

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	Biology I (The Diversity of Life)	2		2		20	30	50
	24ScBioU1102	Lab Course on 24ScBioU1101		2		4	20	30	50
Subject 2 T(2)+(T/P) (2)orT(4)	24ScBioU1201	Introductory and Organic Chemistry	2		2		20	30	50
	24ScBioU1202	Lab Course on 24ScBioU1201		2		4	20	30	50
Subject 3 T(2)+(T/P) (2)orT(4)	24ScBioU1301	Introduction to Biochemistry	2		2		20	30	50
	24ScBioU1302	24ScBioU1301		2		4	20	30	50
IKST(2)	24CpCopU1901	Generic IKS	2		2		20	30	50
GE/OE (T/P) (2)	24ScBioU1401	Applications of Biology I	2		2		20	30	50
SEC (P)(2)	24ScBioU1601	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 + Physics Practical 1	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)	24ScBioU2101	Biology 2 (Biology of Cells)	2		2		20	30	50
	24ScBioU2102	Lab Course on 24ScBioU2101		2		4	20	30	50
Subject 2 T(2)+P(2)	24ScBioU2201	Inorganic and Physical Chemistry	2		2		20	30	50
	24ScBioU2202	Lab Course on 24ScBioU2201		2		4	20	30	50

2)									
Subject	24ScBioU2301	Introduction to Microbiology	2		2		20	30	50
3	24ScBioU2302	LabCourseon24ScBioU2301		2		4	20	30	50
T(2)+P(2)									
GE/OE	24ScBioU2401	Applications of Biology II	2		2		20	30	50
(T/P)(2)									
SECT(2)	24ScBioU2601	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)	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			55
Non CGPA credits	24ScBLEU2291	Algebra	4		4		40	60	10
Non CGPA credits	24ScBLEU2292	Modern Physics	2	2	2	4	40	60	10

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First Year B. Sc. Blended (Biosciences)
Semester I
2024 Course under NEP 2020)

Course Code: 24ScBioU1101 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, students will be able to know about the origin of earth, origin of diversity of life, covering the domains and classification of plants, animals and micro-organisms.

- As it covers the details for and highlights the origin of life students will know the array of life on earth and how it is classified.
- Students get the insights for what distinguishes one organism from another and much more.

Course Contents

Unit	Title	Lectures 30 Lectures
Unit 1	Unifying themes in Biology	12 Lectures
	• 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 Lectures
	• 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.
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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.
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Course Code : 24ScBioU1102 Course Name : Lab Course on 24ScBioU1101**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:**

- Study of Evolution of Plants from Bryophytes to Angiosperms with examples.
- Study of Animal diversity with different examples.

Course Outcomes:

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

- Learn different characteristic features of Organisms that inhabit in nature.

Course Contents**Semester I**

Practicals	Title	No. of practicals 10 p
Practical-1	Study of Bryophytes.	1 Practical
	• To study characteristics of bryophytes.	
Practical-2	Study of Pteridophytes.	1 practical
	• To Study characteristics of Pteridophytes.	
Practical-3	Study of Red and Green Algae.	1 practical
	• To Study characteristics of Red and Green Algae.	
Practical-4	Study of Gymnosperms.	1 practical
	• To Study characteristics of Gymnosperms.	
Practical-5	Study of Fungi.	1 practical
	• To Study characteristics of Fungi.	
Practical-6	Study of Angiosperms.	1 Practical
	• To Study characteristics and reproductive parts of Angiosperm flower with examples.	
Practical-7	Study of Phylum Porifera, Cnidaria and Platyhelminthes.	1 practical
	• To Study characteristics of Porifera, Cnidaria and Platyhelminthes with examples.	

Practical-8	Study of Phylum Aschelminthes, Annelida and Arthropoda.	1 practical
	To study characteristics of Aschelminthes, Annelida and Arthropoda with examples.	
Practical-9	Study of Phylum Mollusca and Echinodermata.	1 practical
	To study characteristics of Mollusca and Echinodermata with examples.	
Practical-10	Study of Phylum Hemichordata and Chordata (Pisces and Amphibians).	1 practical
	To study characteristics of Hemichordata and Chordata (Pisces and Amphibians) with examples.	
Practical-11	Study of Phylum Chordata (Reptilia, Aves and Mammalia).	1 practical
	To study characteristics of Chordata (Reptilia, Aves and Mammalia) with examples.	
Practical-12	Primates	1 practical
	Comparative study of Primates. (skulls etc.)	

