course under NEP 2020)

Course Code: 24ScBleU1291

Credits: 4T

Examination Scheme: CIA: 40 Marks

Course name: Calculus

END-SEM: 60 Marks

Prerequisite: 11th and 12th standard Mathematics.

Course Objectives: To learn,

- Logic And Proof
- Sequences and Series
- Differential Calculus
- Integral Calculus

Course Outcomes:

Course Contents

Mathematics		
Unit	Title	60 Lectures
Unit 1	Logic and Proof	15
	• Basic set theory (review) • Logical connectives (conjunction, disjunction, negation, conditional, biconditional) and truth tables • Propositional logic, logical equivalence, logical laws, • Quantifiers, predicate calculus • Relations, equivalence relations, ordering • Functions including injective, surjective, bijective, inverse, composition • Number systems: Natural numbers, integers, rational numbers and their properties (eg closure under addition/multiplication/division; existence of additive/multiplicative identity/inverses) • Real numbers and their properties;	

	completeness property • Proof methods: direct proof, contrapositive • Proof methods: contradiction, proof by cases • Proof methods: induction • Natural numbers, integers, rational numbers • Real numbers	
Unit 2	Sequences and Series	12
	• Sequences, limits, convergence and divergence • Proving limits using definition • Methods for evaluating limits: standard limits, limit theorems, continuity rule, sandwich theorem • Series, convergence and divergence of series, geometric series, harmonic p-series • Series convergence tests: divergence test, comparison test • Series convergence tests: ratio test, integral test, alternating series test • Power series, Taylor polynomials • Taylor series • Taylor's theorem, error in Taylor polynomial estimates	
Unit 3	Differential Calculus	8
	• Review of differential calculus: limits, derivative, differentiation rules incl. polynomials, trigonometric, exponential, log functions; product, quotient, chain rules • Review of inverse trigonometric functions and their derivatives, implicit differentiation	
Unit 4	Integral Calculus	9
	• Riemann integration • Fundamental Theorem of Calculus; review of standard antiderivatives • Techniques of integration (review): derivative present substitution, linear substitution • Techniques of integration (review): integration of	

	trigonometric functions using identities • Techniques of integration (review): integration of rational functions including partial fractions, integration yielding inverse trig functions • Techniques of integration (review): trigonometric substitutions; integration by parts • Improper integrals • Applications of integration: areas between curves • Applications of integration: volumes of surfaces of revolution	
Unit 5	ODEs - Designed and shared collectively by Physics. Chemistry and Mathematics.	4

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5
First Year of B.Sc.Blended (Biosciences)
(2024 Course under NEP 2020)
Semester I

Course Code: 24ScBleU1292

Course Name: Introductory classical Physics + Physics Practical 1

Teaching Scheme: TH: 3 Hours/Week

Credit: 4C (2T+2P)

Examination Scheme: CIA: 40 Marks

End-Sem : 60 Marks

Prerequisite Courses:

- Kinematics, equation of motion, elasticity, waves and oscillations, fluid mechanics, geometrical optics

Course Objectives:

- Students will be given the basic information of introductory classical physics, waves, gravitation

Course Outcomes:

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

- Apply the basic knowledge of classical mechanics in day to day life

Unit	Title	30 Lectures
Unit -1	Classical mechanics	12
	• Straight line motion : Review problems of motion in 1-d, Distance-Velocity graphs, velocity acceleration graphs, distance acceleration graphs	1
	• Vectors Properties of vectors, gradient, scalar and vector products, Frame of reference, Coordinate systems, basis vectors, polar coordinates	1
	• Two & three dimensional motion: kinematics Constant acceleration in 2D motion, velocity and	1

