

Department of Physics

Lesson Plan

Name of the Course **PHYSICS-DSC 1A: MECHANICS (Credits: Theory-04)**

Code **PHYS101TH**

Unit-I

Ordinary Differential Equations: 1 st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. Coordinate systems and motion of a particle: Volume, velocity and acceleration in Cartesian and Spherical co-ordinate systems, Solid angle. Space Time Symmetry and Conservation Laws: Relationship of conservation laws and symmetries of space and time. Frames of Reference: Inertial frames of reference, Galilean transformation and Galilean invariance. Non-inertial frames, Coriolis force and its applications; Foucault's pendulum.

Unit-II

Gravitation and Inverse Square Force Law: Newton's Law of Gravitation, Various forces in nature (qualitative). Central and non-central forces, Inverse square force, Centre of mass. Equivalent one body problem. Reduced mass, angular momentum in central force field. Equation of motion under a force law. Equation of orbit and turning points. relationship between eccentricity and energy, Kepler's laws., Basic idea of global positioning system (GPS).

Unit-III

Rotational Motion and Kinematics of Elastic and Inelastic Collisions: Angular velocity, angular momentum, Torque, Conservation of angular momentum, Elastic and inelastic collisions, coefficient of restitution, Elastic collisions in laboratory and C.M. systems, Velocities, angle and energies in elastic collisions in C.M. and lab. Systems, Classical Scattering: Cross- section for elastic scattering, Rutherford scattering (with derivation).

Unit IV

Special Theory of Relativity: Concept of stationary universal frame of reference and search for ether. Michelson- Morley experiment, postulates of special

theory of relativity. Lorentz transformations. Observer in relativity. Relativity of simultaneity. (8 Lectures) Effects of Relativity: Length contraction. Time dilation. Relativistic addition of velocities. Relativistic Doppler effect. Variation of mass with velocity and mass energy equivalence. Increase of mass in an inelastic collision, Relativistic momentum and energies. Transformation of momentum, energy. Minkowsky space.

Reference Books:

- University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Mechanics, D.S. Mathur, S. Chand and Company Ltd.
- An Introduction to Mechanics, Kleppner, Tata Macgraw Hill.

S.No	Month	Topic	No. of lectures	Methods
1.	Last week of July and August	Ordinary Differential Equations: 1 st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. Coordinate	15	Lecture Method through chalk and talk , slide presentation of various topics and providing e-resources.

		<p>systems and motion of a particle: Volume, velocity and acceleration in Cartesian and Spherical co-ordinate systems, Solid angle. Space Time Symmetry and Conservation Laws: Relationship of conservation laws and symmetries of space and time. Frames of Reference: Inertial frames of reference, Galilean transformation and Galilean invariance. Non-inertial frames, Coriolis force and its applications; Foucault's pendulum.</p> <p>Special Theory of Relativity: Concept of stationary</p>		
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		<p>universal frame of reference and search for ether. Michelson-Morley experiment, postulates of special theory of relativity. Lorentz transformations. Observer in relativity. Relativity of simultaneity. Effects of Relativity: Length contraction. Time dilation. Relativistic addition of velocities. Relativistic Doppler effect. Variation of mass with velocity and mass energy equivalence. Increase of mass in an inelastic collision, Relativistic momentum and energies.</p>		
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		Transformation of momentum, energy. Minkowsky space.		
3.	November	Gravitation and Inverse Square Force Law: Newton's Law of Gravitation, Various forces in nature (qualitative). Central and non-central forces, Inverse square force, Centre of mass. Equivalent one body problem. Reduced mass, angular momentum in central force field. Equation of motion under a force law. Equation of orbit and turning points. relationship between eccentricity and energy, Kepler's laws., Basic idea	15	Lecture Method through chalk and talk , slide presentation of various topics and providing e-resources.

		of global positioning system (GPS).		
4.	December and February	Rotational Motion and Kinematics of Elastic and Inelastic Collisions: Angular velocity, angular momentum, Torque, Conservation of angular momentum,; Elastic and inelastic collisions, coefficient of restitution, Elastic collisions in laboratory and C.M. systems, Velocities, angle and energies in elastic collisions in C.M. and lab. Systems, Classical Scattering: Cross- section for elastic scattering,	15	Lecture Method through chalk and talk , slide presentation of various topics and providing e-resources.

		Rutherford scattering (with derivation).		
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Name of the Course PHYSICS-DSC 1B: ELECTRICITY, MAGNETISM AND EMT.

Lesson Plan

Code PHYS102TH

Unit-I

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem, Stokes's theorem, Green's theorem. Electrostatics: Significance of electrostatic force, Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor, electrostatic potential, electrostatic potential energy. Electric potential due to a dipole and quadrupole, long uniformly charged wire, charged disc. Electric potential energy. Electric field as a gradient of a scalar potential. Calculation of electric field due to a point charge and a dipole from potential. Method of Electrical Images. Poisson and Laplace equations. Electric Current and Fields of Moving charges: Current and current density. Continuity equation; $\nabla \cdot \mathbf{J} + \partial\rho/\partial t = 0$. Microscopic form of Ohm's law ($\mathbf{J} \propto \mathbf{E}$) and conductivity. Failure of Ohm's law and its explanation. Invariance of charge.

Unit-II

Magnetism: Ampere circuital law and its applications. Hall Effect, Expression for Hall constant and its significance. Divergence and curl of magnetic field \mathbf{B} . Vector potential: Definition of vector potential \mathbf{A} and derivation. (5 Lectures) Field of Moving Charges: \mathbf{E} in different frames of reference. Field of a point charge moving with constant velocity. Field of charge that starts or stops (qualitative). Interaction between moving charge and force between parallel currents. Surface current density: Definition. and its use in calculation of

change in magnetic field at a current sheet. Transformation equations of E and B from one frame of reference to another. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Clausius - Mossotti equation, boundary conditions satisfied by E and D at the interface between two homogenous dielectrics, illustration through a simple example.

Unit-III Electrostatic Fields in Dielectrics: Polarization of matter. Atomic and molecular dipoles, induced. Dipole moment and atomic polarizability. Electric susceptibility and polarization vector. Capacity of a capacitor filled with Dielectrics. Dielectrics and Gauss's law Displacement vector. Establishment of relation $\nabla \cdot D = \rho_{\text{free}}$. Energy stored in a dielectric medium. Magnetic Fields in Matter: Behavior of various substances in magnetic fields. Definition of M and H and their relation to free and bound currents. Magnetic permeability and susceptibility and their interrelation. Orbital motion of electrons and diamagnetism. Electron spin and paramagnetic. Ferromagnetism. Domain theory of ferromagnetism, magnetization curve, hysteresis loss, ferrites.

Unit-IV

Maxwell's equations and Electromagnetic wave propagation: Displacement current, Maxwell's equations and its physical interpretation, EM waves and wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma = 0$. Poynting vector, Poynting theorem, Impedance of a dielectric to EM waves, EM waves in conducting medium and skin depth. EM waves velocity in a conductor and anomalous dispersion. Reflection and Transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence of reflection of EM waves from the surface of a conductor at normal incidence.

Reference Books:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

- Introduction to Electrodynamics, D.J. Griffith, 3rd Edition, Prentice Hall of India.
- Electricity and Magnetism, Brij Lal and Subramaniam, S. Chand & Co. Ltd.
- Electricity and Magnetism, A S Mahajan and A A Rangwala, Tata McGraw Hill Co.

S.No	Month	Topic	No. of lectures	Method
1.	Last week of July and August	Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem, Stokes's theorem, Green's theorem. Electrostatics: Significance of electrostatic force, Electrostatic Field, electric flux, Gauss's theorem of	15	Lecture Method through chalk and talk , slide presentation of various topics and providing e-resources.

		<p>electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor, electrostatic potential, electrostatic potential energy. Electric potential due to a dipole and quadrupole, long uniformly charged wire, charged disc. Electric potential energy. Electric field as a gradient of a scalar potential. Calculation of electric field due to a point charge and a dipole from potential. Method of Electrical Images. Poisson</p>		
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		<p>and Laplace equations.</p> <p>Electric Current and Fields of Moving charges: Current and current density. Continuity equation; $\nabla \cdot \mathbf{J} + \partial \rho / \partial t = 0$.</p> <p>Microscopic form of Ohm's law ($\mathbf{J} \propto \mathbf{E}$) and conductivity.</p> <p>Failure of Ohm's law and its explanation.</p> <p>Invariance of charge.</p>		
2.	September and October	<p>Magnetism: Ampere circuital law and its applications. Hall Effect, Expression for Hall constant and its significance. Divergence and curl of magnetic field \mathbf{B}. Vector potential: Definition of vector potential \mathbf{A} and</p>	15	<p>Lecture Method through chalk and talk , slide presentation of various topics and providing e-resources.</p>

		<p>derivation. Field of Moving Charges: E in different frames of reference. Field of a point charge moving with constant velocity. Field of charge that starts or stops (qualitative). Interaction between moving charge and force between parallel currents. Surface current density: Definition. and its use in calculation of change in magnetic field at a current sheet. Transformation equations of E and B from one frame of reference to another. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and</p>		
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		<p>polarization vector, displacement vector D, molecular interpretation of Clausius - Mossotti equation, boundary conditions satisfied by E and D at the interface between two homogenous dielectrics, illustration through a simple example.</p>		
3.	November	<p>Electrostatic Fields in Dielectrics: Polarization of matter. Atomic and molecular dipoles, induced. Dipole moment and atomic polarizability. Electric susceptibility and polarization vector. Capacity of a capacitor</p>	15	<p>Lecture Method through chalk and talk , slide presentation of various topics and providing e-resources.</p>

