CHINMAYA DEGREE COLLEGE

BHEL, HARIDWAR

Criterion II
Teaching- Learning and Evaluation

2.6 Student Performance and Learning Outcome

2.6.1 Programme Outcomes (POs) and Course Outcomes (COs) for all Programmes offered by the institution are stated and displayed on website and attainment of POs and COs are evaluated

Documents Attached

Sr. No.	Document Name
1.	List of Department in the college
2.	Programme outcome
3.	Course outcome (a) Lesson Plan

List of Department in the College

ACADEMIC STAFF

Principal

Prof. Alok Kumar	M.Sc., Ph.D.

Department of Chemistry

1. Dr. Alok Agarwal (Associate Professor) Incharge	M.Sc., Ph.D.
2. Dr. A.S. Singh (Associate Professor)	M.Sc., Ph.D.
3. To be appointed	
4. To be appointed	
5. To be appointed	
6. To be appointed	
7. To be appointed	

Department of Physics

1. Dr. P. K. Sharma (Associate Professor) Incharge	M.Sc., Ph.D.
2. Sh. B.P. Gupta (Associate Professor)	M.Sc.
3. To be appointed	
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Department of Mathematics

1. Dr. (Mrs.) Shikha Gupta (Associate Professor) Incharge	M.Sc., Ph.D.
2. To be appointed	
3. To be appointed	

Department of Botany

1. Dr. (Mrs.) Manisha (Associate Professor) Incharge	M.Sc., D.Phil.
2. To be appointed	
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Department of Zoology

1. Dr. Ajay Kumar (Associate Professor) Incharge	M.Sc., Ph.D.
2. To be appointed	
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Department of Microbiology

1. Dr. Deepika Upadhyay, Incharge	M.Sc., D.Phil.
2. To be appointed	
3. To be appointed	

Department of Computer Science

1. Dr. Vashno Das Sharma, Incharge	M.C.A., Ph.D.
2. To be appointed	
3. To be appointed	
4. To be appointed	

Department of Biotechnology

1. Ms. Varnika Chaudhary	M.Sc.
2. To be appointed	

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Department of Biotechnology

1 Dr. Swati Shukla	M.Sc., Ph.D
2. To be appointed	To be appointed

ACADEMIC STAFF

Principal		
	Dr. Alok Agarwal (Officiating Principal)	M.Sc., Ph.D.
Director SFS		
	Dr. Vaishno Dass Sharma	M.Sc., Ph.D.
Department of Chemistry		
1.	Dr. Alok Agarwal (Associate Professor) Incharge	M.Sc., Ph.D.
2.	Dr. A.S. Singh (Associate Professor)	M.Sc., Ph.D.
3.	Dr. Ruchira Chowdhury (Assistant Professor) Incharge SFS	M.Sc., Ph.D
4.	Ms. Kamna Chauhan, Assistant Professor	M.Sc.
5.	Dr. Geeta Badola, Assistant Professor	M.Sc., Ph.D
6.	Vacant	
Department of Physics		
1.	Dr. P. K. Sharma (Associate Professor) Incharge	M.Sc., Ph.D.
2.	Sh. B.P. Gupta (Associate Professor)	M.Sc.
3.	Dr. Omkant, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
4.	Mrs. Meenu Malik, Assistant Professor	M.Sc.
5.	Dr. Amar Deep, Assistant Professor	M.Sc., Ph.D
6.	Ms. Jagrati Tyagi, Assistant Professor	M.Sc.
7.	Ms. Shivani Tyagi, Assistant Professor	M.Sc.
Department of Mathematics		
1.	Mrs. Surbhi Gupta, (Assistant Professor) Incharge SFS	M.Sc.
2.	Ms. Himani Sharma, Assistant Professor	M.Sc.
3.	Vacant	
Department of Botany		
1.	Dr. (Mrs.) Manisha (Associate Professor) Incharge	M.Sc., Ph.D
2.	Dr. Madhu Sharma, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
3.	Vacant	
Department of Zoology		
1.	Dr. Ajay Kumar (Associate Professor) Incharge	M.Sc., Ph.D
2.	Dr. Sandhya Vaid, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
3.	Ms. Shaily, Assistant Professor	M.Sc.
4.	Dr. Shikha Gaur, Assistant Professor	M.Sc., Ph.D
5.	Vacant	
Department of Microbiology		
1.	Dr. Deepika, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
2.	Sh. Himanshu Singh, Assistant Professor	M.Sc.
3.	Ms. Arti Thakur, Assistant Professor	M.Sc.
4.	Dr. Nidhi Singh Chauhan, Assistant Professor	M.Sc., Ph.D
Department of Computer Science		
1.	Dr. Vaishno Dass Sharma, (Assistant Professor) Incharge SFS	MCA., Ph.D.
2.	Sh. Santosh Kumar, Assistant Professor	M.Sc. (CS)
3.	Sh. Ankur Kumar, Assistant Professor	MCA
4.	Sh. Hitesh Pujari, Assistant Professor	MCA
5.	Sh. Rishabh Narayan, Assistant Professor	MCA
Department of Biotechnology		
1.	Dr. Swati Shukla (Assistant Professor) Incharge SFS	M.Sc., Ph.D
2.	Dr. Jyoti Choudhary, Assistant Professor	M.Sc., Ph.D

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5.	Ms. Anju Sharma, Assistant Professor	M.Sc.
6.	Ms. Shivani, Assistant Professor	M.Sc.
7.	Ms. Shivani Chouhan, Assistant Professor	M.Sc.
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Department of Botany		
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2.	Dr. Madhu Sharma, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
3.	Ms. Ayushi Dhiman, Assistant Professor	M.Sc.
4.	Ms.Kiran Shumalia, Assistant Professor	M.Sc.
Department of Zoology		
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3.	Dr. Shikha Gaur, Assistant Professor	M.Sc., Ph.D
4.	Ms. Prerna Rajput, Assistant Professor	M.Sc.
5.	Ms. Versha, Assistant Professor	M.Sc.
Department of Microbiology		
1.	Dr. Deepika, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
2.	Sh. Himanshu Singh, Assistant Professor	M.Sc.
3.	Dr. Nidhi Singh Chauhan, Assistant Professor	M.Sc., Ph.D
4.	Ms. Divya Singh, Assistant Professor	M.Sc.
Department of Computer Science		
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3.	Sh. Ankur Kumar, Assistant Professor	MCA
4.	Sh. Rishabh Narayan, Assistant Professor	MCA
5.	Ms. Himangi Sharma, Assistant Professor	M.Sc.
Department of Biotechnology		
1.	Dr. Swati Shukla (Assistant Professor) Incharge SFS	M.Sc., Ph.D
2.	Dr. Jyoti Choudhary, Assistant Professor	M.Sc., Ph.D

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5.	Ms. Rakhi Goyal, Assistant Professor	M.Sc.
6.	Ms. Shivani Chouhan, Assistant Professor	M.Sc.
7.	Ms. Apoorva Shotri	M.Sc.

Department of Physics

1.	Dr. P. K. Sharma (Associate Professor) Incharge	M.Sc., Ph.D.
2.	Sh. B.P. Gupta (Associate Professor)	M.Sc.
3.	Dr. Om Kant, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
4.	Dr. Amar Deep, Assistant Professor	M.Sc., Ph.D
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2.	Dr. Madhu Sharma, (Assistant Professor) Incharge SFS	M.Sc., Ph.D
3.	Ms. Nevadita Singh, Assistant Professor	M.Sc.
4.	Ms.Kiran Shumalia, Assistant Professor	M.Sc.

Department of Zoology

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2.	Dr. Jyoti Choudhary, Assistant Professor	M.Sc., Ph.D

Chinmaya Degree College, Haridwar
Programme Outcomes for Students

After the completion of graduation/ post graduation students will be able to acquire the following attributes.	
PO 1	Student will be able to apply techniques, skills and tools in new contexts.
PO 2	Student will be able to analyses problems objectively and find solutions
PO 3	Student will be acquire knowledge of fundamentals, principles and methods
PO 4	Student will be able to use skills acquired during the programme in real life situations.
PO 5	Student will be able to use appropriate individual and group behavior in real life situations.
PO 6	Students will be Effective speaking, active listening, giving and receiving feedback, empathy and respect for others.
PO 7	Student will be able to understand and interact with people belonging to diverse backgrounds(social, cultural, economic, religious and linguistic) and use culture specific norms.
PO 8	Students will be able to use natural and community resources with a sense of responsibility and engage in environmentally sustainable practices.
PO 9	Student will be able to practice ethics in public life and demonstrate adherence to human values.
PO 10	Student will be Motivation to learn and use new and beneficial things for personal and societal benefit.