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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–

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

Course Contents:

General Chemistry		
Chapters	Title	No. of lectures
Chapter 1	The Periodic Table	1 Lecture
	• General Introduction • Groups • Rows • Modern periodic law	
Chapter 2	Molecular Structure and Bonding	2 Lectures
	• 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	
Chapter 3	Acids and Bases	3 Lecture
	• 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		
Chapter 1	Carbon – the basis of life	2 Lecture
Chapter 2	Structure and Bonding Alkanes (sp ³ Hybridisation)	2 Lecture
	• Covalent bonding - H 2	

	• S-bonding and sp^3 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	
Chapter 3	Structure and Bonding Alkenes (sp^2 Hybridisation)	1 Lecture
	• sp^2 hybridisation, s and p bonding in ethene • Nomenclature of alkenes • Geometrical isomerism • Conjugated alkenes	
Chapter 4	Structure and Bonding of Alkynes (sp hybridisation)	1 Lecture
	• sp hybridization, s and p bonding in ethyne • Nomenclature of alkynes	
Chapter 5	Functional Groups	1 Lecture
	• Haloalkanes • Alcohols • Ethers • Amines • Carbonyl compounds • Carboxylic acids and derivatives	
Chapter 5	Electrophiles and Nucleophiles	2L
	• Arrow conventions • Organic acids and bases • Strengths of acids and bases: electronegativity, • Hybridization, resonance	
Chapter 6	Nucleophilic substitution reactions	2L
	• 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	
Chapter 6	Elimination reactions	2L
	• E1 and E2 reactions • Determination of mechanism by stereochemical and kinetic methods • Dehydration of alcohols	
Chapter 7	Addition reactions	2L
	• Markovnikov's rule • Hydration of alkenes	
Chapter 8	Electrophilic aromatic substitution reactions	2 L
	• Substitution reactions of benzene: halogenation, nitration, sulfonation, Friedel-Crafts acylation and alkylation	
Chapter 9	Nucleophilic addition reactions	2L
	• Addition to carbonyl groups by cyanide, Grignard reagents, acetylide anions • Synthesis and chemistry of acids, amides, esters, acyl chlorides and anhydrides	
Chapter 10	Organic redox reactions	3L
	• 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	
Chapter 11	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	
Chapter 12	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	
Chapter 13	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:

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- Concise Inorganic Chemistry . 5th edition (2008), Author: J. D. Lee, John Wiley & Sons, USA.
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(Semester I)
(2024 Course under NEP 2020)

Course Code: 24ScBioU1202

Course Name: Lab Course on 24ScBioU1201

Teaching Scheme: TH: 3 Hours/Week

Credit: 2C

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–

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

Course Contents

Practicals	Title	No. of practicals 12P
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	1 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	1 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 pKa 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	1 practical
	- Recrystallization - TLC	
Practical-12	Simple titration methods	1 practical
	Simple titration between acid and base	

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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: 2C (30 L)

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

Chapter-	Unit	lectures
Chapter-1	Biological chemistry	2 lectures
	• Introduction to biochemistry • Historical perspective- cellular and chemical foundation • origin of life, • Abiotic production of biomolecules	
Chapter-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 • 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.	
Chapter-3	Basic Biomolecules	6 lectures
	• 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	
Chapter-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, - Triacylglycerols - chemical and physical properties, - complex lipids: Phospholipids, sphingo lipids, cerebrosides, gangliosides, prostaglandin - cholesterol (good and bad) Steroids.	
Chapter-5	Proteins	5 lectures
	- 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	
Chapter-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	
Chapter-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.)	
Chapter-8	Nucleic acids	3 Lectures
	• chemical names and structures of nitrogen bases, • Nucleosides, • nucleotides, • Polynucleotide, • DNA and • RNA, • Forces stabilizing nucleic acid structure	

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First Year of B.Sc. Blended Bioscience

(2024 Course under NEP 2020)

Course Code: 24ScBleU1291 Course name: Calculus

Credits : 4T

Examination Scheme: CIA: 40 Marks**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:

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

- Understand set theory, logical connectives, propositional logic, number system, proofs by induction, direct proofs, proofs by contrapositive.
- Understand sequences its convergence and divergence, series, convergence of series by using different tests.
- Solve integrations by different techniques, solving improper integrals, applications of integrations.
- Solve simple first order differential equations, and should know its applications.