		<p>filled with Dielectrics.</p> <p>Dielectrics and Gauss's law</p> <p>Displacement vector.</p> <p>Establishment of relation $\nabla \cdot D = \rho_{\text{free}}$. Energy stored in a dielectric medium.</p> <p>Magnetic Fields in Matter: Behavior of various substances in magnetic fields.</p> <p>Definition of M and H and their relation to free and bound currents.</p> <p>Magnetic permeability and susceptibility and their interrelation.</p> <p>Orbital motion of electrons and diamagnetism.</p> <p>Electron spin and paramagnetic.</p> <p>Ferromagnetism.</p> <p>Domain theory of</p>		
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		ferromagnetism, magnetization curve, hysteresis loss, ferrites.		
4.	December and February	Maxwell's equations and Electromagnetic wave propagation: Displacement current, Maxwell's equations and its physical interpretation, EM waves and wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma = 0$. Poynting vector, Poynting theorem, Impedance of a dielectric to EM waves, EM waves in conducting medium and skin depth. EM waves velocity in a conductor and	15	Lecture Method through chalk and talk, slide presentation of various topics and providing e-resources.

		<p>anomalous dispersion.</p> <p>Reflection and Transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence of reflection of EM waves from the surface of a conductor at normal incidence.</p>		
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Department of Physics

Lesson Plan

Class –Bsc. 2nd year Course Code :- PHYS201TH **Nomenclature:** STATISTICAL AND THERMAL PHYSICS

Syllabus

Unit-I Basic Ideas of Statistical Physics: Scope of statistical physics, basic ideas about probability, distribution of four distinguishable particles in two compartments of equal sizes. Concept of macro-states, micro-states, thermodynamic probability, effect of constraints on the system. Distribution of Particles in Compartments: Distribution of n particles in two compartments, Deviation from the state of maximum probability. Equilibrium state of a dynamic system, distribution of n distinguishable particles in k compartments of unequal sizes.

Unit-II Types of Statistics in Physics: Phase space and division into elementary cells. Three kinds of statistics. The basic approach in the three statistics. M-B. Statistics applied to an ideal gas in equilibrium, experimental verification of the Maxwell Boltzmann's law of distribution of molecular speeds. Need for quantum statistics, h as a natural constant and its implications, indistinguishability of particles and its implications. B-E statistics, Bose Einstein and Fermi Dirac Statistics: Derivation of Planck's law of radiation, deduction of Wien's distribution law and Stefan's law from Planck's law. Fermi-Dirac statistics. Applications to liquid helium, free electrons gas (Fermi level and Fermi Energy), Comparison of M-B, B-E, F-D statistics

Unit-III Entropy and Laws of Thermodynamics: Application of thermodynamics to the thermoelectric effect, change of entropy along a reversible path in a p-v diagram, entropy of a perfect gas, equation of state of ideal gas from simple statistical considerations, heat death of the universe. Statistical Interpretation of entropy: Statistical definition of entropy, change of entropy of system, additive nature of entropy, law of increase of entropy. Reversible and irreversible processes, example of reversible and irreversible processes. Work done in a reversible process, example of entropy in natural process, entropy and disorder.

Unit-IV Maxwell's Thermodynamic Relations and Their Applications: Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Derivation of Maxwell's thermodynamic relations.

Applications of thermodynamics relations. Cooling produced by adiabatic stretching, adiabatic compression, adiabatic Stretching of a wire, stretching of thin films, change of internal energy with volume. Clausius-Clapeyron Equation, Thermodynamical treatment of Joule-Thomson effect for liquification of Helium. Production of very low temperatures by adiabatic demagnetization, TdS equations.

Reference Books: • Statistical Physics and Thermodynamics, V.S. Bhatia, Sohan Lal Nagin Chand & Co, 1986, Jalandhar. • Statistical Mechanics, R.K. Patharia, 2nd Edition, Butterworth-Heinemann. • Introduction to Statistical Mechanics,

B. B. Laud,(1988), Macmillan India Limited • Statistical Physics, Berkley Physics Course, Vol. 5, F. Rief, Mc-Graw Hill Book Company. • Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill. • Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications. • Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa • University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole. • Thermal and Statstical Physics, Brij Lal and Subrahmanyam, S. Chand & Co. Ltd. • Introduction to Statistical Mechanics, B. B. Laud,(1988), Macmillan India Limited • Statistical Physics, Berkley Physics Course, Vol. 5, F. Rief, Mc-Graw Hill Book Company.

Sno	Month	Topic	No. Of Lectures	Methods
1	Last week of July and August	Basic Ideas of Statistical Physics: Scope of statistical physics, basic ideas about probability, distribution of four distinguishable particles in two compartments of equal sizes. Concept of macro-states, micro-states, thermodynamic probability, effect of constraints on the system. Distribution of Particles in Compartments: Distribution of n particles in two compartments, Deviation from the state of maximum probability. Equilibrium state of a dynamic system, distribution of n distinguishable particles in k compartments of unequal sizes.	16	Lecture Method through chalk & talk , slide presentation of various topics and providing e-resources
2	September	Types of Statistics in Physics: Phase space and division into elementary cells. Three kinds	16	-----do-----

		<p>of statistics. The basic approach in the three statistics. M-B. Statistics applied to an ideal gas in equilibrium, experimental verification of the Maxwell Boltzmann,,s law of distribution of molecular speeds. Need for quantum statistics, h as a natural constant and its implications, indistinguishability of particles and its implications. B-E statistics, (8 Lectures) Bose Einstein and Fermi Dirac Statistics: Derivation of Planck"s law of radiation, deduction of Wien"s distribution law and Stefan"s law from plank"s law. Fermi-Dirac statistics. Applications to liquid helium, free electrons gas (Fermi level and Fermi Energy), Comparison of M-B, B-E, F-D statistics.</p>		
3	October	<p>Entropy and Laws of Thermodynamics: Application of thermodynamics to the thermoelectric effect, change of entropy along a reversible path in a p-v diagram, entropy of a perfect gas, equation of state of ideal gas from simple statistical considerations, heat death of the universe.</p>	07	-----do-----

4.	November	Statistical Interpretation of entropy: Statistical definition of entropy, change of entropy of system, additive nature of entropy, law of increase of entropy. Reversible and irreversible processes, example of reversible and irreversible processes. Work done in a reversible process, example of entropy in natural process, entropy and disorder.	07	-----do----- --
5	December	Maxwell's Thermodynamic Relations and Their Applications: Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Derivation of Maxwell's thermodynamic relations	07	-----do-----
6	February	Applications of thermodynamics relations. Cooling produced by adiabatic stretching, adiabatic compression, adiabatic Stretching of a wire, stretching of thin films, change of internal energy with volume. Clausius-Clapeyron Equation, Thermo dynamical treatment of JouleThomson effect for liquification of Helium. Production of very low temperatures by adiabatic demagnetization, TdS equations.	07	-----do-----

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Signature of Teacher

Department of Physics

Lesson Plan

Class –Bsc. 2nd year Course Code :- PHYS202TH **Nomenclature:** WAVES AND OPTICS

Syllabus

Unit-I Simple harmonic motion: characteristics, graphical representation of SHM, phase relation between displacement, velocity and acceleration of a particle, executing SHM, SHM oscillator (mass attached to a spring placed on horizontal frictionless surface). energy of a simple harmonic oscillator. solution of the differential equation of SHM. Average kinetic energy, average potential energy and total energy. (7 Lectures)

Damped SHM: Damped oscillations. differential equation of motion of one dimensional damped harmonic mechanical oscillator. Types of damping. damped harmonic electric oscillator (differential equation and its solutions). Determination of the damping constants. Logarithmic decrement. Relaxation time. The quality factor, power dissipation in a damped harmonic oscillator when damping is weak. Relation between power dissipation energy and relaxation time of damped harmonic oscillator. (8 Lectures)

Unit-II The Forced Oscillator: Transient and steady behaviour of forced oscillator. Displacement and velocity variation with driving force frequency. Variation of phase with frequency. Power supplied to an oscillator and its variation with frequency. Q- value and band width. Q-value as an amplification factor (Phasor treatment to be followed). (4 Lectures)

Coupled Oscillators: Stiffness coupled pendulums. Normal co-ordinates and normal modes of vibration. Inductance coupling of electrical oscillators.