Course Outcomes
Teaching Plan

B.Sc. I Semester

Core Course – Physics

Mechanics

S. No.	Units	Topics	Lectures Required
1.	**Vectors**	1. Vector algebra – intro - Scalar and vector triple products - Properties of vector Triple Products 2. Reciprocal set of vectors – definition 3. Vector derivatives – intro - Differentiation of a vector w.r.t. a scalar – expl. - Differentiation of sum and products - Partial differentiation of vectors - Radial and transverse velocity 4. Vector integrals – intro - Scalar and vector field - Line, Surface & Volume integral – explanation - Gradient, Divergence & curl of a vector field	05
2.	**Ordinary Differential Equation**	1. Differential Equation – intro - Types of D.E. –ordinary and partial - Order & degree of differential equation 2. Linear and non-linear differential equations 3. Solution of differential equation- methods expl. 4. Equation of the first order and first degree – expl. 5. Homogeneous & linear equations - explanation - Solution of Linear differential equation	06

S.No.	Units	Topics	Lectures Required
3.	**Laws of Motion**	1. Reference frame – intro - Inertial & non-inertial reference frame – expl. 2. Newton's laws in reference frame – intro - Newton's first, second & third law – expl.	03
4.	**Momentum and energy**	1. Concept of work – intro - Work done in a stretched spring – derivation - Work-energy theorem – proof 2. Conservative and non-conservative forces - Definition & explanation - Central force is conservative – proof - Concept of Potential energy – explanation - Curl of a conservative force – derivation - Conservation of mechanical energy – proof - Linear restoring force – proof - Potential energy of simple pendulum – proof 3. Centre of mass – intro - equation of centre of mass - Motion of centre of mass - Linear momentum with centre of mass - Conservation of linear momentum 4. Angular momentum of system of particles – proof 5. Rocket : System of Variable Mass – intro - Motion of Rocket - theory	06

S.No.	Units	Topics	Lectures Required
5.	**Rotational Motion**	1. Torque – intro - Translational & Rotational motion – explanation - Angular velocity & Angular acceleration – def. - Torque acting on a particle – definition - Angular momentum of a particle – definition - Relation between torque & angular momentum 2. Moment of Inertia – definition - radius of gyration – definition - K.E. of a rotating body – definition - Angular momentum of a rotating body 3. Theorem of parallel axis – proof 4. Theorem of perpendicular axis – proof 5. Conservation of Angular momentum -proof	06
6.	**Gravitation**	1. Central forces – definition - areal velocity remains constant – proof 2. Kepler's laws of planetary motion – theory/proof - The Law of elliptical orbits – explanation - The Law of areas – explanation - The Harmonic law – explanation - Conclusion of Newton from Kepler's laws 3. Newton's law of Gravitation – definition 4. Period of motion of a planet about sun – expl.	08

S.No.	Units	Topics	Lectures Required
		5. Satellite – intro - Launching of an artificial satellite – explanation - Revolution of a satellite around planet – proof - Geo-stationary Satellite – explanation - Weightlessness inside satellite - theory - Escape velocity and orbital velocity – proof 6. - Global Positioning System – Basic idea	
7.	**Fluids**	1. Surface Tension – definition - Surface energy – explanation 2. Pressure difference b/w two side of curved surface - theory & derivation - Excess pressure inside air bubble – proof 3. Effect of temperature on surface tension – expl. 4. Determination of surface tension – explanation - Jaeger's method – description 5. Viscosity – intro - Stream-lined & turbulent flow – explanation - Critical velocity and Reynolds number - Velocity gradient – explanation - Coefficient of viscosity – definition - Poiseuille's formula – derivation - Determination of viscosity of water – description 6. Determination of coefficient of viscosity – intro - Rotating cylinder method – description	09

B.Sc. II Semester

Core Course – Physics

Electricity and Magnetism

S. No.	Units	Topics	Lectures Required
1.	**Vector Analysis**	1. Multiplication of Vectors - intro - Explanation of dot and cross product - Scalar and Vector Product of two vectors - Characteristics of each product 2. Polar and Axial Vectors - Definition and explanation 3. Gradient of a scalar field - Definition and explanation 4. Divergence and curl of a vector field - Divergence - Definition and explanation 5. Gauss's Theorem of divergence - Gauss's Law, Poisson's and Laplace Eq. - Curl – Definition and explanation 6. Stokes' Theorem – Definition and explanation 7. Vector Integration - Line Integral - Surface Integral - Volume Integral	12

S.No.	Units	Topics	Lectures Required
		- Effect of temperature on viscosity – explanation 7. Stokes' law of viscous force – theory - Calculation of terminal velocity - viscosity of highly viscous liquid - velocity of rain drops	
8.	**Elasticity**	1. Elasticity – intro - Perfectly elastic – explanation - Stress, strain, shear – definition 2. Hook's law – definition - Behaviour of wire under increasing load – theory 3. Young's modulus, Bulk modulus – definition 4. Modulus of Rigidity, Poisson's ratio – definition - Relation among elastic constants – proof 5. Difference b/w Angle of twist & angle of shear - Twisting couple on a cylindrical rod – proof - Torsional rigidity – definition 6. Determination of Modulus of Rigidity - Barton's Statical method – theory & method - Torsional oscillation – explanation - Maxwell's Needle – theory & procedure 7. Bending Beam method – theory & method - Longitudinal filament, Neutral surface- Def. - Plane of Bending, Neutral Axis – Def.	10

S.No.	Units	Topics	Lectures Required
2.	**Electrostatics**	1. Coulomb's Law - Definition and explanation - Electric Field Strength 2. Gauss's Law and its applications - Electric Flux - Definition and explanation 3. Electric Field of a uniformly charge sphere - Derivation and explanation 4. Electric Field due to an infinite line of charge - Derivation and explanation 5. Electric field of an infinite plane sheet of charge - Derivation and explanation 6. Electric field due to charged conductor - Derivation and explanation 7. Electric Potential – Definition and explanation - Electric Potential as line integral of field - Electric field as negative gradient of potential 8. Potential due to a dipole – derivation and exp. 9. Potential due to a charged shell - Internal and external point – derivation 10. Capacitance – Definition and Explanation - Energy of a charged conductor	22

S.No.	Units	Topics	Lectures Required
		11. Capacitor – Definition and explanation - Parallel Plate Capacitor –derivation - Spherical capacitor - Cylindrical capacitor - Capacitor in series and parallel 12. Dielectric - Definition and explanation - Electric Polarisation of matter - Gauss's law of dielectrics – derivation - Parallel plate capacitor with a dielectric slab - Derivation 13. Electric Intensity – Definition & Expl. Electric Polarisation – Definition & Expl. Electric Displacement – Definition & Expl. - Derive relation among these 14. Atomic polarizability – Definition & Expl. Electric Susceptibility – Definition & Expl. Dielectric constant – Definition & Expl. Permittivity – Definition & Expl. - Derive relation among these 15. Molecular Polarizability - explanation - Molecular Field in a Dielectric	

S.No.	Units	Topics	Lectures Required
3.	**Magnetism**	1. Biot-Savart Law – Definition and Explanation - Magnetic field due to a long conductor – Deriv. - Force between two parallel conductors – Expl. 2. Magnetic field on the axis of circular loop – Deriv. - Variation of the field – explanation 3. Magnetic field induction due to solenoid – Deriv. 4. Ampere's circuital law – Definition and Deriv. 5. Divergence and curl of magnetic field - Definition and explanation 6. Magnetic Dipoles - Explanation 7. Magnetic Scalar & Vector Potential - Derivation and explanation 8. Magnetic Properties of matter – explanation - Magnetic Induction – Def. & expl. - Intensity of magnetisation – Def. & expl. - Magnetic Field Intensity – Def. & Expl. 9. Gauss' law in magnetism – Def. & expl. 10. Magnetic Susceptibility – Def. & Expl. - Magnetic Permeability – Def. & Expl. 11. Magnetic Substance – explanation - Dia, Para & Ferro substance & Characteristics - Atomic model explanation of magnetism - Curie temperature - explanation	10

S.No.	Units	Topics	Lectures Required
4.	**Electromagnetic Induction**	1. Electromagnetic Induction – Explanation - Farady's law – first & second law -Definition - Induced emf from Lorentz force - motion of charge in changing magnetic field - Time varying magnetic field 2. Farady's law in universal form – derivation 3. Vector potential in varying magnetic field- deriv. 4. Self-induction – explanation - Coefficient of self induction – def. & deriv. - Determination of self – inductance - Magnetic energy in a magnetic field – deriv. 5. Mutual Induction – explanation - Coefficient of mutual induction – def. & deriv. - Measurement of mutual inductance 6. Inductance in series and parallel - Calculation of equivalent inductance	06