	acceleration as vectors, equations in components	
	Force and Motion: Newton's Laws Newton's first Law, Inertial and non inertial frames, Newton's second law, linear momentum, Forces Newton's third law, internal and external forces, Gravity, electrostatic force.	1
	Force and Motion: Drag and Friction Elastic force, Viscosity, static and dynamic friction	1
	Kinetic energy, work, power : Work Energy Theorem	1
	Potential energy, conservation of energy: Conservative force and potential function, constant energy surfaces	1
	Collisions in 1-d and 2-d : Conservation of linear momentum, elastic and inelastic collisions	2
	Rotational motion : Uniform circular motion, angular velocity and angular acceleration, example	1
	Angular momentum-I Angular Momentum, Rotational kinetic energy, moment of Inertia, examples	1
	Angular momentum-II Torque, Conservation of angular momentum, examples	1
Unit -2	Gravitation	4
	Newton's law of gravitation: Force of gravity at the earth's surface, far above the earth and within the earth, Escape velocity - Kepler's Laws - Orbital motion & energy - Einstein's equivalence principle, gravity, gravitational lenses, gravitational waves	
	Work and gravitational potential energy, Orbital motion and energy	
Unit -3	Thermal Physics	8
	- Zeroth law of thermodynamics - Thermal expansion & absorption of heat - First law of thermodynamics: adiabatic process, constant volume pressure processes, enthalpy, cyclic process, free expansion - Heat transfer, conduction , emission, absorption	

	• Second law of thermodynamics, irreversible process, entropy, free energy • Application	
Unit -4	Elasticity, Fluids, gases	
	• Equilibrium & elasticity • Density & Pressure, Pascal's & Archimedes' principle • Continuity & Bernoulli's equation • Ideal gases (Kinetic theory of gases) • Mean free path, molecular speed distribution • Specific heat, adiabatic expansion • Applications	
Unit -5	ODE	
	• Ordinary differential equations • Solving linear ODE using integrating factor • Applications of 1st order ODEs: ecology models, Newton's law of cooling • Second-order ODEs: definitions of homogeneous/inhomogeneous, linear/non-linear; solution of homogeneous constant-coefficient linear ODEs • Applications of 2nd order ODEs: Springs, LCR series electrical circuits	

Prerequisite Courses: Knowledge of Basic physics from XI & XII Science.

Course Objectives:

- Students will be given the basic information of electricity, magnetism, Thermal Physics, Elasticity, Fluids, Gases

Course Outcomes:

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

- Apply the basic knowledge of classical mechanics in day to day life

Course Contents

Practical	Title	15 Practicals
Practical-1	Measurements using Various Instruments	2
Practical-2	Static Friction	1
Practical-3	Frequency of A.C.	2
Practical-4	Plane diffraction grating	1
Practical-5	M.I of flywheel	1
Practical-6	Polarimeter	1
Practical-7	Modulus of rigidity: Torsional Pendulum	1
Practical-8	Simple pendulum	1
Practical-9	Flat Spiral Spring	1
Practical-10	Logic Gates	2
Practical-11	Young's Modulus	1
Practical-12	Characteristics of Thermistor	1

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
First Year B. Sc. Blended (Biosciences)
(2024 Course under NEP 2020)

Semester II

Course Code: 24ScBioU2101 Course Name: Biology 2 (The Biology of Cells)
Teaching Scheme: TH: 2 Hours/Week Credit: 2 T
Examination Scheme: CIA: 20 Marks End-Sem : 30 Marks

Prerequisite Courses:

Basic knowledge of Biology (SSC grade and HSC grade) is required that will help to study in depth of its other divisions.

Course Objectives:

- This course will introduce the students to basic unit of life, the cell, and its structural and functional elements. Students will learn the components of a cells and their functioning, cell division, contribution of a cell to form multicellular units, and flow of genetic information within a biological system through the central dogma of life.
- This subject covers details and highlights of the cell ant its components which is very helpful to get knowledge how components of life works at micro level.