(3 Lectures)

Wave Motion: The type of waves. The wave equation and its solution. Characteristic impedance of a string. Impedance matching. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a string of fixed length. Energy of a vibrating string. Wave velocity and group velocity. (8 Lectures)

Unit-III Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. (3 Lectures)

Interference: Division of wavefront and division of amplitude. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer. (12 Lectures) 30

Unit-IV Diffraction: Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating, Dispersive power of diffraction grating, Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. (8 Lectures)

Polarization: Transverse nature of light waves. Unpolarized and plane polarized light, production of polarized light, Wire grid polarizer, Polaroid, Effect of intensity of light passing through Polaroid, Malus' law, double refraction; ordinary ray and extraordinary ray, positive and negative crystals, birefringence, Nicol Prism, quarter wave plate and half wave plate, Polarization by reflection (Brewster law), polarization by scattering, Circular and elliptical polarization, production of elliptically polarized and circularly polarized light. (7 Lectures)

Reference Books: • A text book of Optics, N. Subrahmanyam, B. Lal, M.N. Avadhanulu, S. Chand & Company Ltd. • Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill. • Principles of Optics, B.K. Mathur, 1995, Gopal Printing. • Fundamentals of Optics: Geometrical Physical and Quantum, D. R. Khanna, H. R. Gulati R. Chand Publication. • Optics, Eugene Hecht, Addison-Wesley 2002.

Sno	Month	Topic	No. Of Lectures	Methods
1	Last week of July and August	Simple harmonic motion: characteristics, graphical representation of SHM, phase relation between displacement, velocity and acceleration of a particle, executing SHM, SHM oscillator (mass attached to a spring placed on horizontal frictionless surface). energy of a simple harmonic oscillator. solution of the differential equation of SHM. Average kinetic energy, average potential energy and total energy. Damped SHM: Damped oscillations. differential equation of motion of one dimensional damped harmonic mechanical oscillator. Types of damping. damped harmonic electric oscillator (differential equation and its solutions). Determination of the damping constants. Logarithmic decrement. Relaxation time. The quality factor	16	Lecture Method through chalk & talk , slide presentation of various topics and providing e-resources
2	September	The Forced Oscillator: Transient and steady behaviour of forced oscillator. Displacement and velocity variation with driving force frequency. Variation of phase	16	-----do-----

		<p>with frequency. Power supplied to an oscillator and its variation with frequency. Q- value and band width. Q- value as an amplification factor (Phasor treatment to be followed).</p> <p>Coupled Oscillators: Stiffness coupled pendulums. Normal co-ordinates and normal modes of vibration. Inductance coupling of electrical oscillators.</p>		
3	October	<p>Wave Motion: The type of waves. The wave equation and its solution. Characteristic impedance of a string. Impedance matching. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a string of fixed length. Energy of a vibrating string. Wave velocity and group velocity.</p>	07	-----do-----
4.	November	<p>Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. (3 Lectures)</p> <p>Interference: Division of wavefront and division of amplitude. Young's Double</p>	07	-----do----- --

		<p>Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer.</p>		
5	December	<p>IV Diffraction: Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating, Dispersive power of diffraction grating, Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.</p>	07	-----do-----
6	February	<p>Polarization: Transverse nature of light waves. Unpolarized and plane polarized light, production of polarized light, Wire grid polarizer, Polaroid, Effect of intensity of light passing through Polaroid, Malus' law, double refraction; ordinary ray and extraordinary ray, positive and negative crystals,</p>	07	-----do-----

		birefringence, Nicol Prism, quarter wave plate and half wave plate, Polarization by reflection (Brewster law), polarization by scattering,. Circular and elliptical polarization, production of elliptically polarized and circularly polarized light.		
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Signature of Teacher

Department of Physics

Lesson Plan

Class –Bsc. 2nd year Course Code :- PHYS203TH Nomenclature: PHYSICS
WORKSHOP SKILL

Syllabus

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothing of cutting edge of sheet using file.

Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Sno	Month	Topic	No. Of Lectures	Methods
1	Last week of July and August	Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains,	04	Lecture Method through chalk & talk , slide presentation of various topics and providing e-resources
2	September	Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal	05	-----do-----

		sheets, composites and alloy, wood. Concept of machine processing,		
3	October	introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothing of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.	05	-----do-----
4.	November	Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.	05	-----do----- --
5	December	Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.	05	-----do-----
6	February	Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism,	06	-----do-----

		Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.		
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Signature of Teacher

Department of Physics

Lesson Plan

Class –Bsc. 2nd year Course Code :- PHYS205TH **Nomenclature:** ELECTRICAL CIRCUITS AND NETWORK SKILLS

Syllabus

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. (4 Lectures)

Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. (4 Lectures)

Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. (3 Lectures) Electric Motors: Single-phase, three-phase & DC motors. Basic design.

Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. (4 Lectures)

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources (3 Lectures)

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) (4 Lectures)

Electrical Wiring: Different types of conductors and cables. Basics of wiring- Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board. (5 Lectures)

Reference Books: • A text book in Electrical Technology - B L Theraja - S Chand & Co. • A text book of Electrical Technology - A K Theraja • Performance and design of AC machines - M G Say ELBS Edn.

Sno	Month	Topic	No. Of Lectures	Methods
1	Last week of July and August	Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and	05	Lecture Method through chalk & talk , slide presentation of various topics and providing e-resources

		three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.		
2	September	Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.	05	-----do-----
3	October	Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. (3 Lectures) Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.	05	-----do-----
4.	November	Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources	05	-----do----- --



GOVT POST GRADUATE COLLEGE

NALAGARH, SOLAN

Department of Botany

B.Sc. Botany

PROGRAMME OUTCOMES

After completion of the BSc Botany, the student will be able to

Knowledge and understanding of: 1. The range of plant diversity in terms of structure, function and environmental relationships. 2. The evaluation of plant diversity. 3. Plant classification and the flora of North India especially Himachal. 4. The role of plants in the functioning of the global ecosystem. 5. A selection of more specialized, optional topics.

Intellectual skills – able to: 1. Think logically and organize tasks into a structured form. 2. Assimilate knowledge and ideas based on wide reading and through the internet. 3. Transfer of appropriate knowledge and methods from one topic to another within the subject. 4. Understand the evolving state of knowledge in a rapidly developing field. 5. Construct and test hypothesis. 6. Plan, conduct and write a report on an independent term project.

Practical skills: Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules. 1. Interpreting plant morphology and anatomy. 2. Plant identification. 3. Vegetation analysis techniques. 4. A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry.

Scientific Knowledge: Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.

Problem analysis: Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

Design/development of solutions: Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

The Botanist and society: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

Environment and sustainability: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes of B.Sc. Botany

1. Critically evaluation of ideas and arguments by collection relevant information about the plants, so as recognize the position of plant in the broad classification and phylogenetic level.
2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.
3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.
4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.
5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists.
6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.
7. Students will be able to apply fundamental Physical, Chemical, and mathematical tools to the analysis of relevant biological situations.
8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, and fungi that differentiate them from each other and from other forms of life.

9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.
10. Students will be able to explain how Plants function at the level of the gene, genome, cell, tissue, Flower development. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and mode of life cycle followed by different forms of plants.
11. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.
12. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

Programme Specific Outcomes: B.Sc. Botany
First Year

Paper-I: Course: Biodiversity (Microbes, Algae, Fungi and Archegoniate) BOTA 101.

Paper-II: Plant Ecology and Taxonomy BOTA 102

On completion of the course, students are able to:

1. Understand the diversity among Algae.
2. Know the systematic, morphology and structure, of Algae. Understand the life cycle pattern of Algae.
3. Understand the useful and harmful activities of Algae.
4. Understand the Biodiversity of Fungi
5. Know the Economic Importance of Fungi
6. Understand the morphological diversity of Bryophytes.
7. Understand the economic importance of the Bryophytes.
8. Understand the morphological diversity of Bryophytes and Pteridophytes and Gymnosperms.
9. Understand the economic importance of the Bryophytes and Pteridophytes and Gymnosperms.
10. Know the evolution of Bryophytes and Pteridophytes and Gymnosperms.
11. Understand the habit of the angiosperm plant body.
12. Know the vegetative characteristics of the plant.
13. Learn about the reproductive characteristics of the plant.
14. Understand the plant morphology and basic taxonomy.

Second Year

Paper-III: Plant Anatomy and Embryology BOTA 201

Paper-IV: Plant Physiology and metabolism BOTA 202

On completion of the course, students are able to:

1. Understand the Biochemical nature of cell.
2. Know the chemical nature of biomolecules.
3. Understand the different types of interaction in Biomolecules.
4. Structure and general features of enzymes.
5. Concept of enzyme activity and enzyme inhibition.
6. Know importance and scope of plant physiology.
7. Understand the plants and plant cells in relation to water.
8. Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.
9. Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.
10. Learn about the movement of sap and absorption of water in plant body
11. Understand the plant movements.
12. Learn about the movement of sap and absorption of water in plant body.

Third Year

Paper-V: Economic Botany and Biotechnology BOTA 301

Paper-VI: Cell and Molecular Biology BOTA 303

On completion of the course, students are able to:

1. Gain knowledge about Cell Science.
2. Understand Cell wall Plasma membrane, Cell organelles and cell division.
3. Learn the scope and importance of molecular biology.
4. Understand the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.
5. Understand the process of synthesis of proteins and role of genetic code in polypeptide formation.
6. The eukaryotic cell cycle and mitotic and meiotic cell division
7. Structure and organization of cell membrane
8. Process of membrane transport and membrane models.
9. Know about the genomic organization of living organisms, study of genes genome, chromosome etc.
10. Gain knowledge about the mechanism and essential component required for prokaryotic

DNA replication.

11. Understand the fundamentals of Recombinant DNA Technology.
12. Know about the Genetic Engineering.
13. Understand the principle and basic protocols for Plant Tissue Culture.
14. The concept of operon and its structure and regulation.