Course Contents

Mathematics		
Chapter	Title	Lectures
Chapter 1	Logic and Proof	15 lectures
	• 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	
Tutorials		4 lectures
Chapter 2	Sequences and Series	12 lectures
	• 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	
Tutorials		4 lectures
Chapter 3	Differential Calculus	8lectures
	• 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	
Tutorials		3 lectures
Chapter 4	Integral Calculus	9 lectures
	• 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	
Tutorials		1 lecture
Chapter 5	ODEs - Designed and shared collectively by Physics, Chemistry and Mathematics.	4 lectures

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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

Course Contents

Chapter-1	Classical mechanics	12 Lectures
	- Straight line motion - Vectors - Two & three dimensional motion - Force & Motion: Newton's Law, Drag & friction - Kinetic energy, Work , Power - Potential Energy , conservation of energy - Collision & Momentum - Rotational Motion - Angular Momentum	
Chapter-2	Gravitation	6 Lectures
	- Newton's law of gravity, Superposition - Gravity at the Earth's surface, far above the earth & within the earth - Work & gravitational potential energy - Kepler's Laws - Orbital motion & energy - Einstein's equivalence principle, gravity, gravitational lenses, gravitational waves	
Chapter-3	Thermal Physics	8 Lectures
	- 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	
Chapter-4	Elasticity, Fluids, gases	12 Lectures
	• 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	
Chapter-5	ODE	8 Lectures
	• 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	No.of Practical 12P
Practical-1	• Measurements using Various Instruments	1 Practical
Practical-2	• Static Friction	1 Practical
Practical-3	• Frequency of A.C.	1Practical
Practical-4	• Plane diffraction grating	1 Practical
Practical-5	• M.I of flywheel	1 Practical
Practical-6	• Polarimeter	1Practical
Practical-7	• Modulus of rigidity: Torsional Pendulum	1Practical
Practical-8	• Simple pendulum	1Practical
Practical-9	• Flat Spiral Spring	1Practical
Practical-10	• Logic Gates	1Practical
Practical-11	• Young's Modulus	1Practical
Practical-12	• Characteristics of Thermistor	1Practical

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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 and its components which is very helpful to get knowledge how components of life works at micro level.

Course Outcomes:

- On completion of the course, student will be able to understand the structure and function of each of the organelles and cell division and central dogma of life.
- Students will gain elementary knowledge about how things work at micro level deep inside all organisms', cell to cell signaling and communication.

Course Contents

Chapter	Title	Lectures 36 Lectures + 12 Tutorials
Chapter-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
Chapter-2	The Biology of Cells	
	• Introduction to Cell Biology	2
	Theme: The cell contained	
	• The plasma membrane	2
	• Cell walls, extracellular matrix,	2

	cellulose synthesis, other cell wall components	
	• 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: 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

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3. Cell Biology, 6th edition, (2010) Gerald Karp. John Wiley & Sons., USA.
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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

Practicals	Title	No. of practicals 10 p
Practical-1	Study of Mitosis.	1 Practical
	• To observe and study the process of mitosis.	
Practical-2	Study of meiosis in plants.	1 practical
	• To observe and study the process of meiosis of Pteridophytes.	
Practical-3	Observation of cell organelles.	1 practical
	• To identify and study characteristics of cell organelles.	
Practical-4	To observe cell count using Haemocytometer.	1 practical
	• To observe and study cell count.	
Practical-5	Use of Micrometry.	1 practical
	• To measure the size of cell by micrometry.	
Practical-6	Isolation of nucleus, mitochondria of lysosomal functions.	1 Practical
	• To isolate nuclei and mitochondria from	

	cauliflower.	
Practical-7	Study of cell lysis.	1 practical
	To study methods of cell lysis.	
Practical-8	Differential white blood cell count.	1 practical
	To find differential leucocyte count.	

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(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

Chapters	Title	No. of lectures
Chapter 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	
Chapter 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	
Chapter 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	
Chapter 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	

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- Organic chemistry by Jonathan clayden, nick greeves and stuart warren
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Course Code: 24ScBioU2202

Course Name: Lab Course on 24ScBioU2201

Teaching Scheme: TH: 4 Hours/Week

Examination Scheme: CIA: 20 Marks

Credit: 2P

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

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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

Chapter	Title	Lectures 24 Lectures + 6 Practicals
Chapter-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
Chapter-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)	

Chapter-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	
Chapter-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: - Monochrome staining and Negative (Relief) staining - 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:

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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 optical), working and care of bright field microscope	1
	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

**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		
Chapter 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
Chapter 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
Chapter 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
Chapter 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

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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

Chapter	Title	Lectures
Chapter-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	
Chapter-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	
Chapter-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	
Chapter-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	

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(Semester II)

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

Teaching Scheme: TH: 4 Hours/Week
Examination Scheme: CIA: 20 Marks

Credit: 2P
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 practical
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