Course Outcomes:

Course Contents:

Unit	Title	30 Lectures
------	-------	-------------

Unit -1	Chemistry of Life	
	• The chemical basis of life	1
	• Bioenergetics	1
	• Enzymes and catalysed reactions :	2
	• Metabolism: Catabolism and anabolism	2
	• Concatenation and Biopolymers	1
	• Stereochemistry and Biomolecular chirality	1
	• Biochemistry and Biomolecular structure	2
	• Small inorganic molecules of biological importance	2
	Tutorial	4
Unit -2	The Biology of Cells	
	• Introduction to Cell Biology	2
	Theme: The cell contained	
	• The plasma membrane	2
	• Cell walls, extracellular matrix, cellulose synthesis, other cell wall components	2
	• Cytoplasm: content, chemistry and properties	1
	• Cytoskeleton, actin filaments, microtubules	2
	Tutorial	2
	Theme: Information flow in the cell	
	• Nucleus, chromosomes, DNA	2
	• Genes and the genetic code	3
	• Control of gene expression	3
	Theme: Endomembrane System and Intracellular Trafficking	
	Theme: Harvesting energy	
	• Mitochondria, ATP, energetic reactions, electron transport pathways, cellular respiration	2
	• Chloroplasts, photosynthesis, historical experiments, pigments, photosystems	2
	Tutorial	2
	Theme: Multicellularity and the Dividing Cell	
	• Cell division, cell cycle, mitosis, cytokinesis, division and distribution of organelles	3
	• Meiosis, formation of haploid cells	1
	• Communication and signaling, recognizing and responding	3
	• Cell differentiation and multicellularity	2
	Tutorial	2

References :

1. Molecular Cell Biology. 7th Edition, (2012) Lodish H., Berk A, Kaiser C., KReigerM.,Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., W.H. Freeman and Co., USA.
2. Molecular Biology of the Cell, 5th Edition (2007) Bruce Alberts, Alexander Johnson,JulianLewis, Martin Raff, Keith Roberts, Peter Walter. Garland Science, USA
3. Cell Biology, 6th edition, (2010) Gerald Karp. John Wiley & Sons., USA.
4. The Cell: A Molecular Approach, 6th edition (2013), Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, Inc. USA.

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
First Year B. Sc. Blended (Biosciences)
(2024 Course under NEP 2020)
Semester II

Course Code: 24ScBioU2102 **Course Name:** Lab Course on 24ScBioU2101
Teaching Scheme: TH: 4 Hours/Week **Credit:** 2P
Examination Scheme: CIA: 20 Marks **End-Sem:** 30 Marks
Prerequisite Courses: Knowledge of Basic biology from XI & XII Science.

Course Objectives:

- To study mitosis and meiosis in plants.
- To study cell count using haemocytometer.

Course Outcomes:

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

- Distinguish between mitosis and meiosis.
- Isolate nucleus, mitochondria.
- Study characteristics of cells.

Course Contents:

Semester II

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5
First Year of B.Sc.Blended (Biosciences)
(2024 Course under NEP 2020)
(Semester II)

Course Code: 24ScBioU2201

Course Name: Inorganic and Physical chemistry

Teaching Scheme: TH: 2 Hours/Week

Credit: 2T

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses: Knowledge of Basic chemistry from 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—

- Study all basic fundamentals of chemistry
- Can extend their analytical thinking in research field.

Course Contents

Unit s	Title	No. of lectures
Unit 1	Chemistry of Life	12 L
	• The chemical basis of life	
	• Bioenergetics	
	• Enzymes and catalysed reactions	