Dr Neel Kant Sharma
Head, Department of Botany

Dr Sapna Sanjay Pandit
Principal, Govt Degree College,
Nalagarh Solan, HP

Tentative teaching plan
Department of Chemistry (2024-25)

BSc 1 year

Dr Anita

Methodology- Lecture-Cum-Demonstration (Using LabI+LabII)

CHEM 101 (ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS)

July

Atomic Structure

- *Review of Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation,
- *Heisenberg Uncertainty principle. Hydrogen atom spectra. Significance of ψ and ψ^2 .
- *Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals.
- *Significance of quantum numbers, Shapes of s, p and d atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy.
- *Slater's rule and its applications.
- *Revision
- *Oral test
- *Written test
- * Discussion on the problems

August

Recapitulation

- ***Ionic Bonding:** General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds.
- * Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.
- *Covalent bonding- VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

*Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals,

*MO treatment of homonuclear diatomic molecules up to Ne (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO⁺. Comparison of VB and MO approaches.

*Revision

*Oral test

*Written test

* Discussion on the problems

September

*Recapitulation

*Fundamentals of Organic Chemistry- Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

*Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

*Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

*Revision

*Oral test

*Written test

* Discussion on the problems

October

*Stereochemistry- Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer projections.

*Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

*Revision

*Oral test

*Written test

* Discussion on the problems

November

***Recapitulation**

***Aliphatic Hydrocarbons-** Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

***Alkanes:** (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

***Alkenes:** (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO_4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

December

***Alkynes:** (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

***Reactions:** Formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alkaline KMnO_4 .

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

February and March

***Revision and discussion of all the important topics.**

***Oral test**

***Written test**

*** Discussion on the problems**

Tentative Teaching Plan

B.Sc 1

LAB COURSE CHEM 101 PR

Dr Anita

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

August

Inorganic Chemistry - Volumetric Analysis - Introduction

Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.

- * Revision
- * Viva-Voce
- * Note-books

September

Estimation of oxalic acid by titrating it with KMnO_4 .

- * Revision
- * Viva-Voce
- * Note-books

October

Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .

- * Revision
- * Viva-Voce
- * Note-books

November

Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.

Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

- * Revision
- * Viva-Voce
- * Note-books

December

II. Organic Chemistry 1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.

- * Revision
- * Viva-Voce

***Solids - Forms of solids, Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X-Ray diffraction by crystals, Bragg's law.**

*** Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals.**

***Chemical Kinetics The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction.**

***Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.**

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

October

***Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).**

*** Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.**

***Aromatic hydrocarbons Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).**

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

November

***Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation, Williamson's ether synthesis.**

*** Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by -OH group) and effect of nitro substituent.**

Tentative teaching plan

Department of Chemistry (2024-25)

BSc 1 year

CHEM 102TH

Dr Anita

Methodology- Lecture-Cum-Demonstration (Using LabI+LabII)

July

***STATES OF MATTER ,CHEMICAL KINETICS & FUNCTIONAL ORGANIC CHEMISTRY - A Kinetic Theory of Gases Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.**

***Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature . Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO₂. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies and their importance.**

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

August

***Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation).**

*** Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only). Liquids - Surface tension and its determination using stalagmometer.**

***Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid.**

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

September

B.Sc I

LAB COURSE CHEM 102 PR STATES OF MATTER, CHEMICAL KINETICS & FUNCTIONAL ORGANIC CHEMISTRY LAB

August

Physical Chemistry Practicals

*Surface tension measurement. a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer. b) Study of the variation of surface tension of a detergent solution with concentration.

* Revision

*Viva-Voce

*Note-books

September

*Viscosity measurement a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer. b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

* Revision

*Viva-Voce

*Note-books

October

*Chemical Kinetics Study the kinetics of the following reaction: i). Acid hydrolysis of methyl acetate with hydrochloric acid. ii). Saponification of ethyl acetate. iii). Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate II

* Revision

*Viva-Voce

*Note-books

November-December

*Organic Chemistry - Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines)

* Revision

*Viva-Voce

*Note-books

February

***Benzyne Mechanism:** KNH_2/NH_3 (or $\text{NaNH}_2/\text{NH}_3$). **Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.**

***Alcohols: Preparation:** Preparation of **primary, secondary and tertiary alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO_4 , acidic dichromate, conc. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.**

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

December

***Phenols: (Phenol case) Preparation:** Cumene hydroperoxide method, from diazonium salts. **Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer - Tiemann Reaction, Gattermann-Koch Reaction,**

***Houben-Hoesch Condensation, Schotten - Baumann Reaction. Ethers (aliphatic and aromatic): Cleavage of ethers with HI.**

***Revision**

***Oral test**

***Written test**

*** Discussion on the problems**

February

*** Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde) Preparation: From acid chlorides and from nitriles. Reactions: Reaction with HCN, ROH, NaHSO_3 , NH_2 -G derivatives. Iodoform test.**

***Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.**

***Revision**

***Oral test**

*** Written test**

*** Discussion on the problems**

March

Revision and discussion of **all the important topics.**

~~Tentative Teaching Plan~~

Department of Chemistry

Tentative Lesson Teaching Plan (2024-25)

B.Sc IIInd Year

Title: Chemistry of Main Group Elements, Chemical Energetics & Equilibria

Course Code: CHEM 202TH

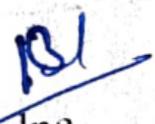
Dr. Kumari Bandna

Section	Topic	Details	Month	Remarks
A	1 Hydrogen 2 S-Block Elements	Hydrogen Unique position of Hydrogen in the periodic table, isotopes, ortho and para hydrogen, Industrial production, Hydrides and their chemistry, Heavy water, Hydrogen bonding, Hydrates. S-Block Elements Periodicity of elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling Scale). General characteristics of s-block elements like density, melting points, flame coloration and reducing character, solvation and complexation tendencies and solutions of metals in liquid ammonia	July -August	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations. Daily Test will be given to students related to topics covered
B	1. P- Block Elements 2. Noble Gases	P- Block Elements Comparative studies including diagonal relationship of group 13 and 14 elements. Borohydrides, Hydrides, oxide and oxy-acids and halides of boron, borax, Borazine. allotropic forms of carbon, fullerenes, carbides of calcium and silicon. Hydrides, oxides, oxoacids and halides of nitrogen. Allotropic forms of phosphorous. Hydrides, halides, oxides and oxyacids of	September-October	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily Class test will be given to students related to topics covered

	<p>phosphorous. Basic properties of halogens and inter halogen compounds, pseudo halogens and poly halides</p> <p>Noble Gases Occurrence of noble gases, History of discovery of noble gases and isolation of noble gases from air. Preparation properties and structure of important compounds of noble gases-fluorides, oxides, oxyfluorides of xenon (valence bond structure only). Krypton difluoride and clathrate compounds of noble gases.</p>		
<p>1. Chemical Energetics</p>	<p>Chemical Energetics: Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature - Kirchoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.</p>	<p>November-December</p>	<p>Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily class test will be given to students related to topics covered.</p>
<p>1. Chemical Equilibrium 2. Ionic Equilibrium</p>	<p>Chemical Equilibrium: Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG°, Le Chatelier's principle. Relationships between K_p, K_c and K_x for reactions involving ideal gases.</p> <p>Ionic Equilibria: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt</p>	<p>February-March</p>	<p>Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily class test will be given to students related to topics covered.</p>

	hydrolysis-calculation of hydrolysis constant, degree of hydrolysis, pH for different salt solutions. Solubility and solubility product of sparingly soluble salts. Applications of solubility product principle
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Note: Practical Classes will be held simultaneously and Mid Term test will be taken


Dr. Kumari Bhdna

	hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle	
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Note: Practical Classes will be held simultaneously at the end of each topic. Daily Class test and Mid Term test will be taken during the Session

Dr. Kumari Bindna

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Department of Chemistry

Tentative Lesson Teaching Plan

B.Sc II Year

Title: SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & ORGANIC CHEMISTRY

Course Code: CHEM 201TH

Dr. Chandresh Kumari

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Section	Topic	Details	Month	Remarks
D	Carbohydrates	Classification and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharide. Structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.	July -August	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations, Daily Test will be given to students related to topics
C	<ol style="list-style-type: none"> 1. Carboxylic acids (aliphatic and aromatic) 2. Carboxylic acid derivatives (aliphatic) 3. Amines and Diazonium Salts 	Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Carboxylic acids (aliphatic and aromatic) - Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell - Vohlard - Zelinsky Reaction. Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) - Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their inter conversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation. Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons) - Preparation:	September-October	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily Class test will be given to students related to topics

		<p>from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, reaction with HNO_2, Schotten - Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation. Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes.</p>	
C	<p>1. Conductance 2. Electrochemistry</p>	<p>Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid base). Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using</p>	<p>November-December</p> <p>Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily class test will be given to students related to topics</p>

A

		hydrogen electrode and quinhydrone electrode.		
A	1. Solutions 2. Phase Equilibrium	<p>Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law - non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions.</p> <p>Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Nernst distribution law and its applications, solvent extraction.</p> <p>Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius - Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, NaCl-H₂O and Mg-Zn only).</p>	February-March	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily class test will be given to students related to topics

Note: Practical Classes will be held simultaneously at the end of each topic. Class test after each section and Mid Term test will be taken during the Session