B.Sc. III Semester

Core Course – Physics

Thermal Physics and Statistical Mechanics

S.No.	Units	Topics	Lectures Required
1.	**Thermodynamic description of System**	1. System and its surroundings – Introduction 2. Zeroth law of thermodynamics and temperature - Explanation with diff. between temp. & heat 3. Equivalence of heat work – explanation - Thermodynamic system – intro - external work & internal work – intro 4. Dependence of work done on the path - cyclic process – explanation 5. Internal energy of a system – intro - First law of thermodynamics – explanation 6. Some Thermodynamic processes - explanation - Cyclic, isobaric, isochoric, adiabatic 7. Ideal gas – explanation - equation of state & specific heats of a gas – deriv. - external work done by an ideal gas in Isothermal and adiabatic expansion 8. Isothermal and adiabatic process – Expl. & deriv 9. quasi-static process – explanation 10. Heat engine – thermal efficiency – explanation 11. Carnot's reversible heat engine – explanation	14

S.No.	Units	Topics	Lectures Required
5.	**Maxwell's equations and electromagnetic wave propagation**	1. Equation of continuity – explanation & deriv. 2. Maxwell's displacement current - derivation & explanation 3. Maxwell's equation of electromagnetism - Derivation of Maxwell's first, second, third & fourth eq. 4. Electromagnetic waves – introduction - derivation of eq. for plane electromagnetic Waves - relation between magnitudes of E and B 5. Poynting vector – derivation & explanation - Momentum of an electromagnetic wave 6. Reflection and refraction of EM wave - derivation & explanation 7. Polarisation by reflection – derivation - derivation of reflection coefficient 8. Total internal reflection – derv. & explanation	10

Total Lectures = 60

S.No.	Units	Topics	Lectures Required
3.	**Kinetic Theory of Gases**	1. Kinetic theory of matter – explanation 2. kinetic theory of gases – explanation - Pressure exerted by a gas – expl. & derivation - rms speed – derivation & application 3. Kinetic interpretation of temperature – explanation 4. Law of equipartition of energy - explanation - degrees of freedom - calculation of ratio of specific heats for mono, Dia and triatomic gases 5. Maxwell's law of distribution of speeds – deriv. - calculation of average speed - calculation of rms speed - calculation of most probable speed - momentum wise distribution of speeds - energy wise distribution of speeds 6. Mean free path – explanation and derivation 7. Transport Phenomena – theory - viscosity of a gas – theory and derivation - Thermal conductivity of a gas – theory & deriv. - Diffusion of gases – theory and derivation	12

S.No.	Units	Topics	Lectures Required
		12. Carnot's ideal refrigerator - Coefficient of performance 13. Second law of thermodynamics – explanation 14. Carnot's theorem – explanation 15. Absolute scale of temperature 16. Entropy – physical significance - intro - change in reversible & irreversible cycle - entropy & second law – explanation - carnot cycle on T-S diagram - Entropy change in various phenomenon 17. Third law of thermodynamics - Nernst heat theorem - Entropy and disorder	
2.	**Thermodynamic Potentials**	1. Maxwell's four thermodynamic relations - explanation & derivation 2. Clausius clapeyron equation – derivation 3. expression for Cp-Cv - derivation 4. First and second T dS equation – derivation 5. Joule-Thomson effect – explanation & deriv. 6. Thermodynamic Potentials – explanation - Internal energy, Helmholtz function, Enthalpy Gibbs function	10

S.No.	Units	Topics	Lectures Required
5.	**Statistical Mechanics**	1. Probability of a distribution – derivation - calculation of most probable distribution 2. Maxwell- Boltzmann Distribution law – derivation 3. Ensemble – theory 4. Phase space – theory - microstate and macrostate of a system 5. Classical and quantum statistics 6. Maxwell-Boltzmann classical statistics - theory & derivation 7. Bose-Einstein quantum statistics - theory & derivation 8. Fermi-Dirac quantum statistics - theory & derivation 9. Comparison of three statistics	12

Total Lectures = 60

S.No.	Units	Topics	Lectures Required
4.	**Theory of Radiation**	1. Radiation – intro - Prevost's theory of exchanges – theory - Characteristics of thermal radiation - Pressure of radiation – derivation - concept of energy density 2. Black Body – intro - Emissive & absorptive power – definition - Kirchhoff's law – explanation 3. Stefan's law – definition and derivation - Experimental verification - Stefan-Boltzmann law – theory and experimental determination 4. Spectral distribution of energy in black-body Radiation – explanation - Wein's displacement law – derivation - Wien's distribution law – derivation - Rayleigh-Jeans law – derivation 5. Planck's radiation formula –derivation - Derivation of Rayleigh- Jeans & Wien's law From Planck's law - Derivation of Wien's Displacement law & Stefan's law from Planck's law	12

S.No.	Units	Topics	Lectures Required
		8. Beats – theory with graph - calculation of number of beats per second 9. Formation of Stationary waves –theory - characteristics of stationary waves 10. Phase and group velocity – definition & deriv. - relation between group & wave velocity	
3.	**Oscillations**	1. Simple harmonic motion – intro - various terms explained - Differential equation of motion - Energy of S.H.M. – Potential & kinetic - Time average & position average of energy 2. Free and damped oscillation – intro - equation of damped harmonic oscillator - Power dissipation in damped harmonic oscillator - Quality factor and relaxation time	06
4.	**Sound**	1. Free and forced oscillations – intro - resonance – explanation - equation of forced oscillation - sharpness of resonance 2. Fourier's theorem – intro - evaluation of constants - Analysis of saw tooth wave - Analysis of square wave	06

B.Sc. IV Semester

Core Course – Physics

Waves and Optics

A. Waves

S.No.	Units	Topics	Lectures Required
1.	**Superposition of Harmonic Waves**	1. Principle of superposition – theory -Linear superposition - Addition of two S.H.M. 2. Lissajous figures – theory - Perpendicular superposition - resultant with frequency in ratio 1:1 & 1:2 - graphical and analytical methods - Methods of obtaining Lissajous figures - Application of Lissajous figures	06
2.	**Wave Motion**	1. Wave – intro 2. Propagation of transverse & longitudinal waves - explanation with displacement curve 3. Differential equation of wave motion –derivation 4. Equation of plane progressive wave - derivation - relation between particle and wave velocity 5. Pressure equation of plane wave - derivation 6. Energy distribution in plane progressive wave 7. Interference of waves – theory & derivation - Constructive & destructive	07

S.No.	Units	Topics	Lectures Required
		3. Fresenl's Biprism – theory & derivation - calculation of fringe width & experimental set-up - thickness of a plate 4. Phase change on reflection (stokes' treatment) 5. Lloyd's mirror – theory & derivation - difference between biprism and Lloyd 6. Interference in thin films (division of amplitude) - condition of maxima & minima - Wedge-shaped film – theory & derivation 7. Formation of Newton's rings- - theory & derivation - diameter of bright and dark rings - experimental arrangement - determination of refractive index of a liquid - general expression for rings 8. Fringes of equal thickness and equal inclination 9. Michelson Interferometer – theory - Construction & working - Adjustment of the M.I. - Determination of wavelength - Determination of difference in wavelength	

S.No.	Units	Topics	Lectures Required
		3. Acoustics of Building – intro - Acoustic characteristics of hall & auditorium - Reverberation - Sabine formula and absorption coefficient - Sabine formula for a live room - Reverberation time in dead room	

B. Optics

S.No.	Units	Topics	Lectures Required
5.	**Wave theory of light**	1. Nature of light – intro 2. Huygens' principle – theory - Reflection of a plane wave - Refraction of a plane wave - Total Internal Reflection - Refraction through a lens	03
6.	**Interference**	1. Interference of light – intro 2. Young's experiment (division of wavefront) - Resultant intensity of two interfering waves - fringe width - conditions for interference of light - coherent sources	13

S.No.	Units	Topics	Lectures Required
		3. Doubly-Refracting Crystals – theory - optic axis of the crystal - principal section of the crystal - double refraction 4. Nicol's prism – Construction & action 5. Law of Malus – theory 6. Plane, circular and elliptical polarised light - theory & representation 7. Quarter-wave plate – construction & working 8. Half-wave plate – construction & working 9. Production of Plane polarised light - Production of circular polarised light - Production of elliptical polarised light - Distinction among these 10. Analysis of polarised light - explanation	

Total Lectures = 60

S.No.	Units	Topics	Lectures Required
7.	**Diffraction of Light**	1. Fresnel's Half-Period zones – theory - construction of half-period zones - amplitude due to a zone - resultant amplitude due to all zones 2. Zone plate and its construction - theory of zone plate - multiple focus of zone plate 3. Diffraction of light – theory - Fresnel and Fraunhofer diffraction - Division of cylindrical wavefront - Diffraction at a straight edge – theory & deriv. - Diffraction at a narrow wire - Diffraction at a rectangular aperture 4. Fraunhofer's diffraction at a single slit - theory & derivation Diffraction at a double slit 5. Plane Transmission Diffraction grating - theory & construction - formation of multiple spectra by grating - elementary theory - determination of wavelength of light	14
8.	**Polarization**	1. Polarisation of light – intro 2. Brewster's law	05