	Metabolism: Catabolism and anabolism	
	Concatenation and Biopolymers	
	Stereochemistry and Biomolecular chirality	
	Biochemistry and Biomolecular structure	
	Small inorganic molecules of biological importance	
Unit 2	Inorganic Chemistry	15 L
	Ionic Compounds and their Solutions	
	Structures of Solids	
	Main Group Chemistry	
	Redox reactions and electrochemistry	
	The transition metals : a survey	
	Coordination Chemistry	
Unit 3	Oscillations and Waves	6 L
	Simple harmonic motion, pendulum, diatomic molecules	
	Damped harmonic motion, resonance - electronic circuits, evolution of populations	
	One dimensional waves , Interference and standing waves, Sound waves and the speed of sound, Intensity, sound level and the physics of music	
	Doppler effect and supersonic motion, shock waves	
Unit 4	Modern Physics and Quantum Chemistry	15 L
	Challenges to classical physics; special relativity	
	Lorentz transformation, transformation of velocities, Doppler effect	
	Relativistic momentum and energy	
	Photons and the photoelectric effect	
	Quantum physics, blackbody radiator, matter waves	
	Schrödinger's equation and Heisenberg's Uncertainty Principle	
	Trapped particles and the tunneling particles	
	Bohr and Schrodinger models of the hydrogen atom	
	Complex atoms; Pauli Exclusion Principle, Periodic Table of Elements, selection rules and spectra	
	Nuclear physics, nuclear properties, nuclear decay	
	Nuclear fission and fusion	
	Quarks, Leptons, The Big Bang	

References:

- Stereochemistry: Conformation and mechanism by P.S.Kalsi
- Organic chemistry by Jonathan clayden, nick greeves and stuart warren
- University General Chemistry , 1st edition (2000), C.N. R. Rao, Macmillan Publishers, India ,
- Principles of Physical Chemistry, 4th edition (1965), S.H. Maron and C.F. Prutton, Collier Macmillan Ltd 3. The elements of Physical Chemistry, 5th edition (2009), Atkins P, de Paula J. , W. H. Freeman Publication, USA
- An Introduction to Electrochemistry , edition reprint, 2011, Samuel Glasstone, BiblioBazaar, USA
- Physical Chemistry for biological sciences, 1st edition, (2005), Chang R., University Science Books, USA 6. Physical Chemistry, 1st edition, (2003) David Ball, Thoson Learning, USA.
- Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, ArunBahl, S. Chand Limited, India.
- Concise Inorganic Chemistry . 5th edition (2008), Author: J. D. Lee, John Wiley & Sons, USA.
- Organic Chemistry, 6 th edition, (1992), Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.)
- Guide book to Mechanism in Organic chemistry
- organic Chemistry by Peter Sykes, 6 th edition, (1996), Prentice Hall, India.

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5
FirstYear of B.Sc.Blended (Biosciences)
(2024 Course under NEP 2020)
(Semester II)

Course Code: 24ScBioU2202

Course Name: Lab Course on 24ScBioU2201

Teaching Scheme: TH: 4 Hours/Week

Credit: 2P

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses: Knowledge of Basic chemistry from XI & XII Science.

Course Objectives:

- To study coordination chemistry of metal complexes
- To study electrochemistry of the reaction
- To study reduction reaction using reducing agents
- To expertize students in biochemical calculations

Course Outcomes:

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

- Study all basic fundamentals of chemistry
- Can extend their analytical thinking in research field.
- Develops practical hand

Course Contents

Practicals	Title	No. of practicals 12 P
Practical-1	Colorimetry	1 Practical
	• Determination of $\lambda_{\max}$ by colorimetric method • To determine $\lambda_{\max}$ and concentration of a given solution of copper sulphate ammonia complex by using colorimetry	
Practical-2	Coordination complex synthesis	1 Practical
	• Synthesis of coordination complexes To synthesize hexaammine nickel (II) chloride	

Practical-3	Conductometry	1 Practical
	To perform conductometric titrations of acids and bases	
Practical-4	Potentiometric titrations	1 Practical
	To perform potentiometric titrations	
Practical-5	Indicator constant by colorimetric method	1 practical
	To determine indicator constant of given acid base solution using colorimetric method	
Practical-6	Reduction of benzophenone	1 practical
	To synthesize diphenyl methanol from benzophenone using NaBH_4	
Practical-7	Synthesis of coordination compound	1 practical
	To synthesize hexaammine cobalt (III)chloride	
Practical-8	Potentiometry	1 practical
	To determine formal redox potential of ferrous/ferric system by using potentiometer	
Practical-9	Determination of cell constant, energy of activation and temperature coefficient	1 practical
	- To determine the cell constant by using KCl solution - To determine the temperature coefficient and activation energy of the reaction	
Practical-10	Chemical calculations	1 practical
Practical-11	General introduction to practicals in chemistry	1 practical
Practical-12	Organic synthesis	1 practical