*Ranchhoo
Kumar*

Tentative Lesson Teaching Plan

B.Sc II Year

Title: BASIC ANALYTICAL CHEMISTRY

Course Code: CHEM 203

Dr. Chandresh Kumari

Section	Topic	Details	Month	Remarks
A	3. Introduction 4. Analysis of soil	Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures. Composition of soil. Concept of pH and pH measurement. Complexometric titrations. Chelation, Chelating agents, use of indicators. a. Determination of pH of soil samples. b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.	July -August	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations, Daily Test will be given to students related to topics
C	Chromatography	Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}). b. To compare paint samples by TLC method, Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).	September-October	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily Class test will be given to students related to topics
B	1. Analysis of water	Definition of pure water, sources	November-	Each topic will be

	<p>2. Analysis of food products</p>	<p>responsible for contaminating water, water sampling methods, water purification methods.</p> <p>a. Determination of pH, acidity and alkalinity of a water sample.</p> <p>b. Determination of dissolved oxygen (DO) of a water sample.</p> <p>Nutritional value of foods, idea about food processing and food preservations and adulteration.</p> <p>a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc. b. Analysis of preservatives and colouring matter.</p>	<p>December</p>	<p>explained conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily class test will be given to students related to topics</p>
<p>D</p>	<p>1. Analysis of cosmetics 2. Applications</p>	<p>Major and minor constituents and their function</p> <p>a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate. b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration. Suggested Applications (Any one):</p> <p>a. To study the use of phenolphthalein in trap cases. b. To analyze arson accelerants. c. To carry out analysis of gasoline.</p>	<p>February-March</p>	<p>Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily class test will be given to students related to topics</p>

Note: Class tests after each section and Mid Term test will be taken during the Session

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Tentative Lesson Teaching Plan

B. Sc 3rd Year, Session: 2023-2024

TITLE: POLYMER CHEMISTRY

COURSE CODE: CHEM 305TH (DSE)

Dr. Chandresh & Dr. Kumari Bandna

Teaching Method: Lecture cum demonstration method, general discussion

SECTION	TOPIC	DETAILS	MONTH	REMARKS
A	Introduction and history of polymeric materials	Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, and Texture of Polymers. Functionality and its importance: Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction, and degree of polymerization. Bifunctional systems, Poly-functional systems.	Aug 1 st week-Aug 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.
B	Kinetics of Polymerization Crystallization and crystallinity	Mechanism and kinetics of step-growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques. Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, and Factors affecting crystalline melting point. Nature and structure of polymers-Structure Property relationships.	Sep 1 st week - Sep 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.
C		Determination of molecular weight of polymers (M _n , M _w , etc) by end-group analysis, viscometry, light scattering, and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index. Glass transition temperature (T _g) and determination of T _g . Free volume theory, WLF equation, Factors affecting glass transition temperature (T _g).	Oct 1 st week - Oct 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.

	Polymer Solution	Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.		
D	Properties of Polymers (Physical, thermal, Flow & Mechanical Properties)	A brief introduction to the preparation, structure, properties, and application of the following polymers: polyolefins, polystyrene, and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoropolymers, associated polyamides, and polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide, polypyrrole, polythiophene)].	Nov 1 st week - Nov 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.

Note: Class tests after each section and Mid Term test will be taken during the Session

Chandresh
Kumar

Department of Chemistry

Tentative Lesson Teaching Plan (2024-25)

B.Sc III Year

Title: POLYNUCLEAR HYDROCARBONS, DYES, HETEROCYCLIC COMPOUNDS AND SPECTROSCOPY (UV, IR, NMR)

Course Code: CHEM 301TH

By (Dr) Pooja

Secti on	Topic	Details	Month	Remarks
A	1. Polynuclear Hydrocarbons 2. Synthetic dyes	Synthesis & reactions of Naphthalene, Anthracene & Phenanthrene. Relative reactivity of these compounds at various positions. Colour and constitution [electronic concept], classification of dyes. Chemistry and synthesis of methyl orange, congo red, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and indigo.	July -August	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations, Daily Test will be given to students related to topics
B	Heterocyclic compounds	Introduction, Classification and nomenclature, Molecular orbital picture & aromatic characteristics of pyrrole, furan, thiophene & pyridine. Methods of synthesis, chemical reactions with emphasis on mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five & six-membered heterocyclic compounds, preparation & reactions of indole quinoline & isoquinoline with special reference to Fisher indole synthesis Skraup synthesis & Bischler - Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline, & isoquinoline.	September-October	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily Class test will be given to students related to topics
C	Application of UV and IR Spectroscopy	Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic	November-December	Each topic will be explained by conventional

	to Simple Organic Molecules	radiations, electronic transitions, λ_{max} . & ϵ_{max} . chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} . of conjugated dienes and α , β - unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on $>C=O$ stretching absorptions).		method (Chalk and board) and power point presentation. Assignments, presentations and daily class test will be given to students related to topics
D	Nuclear Magnetic Resonance Spectroscopy	Principle of nuclear magnetic resonance, number of signals, peak areas equivalent & non-equivalent protons, positions of signals, chemical shift. Shielding & deshielding of protons, proton counting, splitting of signals & coupling constants, magnetic equivalence of protons. Discussion of PMR spectra of molecules: ethyl bromide, n - propyl bromide, isopropyl bromide 1,1-dibromoethane 1,1,2- tribromo ethane, ethanol, toluene, acetaldehyde, acetophenone. Simple problems on PMR spectroscopy for structure determination of organic compounds.	February-March	Each topic will be explained by conventional method (Chalk and board) and power point presentations. Assignments, presentations and daily class test will be given to students related to topics

Note: Daily Class test and Mid Term test will be taken during the Session

Tentative Lesson Teaching Plan

B. Sc 3rd Year, Session: 2024-2025

TITLE: POLYMER CHEMISTRY

COURSE CODE: CHEM 305TH (DSE)

Dr. Kumari Bandna & Dr. Chandresh

Teaching Method: Lecture cum demonstration method, general discussion

SECTION	TOPIC	DETAILS	MONTH	REMARKS
A	Introduction and history of	Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers.	Aug 1 st week-Aug 4 th week	Each topic will be explained using conventional methods

	polymeric materials	and Texture of Polymers. Functionality and its importance: Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction, and degree of polymerization. Bifunctional systems, Poly-functional systems.		(chalk and board). Assignments and presentations will be given to students related to topics.
B	Kinetics of Polymerization Crystallization and crystallinity	Mechanism and kinetics of step-growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques. Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, and Factors affecting crystalline melting point. Nature and structure of polymers-Structure Property relationships.	Sep 1 st week - Sep 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.
C	Polymer Solution	Determination of molecular weight of polymers (Mn, Mw, etc) by end-group analysis, viscometry, light scattering, and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index. Glass transition temperature (Tg) and determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg). Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory-Huggins theory, Lower and Upper critical solution temperatures.	Oct 1 st week - Oct 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.
D	Properties of Polymers (Physical, thermal, Flow & Mechanical Properties)	A brief introduction to the preparation, structure, properties, and application of the following polymers: polyolefins, polystyrene, and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoropolymers, associated polyamides, and polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].	Nov 1 st week - Nov 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.

Chandresh Kumar

Dr. CHANDRESH KUMAR

TITLE: CHEMICAL TECHNOLOGY & SOCIETY and BUSINESS SKILLS FOR CHEMISTRY

COURSE CODE: CHEM 307 (SEC)

Lt (Dr) Pooja

Teaching Method: Lecture cum demonstration method, general discussion

SECTION	TOPIC	DETAILS	MONTH	REMARKS
A	Chemical Technology	Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption, and adsorption. An introduction to the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in the chemical industry. Introduction to clean technology.	Aug 1 st week - Aug 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.
B	Society	Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants); energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs.	Sep 1 st week - Sep 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.
C	Business Basics Chemistry in Industry	Key business concepts: Business plans, market needs, project management, and routes to market. Current challenges and opportunities for the chemistry-using industries, role of chemistry in India and global economies.	Oct 1 st week - Oct 4 th week	Each topic will be explained using conventional methods (Chalk and board). Assignments, and presentations will be given to students related to topics.
D	Making money Intellectual property	Financial aspects of business with case studies. Concept of intellectual property, patents.	Nov 1 st week - Nov 4 th week	Each topic will be explained using conventional methods (chalk and board). Assignments and presentations will be given to students related to topics.

Department of Chemistry

Tentative Lesson Teaching Plan (2024-25)

B.Sc 3rd Year

Title: Pesticide Chemistry & Pharmaceutical Chemistry

Course code: CHEM 308

Lt (Dr) Pooja

Section	Topic	Details	Month	Remarks
A	Pesticides (An Introduction)	General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship.	July-Aug	Each topic will be explained by conventional methods (Blackboard and chalk) and PowerPoint presentations. Assignments, presentations, and two to three questions will be given daily to students related to the topics covered for preparation.
B	Some Representative Pesticides	Synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).	Sep-Oct	Each topic will be explained by conventional methods (Blackboard and chalk) and PowerPoint presentations. Assignments, presentations, and two to three questions will be given daily to students related to the topics covered for preparation.
C	Pharmaceuticals Drugs	Drugs & Pharmaceuticals Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, antiinflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).	Nov-Dec	Each topic will be explained by conventional methods (Blackboard and chalk) and PowerPoint presentations. Assignments, presentations, and two to three questions will be given daily to students related to the topics covered for preparation.