S.No.	Units	Topics	Lectures Required
3.	**Wave-Particle Duality (Matter Waves)**	1. De-Broglie Hypothesis of matter waves – intro - De-Broglie wavelength of matter waves - De-Broglie wavelength of Electron - Demonstration of matter waves – intro 2. Davission and Germer Experiment – explanation 3. G.P. Thomson's Experiment- theory & proof 4. De-broglie wavelength of Helium atoms 5. Bohr Quantisation Condition –theory - Circumference of electron orbits 6. Dual nature of light and matter- explanation	06
4.	**Atomic Model**	1. Atomic Structure – intro - Thomson's model of Atom – Explanation - Rutherford's Nuclear Model of Atom – Expl. - Difficulties in Rutherford's model – discussion - Bohr's Quantum model - Wave Mechanical model 2. Bohr theory of Hydrogen Spectrum – intro - Bohr's two postulates – explanation - Emission of Spectrum – emission - Different series & their explanation - Shortcomings of Bohr's theory – discussion - Bohr theory corrected for nuclear mass 3. Sommerfeld's Extension of Bohr Theory	08

B.Sc. V Semester

DSE Course – Physics

Elements of Modern Physics

S.No.	Units	Topics	Lectures Required
1.	**Origin of Quantum Theory**	1. Planck's Quantum hypothesis – intro - Average energy of Planck's Oscillator – proof - Planck's Radiation Formula – derivation - Energy Distribution by Planck's formula – expl. - Properties of Photon – explanation - Classical Mechanics & Origin of Quantum Th.	06
2.	**Photoelectric Effect and Compton Effect**	1. Photoelectric Effect – intro - Experimental observation – discussion - Dependency upon Intensity of Light – discussion - Dependency upon Frequency of Light – disc. - Laws of Photoelectric emission- explanation 2. Compton Effect – intro - Theory & Derivation - Calculation of Compton Wavelength - Experimental Verification - Measurement of Recoiled electron energy 3. Comparison of Compton & Photoelectric effect 4. Franck-Hertz Experiment – explanation - Interpretation of the curve - Demonstration of discrete energy levels	06

S.No.	Units	Topics	Lectures Required
		4. Excitation & Ionisation Potential of an atom- intro - Franck-Hertz Experiment - discussion - Interpretation of the curve 5. Bohr's Correspondence Principle - theory	
5.	**Uncertainty Principle**	1. Heisenberg's Uncertainty Principle - Determination of position of particle – deriv. - Diffraction of electron-beam –theory - Concept of Bohr Orbit – discussion - Uncertainty in Velocity – deriv. - Electrons in Nuclei- discussion - Complementarity Principle - discussion	04
6.	**Quantum Mechanics**	1. Short comings of old quantum theory – intro 2. Operators – intro - Eigenfunctions & Eigenvalues – definition - Properties of functions and operators - Definition of an operator - Linear, Identity, Null operator – definition - Power of an operator – definition - Inverse, singular & non-singular operators – def. 3. Postulates of wave mechanics – intro - Discussion of I, II, III & IV postulates 4. Schrodinger's Time-dependent wave equation - theory & derivation	15

S.No.	Units	Topics	Lectures Required
		5. Schrodinger's time-independent equation - theory & derivation 6. Orthogonality & Normalization o wave function - definition 7. Probability Density – derivation 8. Expectation values of dynamical variables - definition and properties 9. Different operators in Q.M. - Momentum, Velocity, Kinetic & Total Energy - Angular momentum – definitions 10. Principle of Superpositions – definition 11. Potential Problems - Potential step – derivation - Expressions for the wave functions - Probability current densities – calculation - Reflection and Transmission Coefficients 12. Square-well with finite sides – theory & deriv. 13. Particle in a rigid 1-dimensional box – deriv. 14. Eigen functions and Eigen values of a particle In a box – theory & derivation 15. Particle in a 3-D Rigid box – theory & deriv. 16. Quantum Tunnelling – intro - Rectangular potential barrier – theory & deriv.	

S.No.	Units	Topics	Lectures Required
		17. Particle in a finite square potential well (Non rigid) - theory & derivation 18. The harmonic oscillator – theory & derivation 19. Angular Momentum – intro - Calculation of diff. components of A.M.	
7.	**Nuclear Physics**	1. General Properties of Nucleus – intro - Nuclear size & shapes – discussion 2. Structure of the Nucleus – intro - Consideration of nuclear size, spin, magnetic Moment, isotopes, Proton-neutron hypothesis, Nuclear Stability - Basic Properties of an atomic nucleus – angular Momentum, Parity, symmetry, magnetic dipole Moment, electric quadrupole moment – disc. 3. Packing fraction of an isotope – intro - Unified atomic mass unit – def. - Mass defect & binding energy – def. - Binding energy curve - explanation - Angular momentum of nucleus – definition - Nuclear magnetic moment- theory & deriv. 4. Saturation phenomenon & exchange forces – intro - discussion & properties of nuclear forces	15

S.No.	Units	Topics	Lectures Required
		5. Nuclear Models – intro - Liquid drop model of nucleus – discussion - Nuclear binding energies – calculation - Short comings of Liquid-drop model – disc. 6. Semi-empirical mass formula – intro - Calculation of different energies - Application of semi-empirical mass formula 7. Natural Radioactivity – intro - Properties of alpha, beta & gamma particles - Laws of radioactive disintegration- disc. - Calculation of Half-life & Decay constant - Calculation of Mean life of a radioactive element - Soddy's displacement law – discussion - Law of successive disintegration and Radioactive equilibrium – theory & proof - Radioactive dating – calculation of age of earth 8. Alpha decay – theory & explanation 9. Beta decay – theory & explanation - Characteristics & experimental investigation 10. Gamma decay – theory & explanation 11. Nuclear Reactions – theory - Conservation laws - explanation - Cross-sections of nuclear reactions – theory	

B.Sc. V Semester

SEC Course – Physics

Electronics – I

S. No.	Units	Topics	Lectures Required
1.	**Network Analysis and Network Theorem**	1. Kirchhoff's Laws – intro - Series & parallel corrections 2. Network Theorems – intro - Thevenin, Norton, maximum power transfer, Superposition & reciprocity theorem – proof 3. Low & High pass filters – intro - theory & diff. circuits 4. Four terminal network – theory & circuits 5. Electronic Measuring Instruments – intro - VTVM – theory, construction & working - CRO – theory, construction & working	10
2.	**Solid State Devices**	1. Electronic Devices – intro - General idea of diode - Triode – principle, construction & characteristics - Tetrode – principle, const. & characteristics - Pentode – principle, const. & characteristics 2. Semiconductors – intro - Intrinsic & extrinsic semiconductors – theory - p-type & n-type semiconductors –theory - pn junction diode – theory, cons. & working - point contact diode- theory, cons. & working	10

S.No.	Units	Topics	Lectures Required
		- Determination of cross section - Nuclear reactions by alpha-particles, protons Deuterons, neutrons, photons – explanation - Q-values of nuclear reactions 12. Nuclear Fission – intro - Bohr-wheeler theory – explanation - Fission fragments – expl. - Neutron emission & energy released - expl. - Self-sustained chain reaction - Controlled chain reaction - Atom bomb – intro 13. Nuclear reactors – Construction & working 14. Nuclear fusion – theory - Hydrogen bomb – intro - Practical difficulty in controlling fusion	

Total Lectures = 60

S. No.	Units	Topics	Lectures Required
		- Class A – circuit & working - Class B – circuit & working - Class C – circuit & working - Decibel , frequency response & bandwidth	
2.	**Feedback Amplifiers and Oscillators**	1. Feedback Amplifiers – intro - Classification of amplifiers - Negative feedback & its advantage - Voltage & current feedback 2. Oscillators – intro - Positive feedback - discussion - RC phase shift – circuit & working - Wein bridge – circuit & working - Hartley – circuit & working - Colpitts – circuit & working - Tuned Base – circuit & working - Tuned Collector – circuit & working - Tuned drain – circuit & working 3. Crystal oscillators – intro - Piezoelectric effect - discussion - Crystal controlled oscillator – circuit & working - Study of stability 4. Relaxation Oscillators – intro - Types of Multivibrators	15

B.Sc. VI Semester

SEC Course – Physics

Electronics – II

S. No.	Units	Topics	Lectures Required
1.	**Transistor Amplifiers**	1. Transistor Amplifier – intro - Classification of amplifier - Basic amplifier – working - Study of load line graph - Study of different transistor biasing - Transistor equivalent circuit – working - h-parameter calculation 2. Single stage transistor amplifier – intro - CE configuration – circuit & working - CB configuration – circuit & working 3. FET amplifier – intro - Circuit & working 4. RC coupled transistor amplifier – intro - Circuit & working 5. LC coupled transistor amplifier – intro - Circuit & working 6. TC coupled transistor amplifier – intro - Circuit & working 7. Noise & distortion in amplifiers – discussion 8. Power Amplifiers – intro - Types of power amplifiers	15