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
First Year B. Sc. Blended (Biosciences)
(2024 Course under NEP 2020)

Semester II

Course Code: 23ScBLEU2301 Course Name: Introduction to Microbiology
Teaching Scheme: TH: 3 Hours/Week Credit:2 C (30 Lectures)

Examination Scheme: CIA:20 Marks

End-Sem :30 Marks

Prerequisite Courses:

Basic knowledge of Biology (SSC grade and HSC grade) is required to understand the concepts of application and research in microbiology.

Course Outcomes:

After successful completion of this course students will be able to :

CO No.	Course Outcomes (Cos)	Blooms cognitive taxonomy level
CO 1	Recall the history of microorganisms and understand the procedure of isolation, identification and control of microorganisms.	1
CO 2	Understand various microorganisms, their habitat and their replication cycle.	2
CO 3	Develop the biosafety measures in various labs	3
CO 4	Classify the microorganisms	4
CO 5	Compare bacterial and viral cell structure	5
CO 6	Create the media for microorganisms according to their requirements	6

Course Contents

Unit	Title	Lectures 24 Lectures + 6 Practicals
Unit -1	History of Microbiology	7
	- Discovery of microscope II. - Micrographia of Anton von Leeuwenhoek and Robert Hook - Abiogenesis v/s biogenesis	3
	Development of Microbiology in 19th century : Germ theory of fermentation Discovery of anaerobic life & physiological significance of fermentation	1
	Discovery of microbes as pathogens	1
	Developments in 20th and 21st Centuries with respect to Vaccination and Immunology, Molecular Biology & Biotechnology	2
Unit -2	Morphological and differentiating characters of microorganisms:	6
	Principles in classification of Bacteria (Introduction to Bergey's Manual of Determinative and Systemic Bacteriology) and viruses (ICTV)	
Unit -3	Bacterial Cytology	3
	Studies on structure, chemical composition and functions of : Cell wall Cell membrane Endospore Capsule Flagella Fimbriae and Pili Ribosomes Chromosomal & extra-chromosomal material	
Unit -4	Basic Techniques in Microbiology	8
	Units of measurement. Modern SI units (Length, volume, Weight)	1
	- Microscopy: - Bright field microscopy: Structure, working of and ray diagram of a compound light microscope; Concepts of magnification, numerical aperture and resolving power. - Types, ray diagram and functions of – condensers, eye-pieces and objectives	2

	• Staining Techniques : • Definitions of Stain; Types of stains (Basic and Acidic), • Properties and role of Fixatives, Mordants, Decolorisers and Accentuators • Principles of staining techniques for following: i. Monochrome staining and Negative (Relief) staining ii. Differential staining - Gram staining and Acid fast staining	2
	• Sterilization and Disinfection • I. Physical Agents - Heat, Radiation, Filtration • II. Chemical agents and their mode of action - Aldehydes, Halogens, Quaternary ammonium compounds, Phenol and phenolic compounds, Heavy metals, Alcohol, Dyes, Detergents and Ethylene oxide	3

References:

15. Madigan M.T., Martinko J.M. (2006). Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.
16. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata MacGraw Hill Press.
17. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 6th Edition. MacGraw Hill Companies Inc.
18. Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5th Edition. Macmillan Press Ltd.
19. Wilson K. and Walker J.M. (2005) Principles and Techniques of Biochemistry and Molecular Biology. 6th Edition. Cambridge University Press.

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
First Year B. Sc. Blended (Biosciences)
(2024 Course under NEP 2020)

Semester II

Course Code: 24ScBLEU2302

Course Name: Lab Course on 24ScBLEU2301

Teaching Scheme: PR: 4 Hours/Week

Credit: 2 C (15 Practicals)

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses:

Basic knowledge of Biology (SSC grade and HSC grade) is required to understand the concepts of application and research in microbiology.