D	Fermentation	Fermentation Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.	Feb	Each topic will explained conventional methods (Blackboard and chalk) and PowerPoint presentations. Assignments, presentations, and two to three questions will be given daily to students related to the topics covered for preparation.
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Note: Class tests and Mid-Term test will be taken during the session.

LAB COURSE

CHEM 301PR

POLYNUCLEAR HYDROCARBONS, DYES, HETEROCYCLIC COMPOUNDS AND SPECTROSCOPY (UV, IR, NMR) LAB

Max Marks: 20

Credits – 2

1. Separation of mixtures by chromatography: Measure the R_f value in each case. (Combination of two ions to be given) Paper chromatographic separation of Fe³⁺, Al³⁺ and Cr³⁺ or Paper chromatographic separation of Ni²⁺, Co²⁺, Mn²⁺ and Zn²⁺

2. Preparation of any two of the following complexes and measurement of their conductivity: (i) tetraamminecarbonatocobalt (III) nitrate (ii) tetraamminecopper (II) sulphate (iii) potassium trioxalatoferrate (III) trihydrate

3. Colorimetry

Draw calibration curve (absorbance at λ_{max} vs. concentration) for various concentrations of a given coloured compound (KMnO₄/ CuSO₄) and estimate the concentration of the same in a given solution.

Principal
GC Nalagani

LAB COURSE
CHEM 305PR
POLYMER CHEMISTRY

Max Marks: 20

Credits - 2

I. Polymer synthesis

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).
 - a. Purification of monomer
 - b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutyronitrile (AIBN)
2. Redox polymerization of acrylamide
3. Precipitation polymerization of acrylonitrile
4. Preparation of urea-formaldehyde resin
5. Preparations of novalac resin/resold resin.
6. Microscale Emulsion Polymerization of Poly(methylacrylate).

II. Polymer characterization

1. Determination of molecular weight by viscometry:
 - (a) Polyacrylamide-aq. NaNO₂ solution
 - (b) (Poly vinyl propylidene (PVP) in water
 2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of —head-to-headl monomer linkages in the polymer.
 3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).
 4. Testing of mechanical properties of polymers.
 5. Determination of hydroxyl number of a polymer using colorimetric method.
- *At least 6 experiments to be carried out.



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G C Nagarath



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GOVT COLLEGE NALAGARH, SOLAN

DEPARTMENT OF COMPUTER SCIENCE

B.Sc. Physical Science with Physics, Computer Science & Mathematics

Programme Specific Outcomes:

The Program Specific Outcomes (PSOs) for the B.Sc. Physical Science with Physics, Computer Science, and Mathematics are designed to equip students with skills and knowledge that allow them to:

1. **Apply Core Knowledge:** Utilize fundamental concepts and methodologies in physics, computer science, and mathematics to solve complex problems. This includes applying theories in mechanics, electromagnetism, calculus, programming, and data structures to practical scenarios.
2. **Develop Computational Solutions:** Design and implement efficient algorithms and computer programs, use database systems, and work with data structures to address a wide range of computational problems. This outcome emphasizes the ability to create and manage software applications, understand operating systems, and work with various programming environments.
3. **Analyze and Model Physical Phenomena:** Use experimental and theoretical physics knowledge to understand and model physical systems. This includes data collection, statistical analysis, and interpretation of results, enabling students to make informed predictions and conclusions based on scientific reasoning.
4. **Employ Mathematical Reasoning:** Formulate and solve mathematical models for real-world problems using calculus, linear algebra, numerical methods, and other mathematical techniques. This outcome prepares students for analytical roles that require precise quantitative and logical reasoning.
5. **Conduct Research and Projects:** Engage in independent research projects and practical assignments in their areas of study. Students will be able to design experiments, conduct scientific inquiries, and use computer tools to analyze data, developing skills in project management, critical thinking, and technical writing.
6. **Adapt to Interdisciplinary Roles:** Leverage the interdisciplinary foundation provided by the program to apply scientific, mathematical, and computational skills in various fields, including finance, engineering, data science, and technology sectors.
7. **Pursue Advanced Studies and Careers:** With a strong foundation in three critical disciplines, graduates will be well-prepared to pursue higher education and research in physics, computer science, mathematics, or interdisciplinary studies, as well as technical and analytical roles in industries such as IT, engineering, data analysis, and education.



8. Ethical and Environmental Responsibility: Understand the impact of scientific and technological advancements on the environment and society, adhering to ethical standards and sustainable practices in professional settings.

These program-specific outcomes aim to foster well-rounded graduates who can adapt to diverse roles, contribute to scientific and technological progress, and pursue lifelong learning.

Course Outcomes of B.Sc. Physical Science with Physics, Computer Science & Mathematics

The course outcomes for the B.Sc. Physical Science with Physics, Computer Science, and Mathematics program cover a broad range of foundational skills and subject-specific knowledge in each of the three disciplines. Here are the expected learning outcomes across these fields:

1. Physics: Students will gain a solid grounding in mechanics, electricity, magnetism, thermodynamics, optics, and modern physics. They will develop practical skills through laboratory experiments, enhancing their ability to apply theoretical knowledge to real-world scenarios, analyze physical phenomena, and interpret scientific data.

2. Computer Science: The curriculum includes fundamental and advanced topics such as programming, computer architecture, database management, operating systems, data structures, and software engineering. Students will acquire problem-solving skills, proficiency in programming languages like Python and PHP, and practical skills in developing software applications and managing databases.

3. Mathematics: The mathematical component builds strong analytical and problem-solving skills, covering calculus, algebra, real analysis, linear algebra, and numerical methods. These skills will enable students to engage in quantitative analysis, formulate mathematical models, and tackle complex problems.

4. Interdisciplinary Skills: The program also integrates interdisciplinary and skill-enhancement courses, including environmental science and elective courses across the three disciplines. This approach aims to foster a well-rounded education, critical thinking, and adaptability in diverse professional and research environments.

5. Project and Research Skills: Through projects and electives, students will learn to conduct independent research, improve technical writing, and enhance presentation skills, which are essential for careers in academia, industry, and further studies.

These outcomes prepare graduates for various career paths, including research, teaching, software development, data analysis, and technical roles in physics, computer science, and related fields.

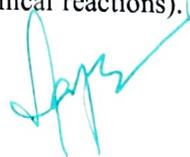


Programme Specific Outcomes of B.Sc. Physical Science with Physics, Computer Science & Mathematics :

COMP101TH: Problem Solving using Computer

The Program Specific Outcomes (PSOs) for the unit on Computer Fundamentals and Python Programming include the following objectives:

1. **Understanding Computer Fundamentals:** Students will understand the essential characteristics, uses, types, and generations of computers, as well as basic computer organization. This includes comprehending the structure of a computer's CPU, ALU, memory hierarchy, registers, and I/O devices, which serves as the groundwork for future studies in computer science.
2. **Problem-Solving and Program Design:** Gain foundational skills in planning and structuring computer programs. Students will learn to define problems, design programs, and understand various types of programming errors and debugging methods. Techniques such as flowcharting, decision tables, algorithms, and structured programming methodologies (top-down and bottom-up) will be used to develop systematic problem-solving skills.
3. **Python Programming Proficiency:** Develop a strong foundation in Python programming. Students will learn the structure of Python programs, basic syntax, and use of Python as a calculator. They will become proficient in writing code with control statements, loops, operators, and managing program flow, including break, continue, and pass statements.
4. **Data Structures in Python:** Understand and implement fundamental data structures in Python such as numbers, strings, lists, tuples, and dictionaries. This knowledge is crucial for efficient data manipulation and organization in computer programs.
5. **Advanced Python Concepts:** Introduction to advanced topics in Python, such as object-oriented programming (OOP) with classes, inheritance, regular expressions, event-driven programming, and GUI programming. This prepares students for more complex programming tasks and problem-solving.
6. **Application Development Using Python:** Through hands-on labs, students will develop practical Python programming skills. They will write programs to perform tasks like converting temperature scales, calculating grades, finding areas of geometric shapes, generating Fibonacci sequences, computing factorials, and performing matrix operations.
7. **Data Visualization and Mathematical Modeling:** Use Python to create visual representations of mathematical objects, display histograms, plot functions like sine, cosine, polynomial, and exponential curves, and develop models for real-world phenomena (e.g., bacterial growth, chemical reactions). These skills are essential for data analysis, scientific computing, and simulations.



8. **Research and Technical Proficiency:** The laboratory component (software lab) enhances students' ability to independently design, implement, and test Python programs. They will gain experience in data visualization and working with libraries and modules in Python, which are essential for data science, engineering, and scientific research.

These outcomes enable students to build a strong foundation in computer fundamentals and Python programming, equipping them with critical skills for advanced courses, research, and professional work in computer science and data analysis.

COMP102TH: Office Automation Tools

The Program Specific Outcomes (PSOs) for COMP102TH: Office Automation Tools aim to equip students with essential documentation, accounting, and presentation skills using office productivity software. Upon completion of this course, students will be able to:

1. **Master Documentation Techniques:** Understand and apply word processing skills using MS Office, Libre Office, or Open Office. This includes creating, formatting, and organizing documents with advanced tools such as tables, lists, headers, footers, and templates to meet professional standards.