S.No.	Units	Topics	Lectures Required
		9. Vector Atom Model – intro - Spatial Quantisation – disc. - Spinning Electron – disc. 10. Coupling Schemes – intro - L-S coupling scheme – Guiding Principle - J-J coupling scheme - discussion	

Total Lectures = 60

S.No.	Units	Topics	Lectures Required
		- Experimental Set-up, Adjustment & Procedure - Explanation of Normal Zeeman Effect – deriv. - Explanation of Anomalous Effect- deriv. - Zeeman effect in some transitions- disc.	
6.	**Many Electron Atoms**	1. Pauli's Exclusion Principle – intro - Shell structure of the atom - Electron distribution in shells - Maximum number of electrons in a shell - Periodic table of elements 2. Physical meaning of identity 3. Symmetrical and antisymmetric wave functions - definition - Exchange degeneracy 4. Spectral terms and their notations 5. Alkali Atoms Spectra – intro - Principal, sharp, diffuse & fundamental series - selection rules – transition rules 6. Coupling of orbital & spin angular momenta - Multiplicity of energy states 7. Spin-orbit Interaction energy- derivation 8. Total Angular Momentum of Electron - Commutation relations of T.A.M. with comp. - Eigen values of J^2, J_z, J_+ and J_- - calculation	10

S.No.	Units	Topics	Lectures Required
		- Solution of r-equation - The total wave function - Energy of atomic levels & degeneracy – disc. 5. Angular momentum operator & their commutations rules - intro - commutation rules & operators - Eigen values of L^2 and L_z – calculation - Eigen functions of L^2 and L_z - calculation	
5.	**Atoms in Electric and Magnetic fields**	1. The orbital and the spin magnetic moment – intro - def. of orbital magnetic moment - def. of Bohr magneton, Gyromagnetic ratio & Lande's splitting factor - The spin magnetic moment - definition 2. Larmor Precession – def. & discussion - Space Quantisation 3. Vector Atom model – discussion - Principle of V.A.M. - Experimental Arrangement (Stern & Gerlach) - Results & discussion - Limitations of Stern-Gerlach - Description of quantum numbers in V.A.M. 4. Zeeman effect – intro - Normal & Anomalous Zeeman effects	12

S.No.	Units	Topics	Lectures Required
		- Parabolic potential well - Calculation by classical & quantum method - Calculation of Eigen value & probability Distribution 3. 1-D motion in step potential – intro - The single step barrier – calculation 4. The square well potential – intro & calculation - The case of discrete energy levels & scattering - Calculation of maximum & minimum values of the transmittance - Infinitely deep square well 5. Rectangular potential barrier – calculation - Tunnel effect – discussion - Application of Tunnel effect	
4.	**Quantum theory of hydrogen-like atoms**	1. Time independent Schrodinger equation in spherical polar co-ordinates- intro - Separation of variables - Solution of the equations (quantum numbers) - Interpretation of quantum numbers 2. 3-D Harmonic Oscillator- intro & derivation 3. Rigid Rotator – derivation 4. The hydrogen atom – intro - Solution of phi equation	10

S.No.	Units	Topics	Lectures Required
		- Commutation relation b/w position & momentum 7. Expectation values of the dynamical variables - definition of different quantities 8. The Uncertainty principle- Statement & expl. - Examples of uncertainty principle - Application of uncertainty principle 9. Complementarity Principle - intro	
2.	**Time Independent Schrodinger Equation**	1. Schrodinger's time independent wave equation - intro & derivation - Stationary state (time independent) solution 2. Wave packet – introduction & derivation - representation by Fourier methods - Fourier series and Fourier integral 3. Fourier Integral theorem from Parseval's formula 4. Application of Fourier transforms to a Gaussian Function – calculation 5. Superposition of plane waves moving in space with angular frequency	10
3.	**General discussion of bound state in an arbitrary potential**	1. A particle in a rigid 1-D box (infinite potential well) – introduction & derivation - calculation of Eigen values of energy, wave function, probability density 2. 1-D linear harmonic oscillator – intro	12

B.Sc. VI Semester

DSE Course – Physics

Quantum Mechanics

S.No.	Units	Topics	Lectures Required
1.	**Time Dependent Schrodinger Equation**	1. Schrodinger's time independent wave equation - introduction - equation of motion for a free particle - Time dependent Schrodinger equation – proof 2. Properties of wave function – discussion - Physical interpretation of wave function – expl. - Condition for physical acceptability- disc. - Probability current density/particle flux – deriv. - Normalization of wave functions – disc. 3. Solution of time dependent Schrodinger equation - calculation 4. Orthonormal Properties of wave function- calcu. 5. Eigen values and eigen functions – explanation - superposition of eigen states – proof 6. Operators – intro - definition of energy, momentum, K.E., velocity Potential energy - Theorem of commutativity and simultaneity - Converse of theorem – proof - Commutator algebra – explanation - Parity, pi & projection operator – definition	06

S.No.	Units	Topics	Lectures Required
		- Regulated power supply – working - Voltage Regulation by Zener diode – working - Voltage multiplier – theory & working 4. Number Systems – intro - Binary number system – theory & laws - Decimal number system – theory & laws - Hexadecimal number system – theory & laws - Octal number system – theory & laws - Interconversion among diff. number system 5. Boolean Algebra – intro - Study of different laws 6. Logic Gates – intro - OR,AND & NOT Gate – sym., circ. & truth table - NAND, NOR, XOR- sym., circ. & truth table	

Total Lectures = 30

S.No.	Units	Topics	Lectures Required
		- Zener diode - theory, cons. & working - Varactor - theory, cons. & working - Tunnel Diode - theory, cons. & working - Photodiode - theory, cons. & working - LED - theory, cons. & working 3. Transistors – intro - Operation & characteristic curves - CE configuration – Characteristic - CB configuration – Characteristic - CC configuration – Characteristic - Current amplification 4. Field Effect Transistor – intro - Theory & Working	
3.	**Rectifiers and Filters**	1. Rectifiers - intro - HW rectifier – circuit & working - FW rectifier – circuit & working - Bridge rectifier – circuit & working 2. Filter Circuits – intro - Series L – theory & working - Shunt C – theory & working - PI filter – theory & working 3. Power Supplies – intro - Unregulated power supply – working	10

S. No.	Units	Topics	Lectures Required
		- Astable multivibrator – circuit & working - Monostable multivibrator – circuit & working - Bistable multivibrator – circuit & working	

Total Lectures = 30

B.Sc. Semester- II

Plant Ecology and Taxonomy

S.No.	Units	Topics	Lectures required
1.	Introduction	Introduction about the subject	2
	Ecological Factors	**1. Soil** ✓ General account ✓ Composition of soil ✓ Types of water in soil ✓ Soil moisture ✓ Water holding capacities of different soils ✓ Adaptations in relation to soil ✓ Soil formation	3
		2. Light factor ✓ General account ✓ Photoperiodism	1
		3. Environmental temperature factor ✓ Regulation of physiological process ✓ Effect on vegetation pattern and composition	1
		4. Concept of limiting factors ✓ Leibig Blackman's law of minimum ✓ Shelford's law of tolerance	2
		5. Adaptations of hydrophytes and xerophytes ✓ Morphological and anatomical features of hydrophytes and xerophytes	2
	Plant communities	**1. Plant communities** ✓ Characteristics ✓ Ecotone and edge effect	2
		2. Succession ✓ Process & Types ✓ Theories of succession ✓ Hydrosere	3

5.	**Pteridophytes**	1. Pteridophytes ✓ Introduction ✓ General characteristics ✓ Classification	2
		2. Early land plants ✓ Cooksonia ✓ Rhynia	2
		3. Classification (upto family), morphology, anatomy and reproduction ✓ Selaginella ✓ Equisetum ✓ Pteris	2
		4. Heterospory and seed habit	1
		5. Ecological and economic importance of pteridophytes	1
	Gymnosperms	1. Gymnosperms ✓ Introduction ✓ General characteristics ✓ Classification	2
		2. Classification (upto family), morphology, anatomy, and reproduction ✓ Cycas ✓ Pinus	3
		3. Ecological and economical importance	1
			Total-14

		✓ Reproduction 2. Classification of Fungi 3. True Fungi ✓ General characteristics ✓ Ecology & significance 4. Life cycles ✓ Rhizopus ✓ Penicilium ✓ Alternaria ✓ Puccinia ✓ Agaricus 5. Symbiotic associations ✓ Lichens ✓ Types of lichens ✓ Genral account ✓ Reproduction ✓ Significance of symbiotic associations 6. Mycorrhiza ✓ General introduction ✓ Ectomycorrhiza ✓ Endomycorrhiza ✓ Significance	2 1 3 2 1
			Total-12
4.	**Introduction to Archegoniate**	1. Archegoniates ✓ Unifying features of archegoniates ✓ Transition to land habit ✓ Alternation of generation	2
	Bryophytes	1. Bryophytes ✓ General characteristics ✓ Adaptation to land habit ✓ Classification ✓ Range of thallus organization 2. Classification (upto family), morphology, Anatomy & Reproduction ✓ Marchantia ✓ Funaria 3. Ecology and economic importance of bryophytes	4 4 2
			Total-12