Course Outcomes:

After successful completion of this course students will be able to :

CO No.	Course Outcomes (Cos)	Blooms cognitive taxonomy level
CO 1	Relate the procedure of isolation, identification and control of microorganisms to real world application.	1
CO 2	Understand various microorganisms, their habitat and their replication cycle.	2
CO 3	Develop the biosafety measures in various labs	3
CO 4	Classify the microorganisms	4
CO 5	Evaluate prokaryotic cell structure	5
CO 6	Create the media for microorganisms according to their requirements	6
Practicals		6
	Introduction to microbiology laboratory instruments e.g. Incubator, Hot Air Oven, Autoclave, Colorimeter, pH Meter, Distillation Unit, Chemical Balance, Laminar air flow hood, Clinical Centrifuge	1
	Construction (mechanical and	1

	optical), working and care of bright field microscope	
	• Observation of microorganisms using staining techniques: a. Monochrome staining and b. Negative /Relief staining (Capsule staining)	1
	• Cultivation of microorganisms: • a. Preparation of simple laboratory nutrient media (solid and liquid) and using them to cultivate bacteria. • b. Observation of the growth of cultures and reporting of colony and cultural characteristics	1
	• Aseptic transfer techniques (slant to slant, broth to broth, broth to agar and Agar to Agar)	2

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
First Year of B.Sc. Blended
(2024 Course under NEP 2020)

(Semester II)

Course Code: 24ScBLEU2291

Course name: Algebra

Credits 4T

Examination Scheme: CIA: 40 Marks

End-Sem : 60 Marks

Prerequisite:

Course Objectives: To learn,

- Analysis
- Complex numbers
- Vectors
- Basic Linear Algebra

Course Contents

Mathematics		
Unit 1	Analysis	15 lectures
	• Limits of real-valued functions, • Proving limits using the definition • Continuity & differentiability • Examples of differentiable and non-differentiable functions; continuity and differentiability of standard functions including polynomials, trigonometric, exponential, log functions and their inverses • Techniques for evaluating limits including L'Hopital's rule, sandwich theorem • Mean Value Theorem and applications • Applications of differential calculus eg related rates	
Tutorials		5

Unit 2	Complex numbers	6 lectures
	• Review of complex numbers including algebra, Argand plane, cartesian and polar form • Complex exponential • Fundamental Theorem of Algebra • de Moivre's theorem; roots of complex numbers	
Tutorials		1 lecture
Unit 3	Vectors	7 lectures
	• Vector arithmetic, dot product, vector projections (review) • Vector cross product; scalar triple product; parametric curves specified by vector equations • Lines and planes in $\mathbb{R}^3$ • Lines and planes in $\mathbb{R}^3$	
Tutorials		1 lecture
Unit 4	Linear Algebra 1	20 lectures
	• Solving systems of linear equations with Gaussian elimination • Solutions of systems of linear equations - consistency, uniqueness • Geometric interpretation of solutions • Matrices, matrix addition, multiplication, transpose and properties (review) • Matrix inverse • Determinant • $\mathbb{R}^n$ as a vector space, linear independence of vectors in $\mathbb{R}^n$ • Span of a set of vectors, subspaces of $\mathbb{R}^n$ • Basis and dimension in $\mathbb{R}^n$ • Abstract vector space axioms; examples and non-examples of vector spaces	

	• Bases, dimension and co-ordinates in (finite dimensional) abstract vector spaces • Definition of linear transformation and examples/non-examples • Linear transformations of the plane • Matrix representation of a linear transformation • Image and kernel of a linear transformation • Rank and nullity	
Tutorials		5 lectures

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5
First Year of B.Sc. Blended (Biosciences)
(2024 Course under NEP 2020)
Semester II

Course Code: 24ScBLEU2292

Course Name: Modern Physics

Teaching Scheme: TH: 2 Hours/Week

Credit: 2C (48 L)