2. **Perform Spreadsheet-Based Calculations and Analysis:** Gain proficiency in spreadsheet applications to perform data entry, formatting, calculations, and complex data analysis. Students will be able to use formulas, functions, create charts and graphs, work with pivot tables, and automate tasks with macros for efficient data handling and reporting.

3. **Develop and Enhance Presentation Skills:** Use presentation software to design and deliver engaging presentations. This involves creating visually appealing slides, formatting text and images, using transitions and animations, and adding multimedia elements to convey information effectively in academic and professional settings.

4. **Handle Office Productivity Software:** Acquire a working knowledge of popular office productivity software tools and apply them for various tasks, whether for documentation, data analysis, or presentations. This foundational skill is highly transferable across administrative, technical, and business roles.

5. **Create and Format Complex Documents in Labs:** In practical lab sessions, students will apply their learning by creating documents like grocery lists, directories, timetables, and newsletters. They will implement formatting skills, use different fonts, styles, and layouts, and handle document settings like page numbers and footers for structured and professional-looking outputs.

6. **Conduct Financial Calculations and Salary Computations Using Spreadsheets:** Use spreadsheets for financial tasks, such as calculating grades, commissions, and salaries with allowances and deductions. Students will be able to design spreadsheets to compute net salaries by applying conditional formatting, advanced formulas, and logic-based functions.

7. Craft Visual and Interactive Presentations: Learn practical presentation skills, including designing slides with themes, aligning text and images, adding effects, and customizing layouts. These skills will help students effectively communicate information and ideas visually in various professional settings.

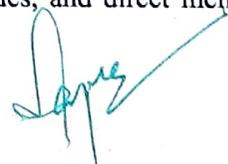
8. Integrate Graphics and Data Visualizations: Develop the ability to include and manipulate graphic objects such as charts, graphs, and other visuals in documents and presentations, enhancing the clarity and impact of data presentation and storytelling.

These outcomes prepare students to confidently use office tools for professional documentation, data management, and presentation, making them valuable in any administrative, analytical, or technical role.

COMP201TH: Computer System Architecture

The Program Specific Outcomes (PSOs) for COMP201TH: Computer System Architecture aim to provide students with foundational knowledge of computer hardware and system architecture. By the end of this course, students will be able to:

1. Understand the Fundamentals of Computer Architecture: Gain a solid understanding of basic computer architecture concepts, including logic gates, Boolean algebra, combinational and sequential circuits, and how they form the foundation of computer systems.
2. Master Data Representation and Arithmetic Operations: Comprehend number systems, complements, and fixed and floating-point representations. Students will learn basic arithmetic operations (addition, subtraction, magnitude comparison) and character representation methods, crucial for data manipulation in computing systems.
3. Analyze Basic Computer Organization and Design: Understand the structural organization of computer registers, bus systems, instruction sets, timing, and control. This knowledge equips students to grasp the organization of the CPU and its operations, including memory reference and input-output functions.
4. Understand Central Processing Unit (CPU) Structure and Operations: Gain insight into the register organization, arithmetic and logical micro-operations, and stack organization within the CPU. This unit helps students comprehend the microprogrammed control of CPU processes and operations, critical for effective resource management within a computer.
5. Programming the Basic Computer: Acquire practical skills in programming the basic computer, including instruction formats, addressing modes, and instruction codes. Students will learn the basics of machine and assembly language, essential for low-level programming and understanding how software interacts with hardware.
6. Explore Input-Output Organization: Understand the structure and functioning of input-output (I/O) organization, including peripheral devices, I/O interfaces, data transfer modes, and direct memory access



(DMA). This knowledge prepares students to manage data flow and communication between internal and external devices.

7. Apply Circuit Design Principles: Use knowledge of combinational and sequential circuits, decoders, multiplexers, and flip-flops to design efficient circuit structures for computer systems. This skill is essential for understanding how complex operations are broken down into manageable digital components.

8. Understand Memory Organization and Storage: Develop an understanding of how memory units work within computer systems, including types of memory, memory hierarchy, and organization. This prepares students to design and optimize memory usage in computer systems.

These outcomes enable students to understand and work with the internal architecture of computers, preparing them for further study in computer engineering, systems design, and hardware-related roles in the technology sector.

COMP202TH: Database Management System

The Program Specific Outcomes (PSOs) for COMP202TH: Database Management System aim to build students' understanding and practical skills in database design and management. By the end of this course, students will be able to:

1. Understand Database Management System Fundamentals: Gain a comprehensive understanding of the fundamental elements of DBMS, including data models, architecture, and the concept of data independence. This foundation is crucial for managing and organizing data efficiently in various applications.
2. Develop Entity-Relationship (ER) Models: Design and interpret ER and Enhanced ER (EER) models for representing simple database application scenarios. This outcome equips students with skills in data modeling and helps them visualize the structure of databases before implementation.
3. Apply SQL for Database Manipulation: Use Structured Query Language (SQL) to create, query, update, and manage databases. Students will learn to execute DDL (Data Definition Language) and DML (Data Manipulation Language) commands, enabling them to handle real-world data management tasks effectively.
4. Implement Relational Database Concepts: Understand and apply the principles of relational databases, including relational constraints and relational algebra. This outcome helps students manage data integrity, perform relational operations, and optimize data retrieval in relational databases.
5. Normalize Databases for Optimization: Improve database design through normalization techniques, focusing on functional dependencies and achieving normal forms up to the third normal form. This skill is essential for reducing redundancy and enhancing database efficiency and consistency.



6. Translate ER Models to Relational Schemas: Convert ER and EER models into relational schemas, preparing students to implement theoretical designs into practical, functioning databases. This skill is fundamental for developing robust database structures that meet business and application requirements.

7. Perform Advanced SQL Operations: Master advanced SQL operations, including complex queries with multiple tables, nested selects, and set operations such as union, intersect, and minus. Students will also learn to organize and categorize data using 'GROUP BY' and 'ORDER BY', along with aggregate functions.

8. Use Database Management Tools: Gain hands-on experience with database management systems like MySQL or Access in lab sessions. Students will implement various SQL commands, manage database schema, and perform data manipulation to reinforce theoretical knowledge with practical application.

These outcomes prepare students to work confidently with relational databases, making them valuable for roles in data management, software development, and systems analysis. The skills acquired in this course are also foundational for more advanced studies in data science, analytics, and database administration.

COMP301TH: Operating System

The Program Specific Outcomes (PSOs) for COMP301TH: Operating System provide students with a deep understanding of operating system concepts, enabling them to manage system resources effectively. Upon completing this course, students will be able to:

1. Comprehend Operating System Services: Understand the various services provided by operating systems across different levels, from process and memory management to file and device management. Students will also gain insight into the real-world applications of operating systems in diverse fields, enhancing their appreciation for OS roles in resource management and system efficiency.

2. Differentiate Types of Operating Systems: Identify and describe the different types of operating systems, including multiprogramming, batch, time-sharing, single-user, multi-user, and real-time systems. This knowledge enables students to evaluate and select suitable OS models for various applications.

3. Implement Process Management Techniques: Understand process management, including process abstraction, resource allocation, and the use of threads and scheduling strategies. Students will learn different scheduling mechanisms, such as pre-emptive and non-pre-emptive, and apply them to optimize process execution in multitasking environments.

4. Master Synchronization and Deadlock Prevention: Apply synchronization techniques and process scheduling algorithms to avoid deadlocks, ensuring efficient and safe process execution. This skill is crucial for developing and maintaining systems that manage concurrent processes effectively.

5. Apply Memory Management Strategies: Learn and apply memory management techniques such as paging, segmentation, fixed and variable partitioning, and virtual memory. These methods help students manage and optimize memory resources, essential for system stability and performance.

6. **Develop Skills in Shell Scripting:** Gain proficiency in shell scripting within Linux environments. Students will learn to write, execute, and debug shell scripts, work with shell variables, and manage system calls, providing essential skills for automation, configuration, and system management tasks.
7. **Understand System Software and Resource Abstraction:** Develop an understanding of system software functions and the principles of resource abstraction, which are vital for designing efficient OS architectures that balance resource allocation and user demands.
8. **Implement System Calls and OS Functions:** Acquire hands-on experience with system calls and OS-level functions, which are key for interacting with hardware, managing files, and performing low-level operations. This skill is essential for roles involving system programming and OS customization.

These outcomes equip students with the knowledge and skills required to understand, design, and manage operating systems effectively, preparing them for careers in system administration, software development, and IT infrastructure management.