B.Sc. Semester- I
Biodiversity (Microbes, Algae, Fungi and Archegoinate)

S.No.	Units	Topics	Lectures required
1.	**Microbes**	1. Viruses ✓ Introduction ✓ Discovery ✓ General structure ✓ Replication (general account) ✓ DNA virus (T-phage) ✓ Lytic & Lysogenic cycle ✓ RNA virus (TMV) ✓ Economic importance 2. Bacteria ✓ Introduction ✓ Discovery ✓ General characteristics ✓ Cell structure ✓ Bacterial Reproduction- Vegetative, Asexual and Recombination (Conjugation, Transformation & Transduction) ✓ Economic importance	5 5
			Total-10
2.	**Algae**	1. Algae ✓ General Characteristics ✓ Ecology and distribution ✓ Range of thallus organization ✓ Reproduction in algae 2. Classification of Algae 3. Morphology and life cycles of the following algae ✓ Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Fucus, Polysiphonia 4. Economic importance of bacteria	4 2 5 1
			Total-12
3.	**Fungi**	1. Introduction ✓ General characteristics ✓ Ecology & Significance ✓ Range of Thallus Organization ✓ Cell wall composition ✓ Nutrition	3

		2. Selection methods ✓ For Self pollinated ✓ For cross pollinated ✓ For vegetatively propagated plants	3
		3. Hybridization- Procedure, advantages & limitations ✓ For self pollinated ✓ For cross pollinated ✓ For vegetatively propagated plants	3
	Quantitative Inheritance	1. **Quantitative Inheritance** ✓ Concept ✓ Mechanism ✓ Examples ✓ Monogenic v/s Polygenic inheritance	2
			Total-16
5.	**Inbreeding depression and heterosis**	**1. Inbreeding depression** ✓ Introduction ✓ History ✓ Genetic basis of inbreeding depression	2
		2. Heterosis ✓ Introduction ✓ Genetic basis of Heterosis ✓ Applications	2
	Crop improvement and breeding	**1. Crop Improvement & breeding** ✓ Introduction ✓ Mutation and its role in crop improvement and breeding ✓ Polyploidy ✓ Distant hybridization ✓ Role of biotechnology in crop improvement	4
			Total- 8

		✓ Bridges experiment ✓ Coupling and repulsion ✓ Recombination frequency ✓ Genetic mapping **2. Crossing over** ✓ Concept ✓ Crossing over in maize ✓ Mechanism of crossing over ✓ Types of crossing over ✓ Significance of crossing over	4
			Total-12
3.	**Mutation and Chromosomal Aberrations**	**1. Mutation** ✓ Introduction ✓ General Characterstics ✓ Role of mutation ✓ Molecular basis of gene mutation ✓ Error in DNA replication ✓ Mutagens- Physical & Chemical **2. Numerical Chromosomal Changes** ✓ Euploidy ✓ Polyploidy ✓ Aneuploidy **3. Structural Chromosomal changes & its effect on genetic level** ✓ Deletions ✓ Duplications ✓ Inversions ✓ Translocations	2 1 1
			Total- 4
4.	**Plant Breeding**	**1. Plant Breeding** ✓ General Introduction ✓ History of Plant breeding ✓ Nature of plant breeding ✓ Objectives **2. Breeding systems** ✓ Modes of Reproduction ✓ Pollination control ✓ Activities in plant breeding ✓ Some important achievements ✓ Undesirable consequences	2 3
	Methods of Crop Improvement	1. **Introduction** ✓ Centres of origin ✓ Domestication of crop plants ✓ Plant genetic resources ✓ Acclimatization	3

B.Sc. Semester- VI
Genetics and Plant Breeding

S.No.	Units	Topics	Lectures Required
1.	**Heredity**	**1. Brief life history of Mendel** ✓ Seven traits of pea plant	1
		2. Terminologies	1
		3. Laws of Inheritance ✓ Law of Dominance, Law of Segregation, Law of independent assortment	2
		4. Modified Mendelian ratios ✓ Lethal genes, Multiple genes, Co-dominance, Incomplete dominance, Epistasis	4
		5. Chi Square test ✓ General introduction, Formula, and its uses	2
		6. Pedigree Analysis ✓ Autosomal linked, X-linked pedigree	3
		7. Cytoplasmic Inheritance ✓ General account, Maternal effect, maternal inheritance, Shell Coiling in Snail, Kappa particles in Paramecium, leaf variegation in Mirabilis jalapa, Male sterility	3
		8. Multiple Allelism ✓ ABO blood group system & Rho blood group	2
		9. Pleitropism & Chromosome theory of inheritance	2
			Total- 20
2.	**Sex determination And Sex-Linked Inheritance**	**1. Sex determination & Sex-Linked inheritance** ✓ In Humans ✓ In Plants	2
	Linkage and Crossing over	1. **Linkage** ✓ Concept and history ✓ Types of Linkage	6

		3. Translation ✓ General account, Translation of mRNA, Polysomes, Post-Translational modifications, Ribosomes and their role in protein synthesis, General account of genetic code	3
	Regulation of Gene Expression	**1. Gene Expression** ✓ Mechanism of gene expression, Control of gene expression in prokaryotes	2
		2. Lac operon ✓ Components of Lac operon, Functioning of operon	2
		3. Tryptophan operon model	1
			Total-12

		model) ✓ Lipid fluidlty pf membrane ✓ Semi-permiability of Membrane ✓ Functions **2. Cell Wall** ✓ Introduction ✓ Structure ✓ Chemical Nature of cell wall ✓ Functions of cell wall **3. Cell Cycle** ✓ Overview of Cell cycle ✓ Mitosis- Stages of Mitosis, Significance of mitosis ✓ Meiosis- Stages & its significance ✓ Difference b/w Mitosis & Meiosis ✓ Molecular controls	**2** **5**
			Total-12
4.	**Genetic Material**	**1. DNA** 2. Miescher to watson & Crick- Historic perspective, Griffith's & Avery's transformation experiments, evidences from bacterial transformation, Hershey Chase bacteriophage experiment, Structure of DNA, Types of DNA, Pallindromic DNA, Repetitive DNA, Types of genetic material, Difference b/w DNA & RNA **3. DNA Replication** ✓ Semi conservative method of DNA replication, DNA replication in prokaryotes, DNA replication in eukaryotes, Enzymology of DNA replication, Replication models, Semi discontinous RNA priming.	**3** **3**
			Total-6
5.	**Transcription (Prokaryotes & Eukaryotes)**	**1. RNA** ✓ Types of RNA (mRNA, tRNA, rRNA), types of RNA polymerase. **2. Transcription** ✓ Introduction, Molecular mechanism of transcription, promoter region, TATA box, Difference in RNA transcription in Prokaryotes & Eukaryotes, RNA processing, Reverse transcription	**1** **3**

		✓ Synthesis of protein within mitochondria **2. Chloroplast** ✓ Introduction, Ultrastructure, marker enzymes ✓ Composition ✓ Chloroplast as semiautonomous organelle ✓ Chloroplast DNA ✓ Functions of Chloroplast **3. Endoplasmic Reticulum** ✓ Introduction, Ultrastructure of ER, Types of ER, Functions **4. Golgi bodies** ✓ Introduction, Ultrastructure & Functions **5. Lysosomes** ✓ Introduction, Structure, Types, Functions & Lysosomal diseases **6. Peroxisomes & Glyoxysomes** ✓ Occurrence, Structure, Functions & biogenesis **7. Nucleus** ✓ General Introduction ✓ Ultrastructure of Nucleus ✓ Nuclear pore complex- Structure & Functions ✓ DNA Packaging- Chromatin (Heterochromatin & Euchromatin) ✓ Nucleolus- Structure, composition & functions ✓ Ribosomes- Types, Structure & Functions	3 2 2 2 3 5
			Total- 22
3.	**Cell Membrane & Cell Wall**	**1. Plasma Membrane** ✓ Introduction, Composition of Plasma membrane (Carbohydrates, Proteins, Lipids & their functions) ✓ Structure ✓ Models of plasma membrane (Lipid bilayer model, Danielle danson model, Robertson unit membrane model, Fluid mosaic	5