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses: Kinematics, equation of motion, elasticity, waves and oscillations, fluid mechanics, geometrical optics

Course Objectives:

- Students will be given the basic information of electricity, magnetism and quantum mechanics

Course Outcomes:

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

- Apply the basic knowledge of classical mechanics in day to day life

Course Contents

Unit	Title	Lectures
Unit -1	Electricity and magnetism	18 Lectures
	• Electric charge ,conductors and insulators • Coulomb's Law, superposition principle • Electric field, superposition principle • Electric flux • Gauss's law, applications • Energy and electric field; electric potential • Calculating potential from the field, electric potential,potential energy surfaces. • Electric dipoles	

	• Capacitance; parallel plate capacitors • Energy storage in capacitors, dielectrics, series and parallel circuits • Conductors, electric current, electric power, Ohm's law • Kirchoff's rules, resistors in series and parallel circuits • Magnetic field, magnetic force, Lorentz force, cyclotrons • Lorentz force, ion velocity filter, Hall effect, Biot-Savart Law • Bio-Savart Law, Ampere's Law, solenoids, earth's magnetic field • Magnetic field due to a current, forces on current-carrying wires, Electromagnetic induction, magnetic flux • Lenz' Law, Faraday's law, Maxwell's equations, application • Magnetic materials	
Unit -2	Oscillations and Waves	6 Lectures
	• Simple harmonic motion, pendulum, diatomic molecules • .Damped harmonic motion, resonance - electronic circuits, evolution of populations • One dimensional waves , Interference and standing waves, Sound waves and the speed of sound, Intensity, sound level and the physics of music • Doppler effect and supersonic motion, shock waves	
Unit -3	Optics	10 Lectures
	• Images and mirrors • Thin lenses and optical instruments • Young's experiment, interference • Thin films and the Michaelson interferometer • Diffraction by slits and apertures • Diffraction by gratings and X-ray diffraction • Optical Microscopy • Spectroscopy	
Unit -4	Modern Physics	14Lectures
	• Challenges to classical physics • Lorentz transformation, transformation of velocities, Doppler effect	

	• Relativistic momentum and energy • Photons and the photoelectric effect • Quantum physics, blackbody radiator, matter waves • Schrödinger's equation and Heisenberg's Uncertainty Principle • Trapped particles and the tunneling particles • Bohr and Schrodinger models of the hydrogen atom • Complex atoms; Pauli Exclusion Principle • Nuclear physics, nuclear properties, nuclear decay • Nuclear fission and fusion • Quarks, Leptons, The Big Bang	
--	--	--

Progressive Education Society's
Modern College of Arts, Science and Commerce,
Shivajinagar, Pune - 5
First Year of B.Sc.Blended (Biosciences)
(2024 Course under NEP 2020)
(Semester II)

Course Code: 24ScBLEU2293 Course Name: Lab Course Based on 24ScBLEU2292

Teaching Scheme: TH: 4 Hours/Week

Credit: 2P

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses: Knowledge of Basic physics from XI & XII Science, First Semester.

Course Objectives:

- Students will be given the basic information of electricity, magnetism, Oscillations & Waves, Optics.

Course Outcomes:

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

- Apply the basic knowledge of classical mechanics&Modern physics in day to day life

Course Contents

Practicals	Title	No. of Practical 12P
Practical-1	• Digital multimeter	1 Practical
Practical-2	• Use of Oscilloscope	1 practical
Practical-3	• Kirchhoff's laws	1 practical
Practical-4	• Zener diode	1 prcatical
Practical-5	• Rectifiers	1 practical

Practical-6	• Transistor Characteristics	1 practical
Practical-7	• Calibration of spectrometer	1 practical
Practical-8	• Franck-Hertz experiment	1 practical
Practical-9	• Characteristics of Diode	1 practical
Practical-10	• Coupled Oscillator	1 practical
Practical-11	• Dispersive Power	1 practical
Practical-12	• Double Refracting Prism	1 practical