B.Sc. V Semester
Cell and Molecular Biology

S.No.	Units	Topics	Lectures Required
1.	Techniques in Biology	**1. Principles of Microscopy** ✓ Magnification power, Resolving power, Factors affecting resolving power	1
		2. Light Microscopy ✓ Parts of Microscope ✓ Bright field microscope ✓ Dark field microscope ✓ Sample preparation for light microscopy	1
		3. Phase Contrast Microscopy ✓ Working principle & its Uses	1
		4. Fluorescence microscopy ✓ Working principle & its uses	1
		5. Confocal Microscopy ✓ Working principle & its uses	1
		6. Electron microscopy ✓ Types of electron microscope ✓ Working- Transmission electron microscope & Scanning electron microscope ✓ Sample preparation of electron microscope	2
		7. X-Ray diffraction analysis ✓ Principle & its uses	1
			Total-8
8.	Cell as a unit of Life	**1. Cell** ✓ The Cell Theory ✓ Prokaryotic & Eukaryotic cells ✓ Cell Size & shape ✓ Components of Eukaryotic cell	2
	Cell Organelles	**1. Mitochondria** ✓ Introduction, Ultrastructure, marker enzymes, oxysomes, functions of mitochondria ✓ Composition ✓ Semiautonomous nature ✓ Symbiotic hypothesis	3

			Total-6
5.	**Role of Plants in relation to human welfare (b)**	1. **Forestry** ✓ What is forestry? ✓ General introduction ✓ Importance of forestry ✓ Its utilization ✓ Commercial aspects	2
		2. Wood ✓ What is wood? ✓ General account ✓ Different types of wood and its function ✓ Seasoning of wood ✓ Defects of wood	2
		3. **Ornamental plants of India** ✓ General account ✓ Different ornamental plants found in India ✓ Importance or Uses	2
			Total-6

		3. Biodiversity legislation and conservation, Biodiversity information management and communication	**1**
			Total-6
3.	**Conservation of Biodiversity**	**1. Conservation** ✓ Genetic diversity ✓ Species diversity ✓ Ecosystem diversity **2. Types of conservation** ✓ In-situ conservation- Introduction and examples ✓ Ex-situ conservation- Introduction and examples **3. Social approaches to conservation and Biodiversity awareness programmes** **4. Sustainable development** ✓ Introduction ✓ Need of sustainable development ✓ Conferences & projects regarding sustainable development	**1** **2** **1** **2**
			Total-6
4.	**Role of plants in relation to human welfare (a)**	**1. Cereals** ✓ Wheat - General account and its role ✓ Rice- General account and its role **2. Pulses** ✓ General account ✓ Examples ✓ Role **3. Fruits** ✓ General account ✓ Examples ✓ Types of fruit ✓ Role **4. Alcoholic beverages** ✓ General account ✓ Distilled beverages ✓ Non-distilled beverages ✓ Role	**2** **2** **1** **1**

B.Sc. Semester- IV

Skill Enhancement Course
Plant Diversity and Human Welfare

S.No.	Units	Topics	Lectures Required
1.	Plant diversity and its scope	**1. Biodiversity** ✓ General Introduction ✓ Genetic diversity ✓ Species diversity ✓ Plant diversity at the ecosystem level	2
		2. Agrobiodiversity ✓ General introduction ✓ Cultivated plant taxa ✓ Wild taxa	2
		3. Values and uses of biodiversity ✓ Ethical and Aesthetic value ✓ Precautionary principle ✓ Methodologies for valuation ✓ Uses of plants ✓ Uses of microbes	2
			Total-6
2.	Loss of Biodiversity	**1. Loss of Biodiversity** ✓ Loss of genetic diversity ✓ Loss of species diversity ✓ Loss of ecosystem diversity ✓ Loss of Agrobiodiversity	1
		2. Projected scenario for biodiversity loss	1
	Management of Plant biodiversity	**1. Management** ✓ What are the needs for management? ✓ Why management is important? ✓ Organizations associated with biodiversity management	1
		2. Methodology for execution ✓ IUCN ✓ UNEP ✓ UNESCO ✓ WWF ✓ NBPGR	2

		Rhizoblum species.	
	Plant Growth Regulators	**1. Plant growth regulators** ✓ General Introduction ✓ Importance ✓ Auxin, Gibberelllins, Cytokinins, ABA, Ethylene. **2. Discovery & Physiological Roles of Plant growth regulators**	2 4
	Plant response to light and temperature	**1. Photoperiodism** ✓ Short day plants ✓ Long day plants ✓ Day neutral plants ✓ Short-long day plant & Long-short day plant ✓ Importancef light & dark period ✓ Floral horomone- Florigen **2. Phytochrome** ✓ Discovery & its structure ✓ Red & Far-red light responses on photomorphogenesis **3. Vernalization** ✓ General account ✓ Devernalization ✓ Vernalization & Gibberellins	2 2 2
			Total- 20

			Total- 12
4.	**Respiration**	**1. Respiration** ✓ Types of Respiration ✓ Respiratory Substrates	**1**
		2. Mechanism of Respiration ✓ Glycolysis ✓ TCA cycle	**2**
		3. Oxidative Phosphorylation ✓ The Chemiosmotic hypothesis ✓ Difference b/w Oxidative phosphorylation & phosphorylation	**1**
		4. Fermentation, Relation b/w Anaerobic respiration & Fermentation, Respiratory Quotients, Factors affecting the rate of respiration	**1**
		5. Glyoxylate & Oxidative Pentose Phosphate Pathway	**1**
			Total- 6
5.	**Enzymes**	**1. Structure & Properties** ✓ Introduction of Enzyme ✓ Apoenzyme & Co-factors ✓ Classification of enzymes	**1**
		2. Mechanism os enzyme catalysis ✓ Theories of Mechanism of enzyme action (Enzyme substrate complex, Lock & Key, Induced fit theory) ✓ Factors affecting enzyme action ✓ Isozymes, Zymogen ✓ Michaelis menten equation	**2**
		3. Enzyme inhibition ✓ Reversible Inhibition ✓ Non-reversible inhibition ✓ Allosteric inhibition	**1**
	Nitrogen metabolism	**1. Biological Nitrogen fixation** ✓ Nitrogen cycle ✓ Nitrogen fixing prokaryotes	**2**
		2. Nitrate & Ammonia assimilation & Nodule formation in leguminous plants by	**2**

		3. Role of essential elements ✓ Specific role of main essential elements ✓ Specific role of trace essential elements	**2**
		4. Availability of mineral salts to plants ✓ Carbonic acid exchange theory ✓ Contact exchange theory	**1**
		5. Active transport, Passive transport, carriers, channels & pumps	**2**
	Translocation in phloem	**1. Composition of phloem sap** ✓ Downward translocation ✓ Upward translocation	**2**
		2. Girdling experiment & Pressure flow model	**2**
		3. **Phloem loading & unloading**	**2**
			Total- 14
3.	**Photosynthesis**	**1. Photosynthetic pigments** ✓ Structure of Chl a, b, Xanthophylls, Carotene ✓ Mechanism of absorption of light ✓ Red drop & Emerson's enhancement effect	**3**
		2. Two pigment systems ✓ PS I & PS II ✓ Light reaction ✓ Cyclic & Non- cyclic photophosphorylation ✓ Mechanism of ATP synthesis	**4**
		3. Different pathways of carbon fixation ✓ Calvin cycle (C3) ✓ C4 cycle ✓ Difference b/w C3 & C4 cycle ✓ CAM pathway	**3**
		4. Photorespiration ✓ Photorespiration site ✓ Process of photorespiration ✓ Significance	**2**

B.Sc. IV Semester

Plant Physiology and Metabolism

S.No	Units	Topics	Lectures Required
1.	Plant water relation	1. Importance of water to plant life	1
		2. Water & its components ✓ What is water potential? ✓ Physical properties of water ✓ Plant cell as osmotic system ✓ Diffusion pressure deficit ✓ Components of water potential- Matric potential, Osmotic potential, Pressure potential	2
		3. Transpiration & its Significance ✓ What is Transpiration? ✓ Types of transpiration ✓ Measurement of transpiration by different methods ✓ Mechanism of stomatal opening & closing ✓ Difference b/w Transpiration & Evaporation ✓ Significance of Transpiration	3
		4. Factors affecting transpiration ✓ Plant factors ✓ Environmental factors	1
		5. Root Pressure, Guttation, Difference b/w transpiration & guttation, Anti-transpirants & its role	1
			Total- 8
2.	Mineral Nutrition	1. Essential elements ✓ Major elements ✓ Micro elements	2
		2. Criteria of essentiality of elements	1

		✓ Development ✓ Seed appendages ✓ Seed dispersal mechanism- by wind, water, animals etc	
			Total- 16
5.	**Embryo and Endosperm**	**1. Endosperm** ✓ Introduction ✓ Structure and its types ✓ Histology and functions	**3**
		2. Embryo ✓ Embryo development in dicotyledons ✓ Embryo development in monocotyledons ✓ Embryo- Endosperm relationship	**5**
	Apomixis and Polyembryony	**1. Apomixis** ✓ Definition ✓ Non- recurrent apomixis ✓ Recurrent apomixis ✓ Parthenogenesis ✓ Apospory ✓ Significance	**4**
		2. Polyembryony ✓ Definition ✓ Types ✓ Causes & Significance ✓ Experimental induction of polyembryony	**4**
			Total- 16

		2. **Role of cambium in secondary growth in root & stem** 3. **Wood-** types, formation and uses	4 2
			Total- 12
3 .	**Adaptive and protective systems**	1. **Epidermis, Cuticle & Stomata** ✓ General account ✓ Functions 2. **Adaptation of Xerophyte & Hydrophytes** ✓ General account ✓ Morphological & Anatomical features ✓ Difference b/w Xerophytes & Hydrophytes	4 4
			Total-8
4.	**Structural organization of flower**	1. **Structure of Anther & Pollen** ✓ Mature anther- Structure ✓ Structure of pollen- pollen viability, pollen germination 2. **Ovule** ✓ Structure ✓ Types of ovules ✓ Embryo sac- Types ✓ Organization and ultra structure of mature embryo sac	3 5
	Pollination & Fertilization	1. **Pollination** ✓ Definition ✓ Types of pollination ✓ Mechanism of pollination ✓ Attraction and rewards of pollinators ✓ Self- incompatibility 2. **Fertilization** ✓ General account ✓ Double fertilization and its significance 3. **Seed** ✓ Seed and its structure	3 2 3

B.Sc. Semester-III

Plant Anatomy and Embryology

S.No	Units	Topics	Lectures Required
1.	**Meristematic and Permanent Tissue**	**1. Meristematic Tissue** ✓ General Characterstics ✓ Role ✓ Types of Meristem	1
		2. Root Apical Meristem ✓ General introduction ✓ Theories regarding the root apical meristem	2
		3. Shoot Apical Meristem ✓ General introduction ✓ Theories regarding the shoot apical meristem	2
		4. Permanent tissue ✓ General characteristics ✓ Types of Permanent tissue ✓ Simple permanent tissue- Characteristics, types, functions. ✓ Complex permanent tissue- Characteristics, types, functions.	3
			Total- 8
2.	**Organs**	**1. Anatomy of dicot plant** ✓ Structure of dicot root, stem and leaf	2
		2. Anatomy of monocot plant ✓ Structure of monocot root, stem and leaf ✓ Difference b/w dicot and monocot structures	2
	Secondary Growth	**1. Vascular cambium** ✓ Origin, structure and function ✓ Seasonal activity	2

			Total-10

	Taxonomic evidences	✓ Flora ✓ Keys- Single access and multi access **1. Taxonomic evidences** ✓ General introduction ✓ Taxonomical evidences from palynology, cytology, phytochemistry, and molecular data	5
			Total-12
4.	**Botanical Nomenclature**	**1.Botanical Nomenclature** ✓ General introduction ✓ Rules of nomenclature ✓ Principles of ICBN ✓ Ranks & Names ✓ Typification ✓ Author citation and valid publication ✓ Principles of priority and its limitations	4
	Classification	**1.Types of Classification** ✓ Bentham and Hooker's system of classification ✓ Engler and Prantl's system of classification	4
	Biometrics, Numerical taxonomy, and cladistics	**1.Characters** ✓ Variations ✓ Operational Taxonomic units ✓ Selection of Characters **2. Coding of Characters and cluster analysis** 3. **Phenograms & Cladograms** ✓ Definition ✓ Differences	1 1 1
			Total-11
5.	**Families**	**1.Taxonomy, important distinguishing characters, classification and economic importance of the following families** ✓ Ranunculaceae, Papaveraceae, Caryophyllaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Solanaceae, Apocynaceae, Asclepidiaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Poaceae	10

		✓ Xerosere	
			Total- 17
2.	**Ecosystem**	**1. Structure of Ecosystem** ✓ General Introduction ✓ Components of Ecosystem	1
		2. Energy flow 3. Food chain & Food web ✓ General introduction ✓ Types of Food chain	1
		4. Ecological pyramids ✓ Pyramid of Number ✓ Pyramid of Biomass ✓ Pyramid of energy	2
		5. Production and productivity ✓ Introduction ✓ Primary production processes ✓ Productivity in different ecosystem	1
		6. Biogeochemical cycles ✓ Introduction ✓ Cycling of carbon, nitrogen & phosphorus	2
	Phytogeography	**1. Principle Biogeographical zones** 2. Endemism	2 1
			Total- 10
3.	**Introduction to plant taxonomy**	**1. Taxonomy** ✓ Definition & Classification ✓ Identification & Nomenclature ✓ Identification keys	2
	Taxonomic Hierarchy	**1. Ranks, categories and taxonomic groups**	1
	Identification	**1. Herbarium** ✓ Definition ✓ Some important herbaria of the world and india ✓ Functions of herbarium ✓ Botanical gardens	2
		2. Documentations	2

Day-2 → Smog formation

Day-3 → Oxides of N & C & their effect

Day-4 → Oxides of S & O & their effect

Day-5 → Petroleum & Minerals.

Day-6 → Pollution by Chemicals, Chlorofluorohydro-carbons.

Day-7 → Analytical Methods to Measure Air pollutants

Day-8 → Continous Monitoring Instruments

SEMESTER-IV

Paper-IV (Environmental Chemistry)

Unit-1 → Environment

Day-1 → Introduction & Composition of atmosphere

Day-2 → Vertical temperature & Vertical stability atmosphere.

Day-3 → Heat Budget of Earth Atmospheric System.

Day-4 → Biogeochemical Cycle of Carbon.

Day-5 → Biogeochemical Cycle of Nitrogen & Phosphorus.

Day-6 → Cycle of Sulphur & Oxygen

Day-7 → Biodistribution of Elements.

~~Day 8~~ →

Unit-4 → Atmosphere

~~Day~~-1 → Chemical & Photochemical reactions in atmosphere.

Day-2 → Exergonic & Endergonic Reactions.

Day-3 → Hydrolysis of ATP & Synthesis of ATP from ADP.

Bioinorganic Chemistry

Bioenergetics & ATP Cycles

Day-1 → DNA Polymerisation.

Day-2 → Metal Complexes in transmission of Energy.

Day-3 → Glucose Storage & Chlorophyll.

Day-4 → Photosystem I & II

Day-5 → Model System.

SEMESTER-III

Paper-III (Bioinorganic, Bioorganic, BioPhysical Chemistry-I)

⇒ BioPhysical Chemistry

Unit → Biological Cells & its Constituents, Cell Membrane & Transport of ions

Day-1 → Biological Cells, Enzymes.
Day-2 → Structure & function of Proteins
Day-3 → DNA & RNA in living system
Day-4 → Helix Coil transition
Day-5 → Structure & function of Cell Membrane
Day-6 → Ion transport through Cell Membrane

Unit → Bio Energetics

Day-1 Standard free Energy Change in biological reactions.

Day-4 Reactivity for aliphatic & aromatic su
at a bridgehead

Day-5 → Reactivity in the attacking radicals & the Effect of solvent on reactivity

Day-6 → Allylic halogenation (NBS)

Day-7 → Oxidation of aldehydes to Carboxylic acid & Auto-oxidation

Day-8 → Coupling of alkynes & arylation of Aromatic Compounds.

Day-9 → Sandmeyer Reaction

Day-10 → Hunsdiecker Reaction

SEMESTER-II

Paper-II [Organic Chemistry]

Unit-I → [Aromatic Electrophilic Substitution]

Day-1 → Orientation & Reactivity, Energy Profile diagram.

Day-2 → Ortho-Para Ratio, ipso attack, Orientation in other ring system.

Day-3 → Reactivity in Substrate & Electrophile

Day-4 → Vilsmeir Haak reaction, Gattermann Koch Reaction

Day-5 → Diazonium Coupling.

Unit-III → Free Radical Reaction

Day-1 Types of free Radical Reaction

Day-2 Free Radical Substitution Mechanism

Day-3 Mechanism of an aromatic Substrate

Day-3 Irving-William Series & Chelate effect

Day-4 Factors affecting stability of Metal Complexes w.r.t. to Nature of Metal & ligand

Day-5 Detection of Complextion in solution

Day-6 Determination of binary formation Constant by PH-Metry Method

Day-7 Determination of binary formation Constant by Spectrophotometric Method

LESSON PLAN [M.Sc.- CHEMISTRY]

SEMESTER- I

Paper- I [Inorganic Chemistry]

Unit-1 → Stereochemistry & Bonding in Main Group Compounds

Day-1 → VSEPR Model & shortcomings

Day-2 → Hybridization & three Center bonds.

Day-3 → Bents Rule & Energetics of hybridization

Day-4 → $P\pi - P\pi$, $P\pi - d\pi$ bonding

Day-5 & 6 → Walsh diagram for tri- & tetra atomic molecules.

Unit-II → Metal - Ligand Equilibria in Solution

Day-1 → Thermodynamic & Kinetic Stability of Complexes.

Day-2 → Stepwise & Overall formation Constant & their interaction


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