COMP302TH: Data Structure and File Processing

The Program Specific Outcomes (PSOs) for COMP302TH: Data Structure and File Processing aim to provide students with essential knowledge and practical skills in data structures and file organization. Upon completing this course, students will be able to:

1. **Develop Skills in Data Structure Implementation:** Gain proficiency in implementing core data structures, including stacks, queues, linked lists, and trees. This knowledge provides the foundation for solving complex computational problems through efficient data organization.
2. **Apply Data Structures to Real-Life Problems:** Utilize various data structures, such as stacks, queues, linked lists, and binary trees, to solve practical software challenges. This outcome helps students understand the importance of choosing the right data structure for specific applications.
3. **Master Searching and Memory Management Algorithms:** Implement fundamental algorithms for searching and memory management, including linear and binary search techniques. Students will also learn garbage collection algorithms and storage allocation for managing memory in systems.
4. **Understand Physical Storage and File System Operations:** Develop an understanding of physical storage devices such as disks and tapes, including their characteristics and I/O buffering mechanisms. This enables students to manage data storage and retrieval effectively, essential for large-scale data processing tasks.
5. **Gain Knowledge of File Organization Techniques:** Learn various file organization methods, such as sequential, indexed sequential, direct, inverted, and multi-list organization. This prepares students to handle data organization tasks that optimize data access speed and efficiency.



6. Implement Indexing Using B-trees and B+ Trees: Understand and apply indexing structures like B-trees and B+ trees, which are critical for efficient data retrieval in databases and file systems. This skill is particularly useful for managing large datasets in a structured and accessible format.

7. Develop File System Operations Skills: Perform basic file system operations such as creating, opening, closing, extending, deleting files, and reading/writing data blocks. Students will also learn about file protection mechanisms, essential for ensuring data integrity and security in file handling.

8. Hands-On Programming with Data Structures: Through lab exercises, students will implement operations on stacks, queues, linked lists, binary trees, and apply search techniques. These practical skills ensure that students can work with data structures and file systems effectively in real-world applications.

These outcomes equip students with a solid foundation in data structures, algorithms, and file processing, preparing them for careers in software development, data management, and systems programming. The skills gained are also essential for advanced studies in algorithms, database management, and data science.

Skill Enhancement Course(SEC)

COMP203TH: PHP Programming

The Program Specific Outcomes (PSOs) for the Skill Enhancement Course (SEC) COMP203TH: PHP Programming aim to equip students with essential skills in PHP programming, particularly for web development and server-side scripting. Upon completing this course, students will be able to:

1. Understand PHP Syntax and Basic Concepts: Gain a foundational understanding of PHP syntax, data types, variables, and operators, which are essential for writing and debugging PHP scripts. This forms the basis for all subsequent work in PHP programming.

2. Develop PHP Scripts to Handle HTML Forms: Learn to handle HTML form data using PHP, including using 'GET' and 'POST' methods to capture and process user inputs. Students will also learn to manage multi-value fields and redirect form submissions, an essential skill for creating dynamic, interactive web applications.

3. Implement Conditional Statements and Loops in PHP: Use conditional statements (e.g., 'if-else', 'switch') and loops ('for', 'while', 'do-while') to control the flow of PHP scripts. This enables students to develop flexible, user-responsive web applications with efficient logic control.

4. Create Functions for Modular Programming: Understand the importance of functions in PHP for organizing code, managing scope, and reusability. Students will learn to declare and call functions, use arguments, and apply both global and local scopes, which are critical for modular and maintainable code.



5. Work with Arrays and Array Manipulation: Develop proficiency in creating and manipulating arrays, including associative arrays. Students will be able to use array-related library functions and loops like 'foreach()' to handle data structures, making PHP scripts more powerful and flexible.

6. Perform String Manipulation and Use Regular Expressions: Learn string manipulation techniques and apply regular expressions ('preg_match()', 'preg_replace()', 'preg_split()') to search, replace, and format strings in PHP. This is essential for validating user input and managing textual data effectively in web applications.

7. Use PHP for Dynamic and Interactive Web Content: Combine PHP with HTML to create dynamic web content, laying the foundation for developing interactive, database-driven websites. Students will gain practical skills in managing content that adapts to user input and interaction.

8. Leverage PHP Libraries for Enhanced Functionality: Use PHP's extensive built-in libraries to streamline common tasks, such as data manipulation and file handling, allowing students to create more complex and feature-rich applications efficiently.

These outcomes prepare students for roles in web development and server-side programming, equipping them with the skills needed to build dynamic, interactive, and functional web applications using PHP. The course also lays the groundwork for further studies in advanced web development and backend programming.

COMP307TH: Multimedia and Applications

Program Specific Outcomes (PSOs) for the Course COMP307TH: Multimedia and Applications

Upon successful completion of this course, students will be able to:

1. Understand the Basics of Multimedia:

- Gain a foundational understanding of multimedia concepts, its components, and diverse applications in various industries.

2. Work with Text in Multimedia:

- Develop proficiency in utilizing text in multimedia projects, including font selection, editing, and design. Students will also learn about hypertext and hypermedia applications.

3. Handle Images in Multimedia:

- Acquire skills in working with both still and dynamic images. This includes understanding bitmap and vector graphics, 3D drawing, color theory, image file formats, and the application of images in multimedia projects.

4. Work with Sound:



- Understand digital and MIDI audio concepts, their differences, and the various audio file formats. Students will be able to work with sound elements in multimedia applications, including editing and integrating audio effectively.

5. Work with Video:

- Master the techniques for handling video in multimedia projects, including knowledge of analog vs. digital video, video file formats, and video shooting and editing processes.

6. Create and Utilize Animation:

- Learn animation principles, techniques, and formats to create dynamic and engaging multimedia content. Students will be able to design and edit animations for various applications.

These outcomes will equip students with a comprehensive skill set to engage in multimedia creation and application development.

A handwritten signature in blue ink, appearing to read 'Jays', with a long horizontal stroke extending to the right.

Programme Specific Outcomes (Mathematics)

By the end of the program UG in Mathematics, the student will be able to:

- 1) Demonstrate in-depth knowledge in one of the foundational areas of the mathematical sciences.
- 2) Think in a critical manner.
- 3) Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand. Formulate and develop mathematical arguments in a logical manner.
- 4) Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
- 5) Understand, formulate and use quantitative models arising in mathematical science and other contexts.

B.A./B.Sc. FIRST YEAR

Differential calculus (MATH101TH)

- 1) Able to define the basic concepts and principles of neighborhood of a point and limits.
- 2) Able to define the basic concepts and principles of differential calculus of real functions.
- 3) Interpret the geometric meaning of differential calculus.
- 4) Apply the concept and principles of differential calculus to solve geometric and physical problems.
- 5) Analyze the properties of functions in daily life.
- 6) Organize solving of complex problems by combining the acquired mathematical concepts and principles.

Differential equations (MATH102TH)

- 1) Delight the solution of differential equations of the first order and of the first degree by variables separable, Homogeneous and Non-Homogeneous methods.
- 2) Find a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p , x and y .

- 3) Compute all the solutions of second and higher order linear differential equations with constant coefficients, linear equations with variable coefficients.
- 4) Solve simultaneous linear equations with constant coefficients and total differential equations.
- 5) Student will be able to solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous, or Bernoulli cases.
- 6) Find the complete solution of a non-homogeneous differential equation as a linear combination of the complementary function and a particular solution.
- 7) Working knowledge of basic application problems described by second order linear differential equations with constant coefficients.

B.A./B.Sc. SECOND YEAR

Real Analysis (MATH201TH)

- 1) Describe fundamental properties of the real numbers that lead to the formal development of real analysis comprehend rigorous arguments developing the theory underpinning real analysis.
- 2) Demonstrate an understanding of limits and different tests and how they are used in sequences and series.
- 3) Construct rigorous mathematical proofs of basic results in real analysis.
- 4) Appreciate how abstract ideas and rigorous tests in real analysis can be applied to important practical problems in daily life.

Algebra (MATH202TH)

- 1) Able to define subgroup, center and normalizer of a subgroup.
- 2) Able to define cycles and transpositions of a given permutations.
- 3) Able to prove Lagrange's theorem, Euler's theorem and Fermat's theorem.
- 4) Able to define cyclic groups.
- 5) Critical approach to get a group has no proper subgroup if it is cyclic group of prime order.
- 6) Able to define normal subgroups, quotient groups and index of a subgroup.
- 7) Able to define homomorphism, kernel of a homomorphism, isomorphism.
- 8) Able to define Cayley's theorem, the fundamental theorem of homomorphism for groups.
- 9) Able to define ring, zero divisors of a ring, integral domain, field and proof of theorems.

Integral Calculus (MATH309TH)

- 10) Basic concepts and principles of integrals calculus of real functions.
- 11) Interpret the geometric meaning of integral calculus.
- 12) Apply the concept and principles of integral calculus to solve geometric and physical problems.
- 13) Understand the basic concepts of reduction formulae.
- 14) Able to define the basic concepts of length, rectification, area and volumes.

Vector calculus (MATH310TH)

- 1) Define scalars, vectors, dot product, cross product and triple product of vectors.
- 2) Analyse vector functions to find limits, derivatives, tangent lines and integrals.
- 3) Compute limits and derivatives of functions of two or three variables.
- 4) Differentiate vector fields.
- 5) Evaluate line integrals, surface area, surface integrals and volume integrals.
- 6) Calculate work, circulation, flux and determine gradient vector fields.

B.A./B.Sc. THIRD YEAR

Matrices (MATH301TH)

- 1) Able to introduce the role of vector spaces and subspaces in daily life.
- 2) Use essential techniques for the study of systems of Linear equations, matrix algebra, and vector space.
- 3) Ability to understand the eigenvalues and eigenvectors.
- 4) Able to understand the basic role of orthogonality and diagonalization.

Numerical methods (MATH304TH)

- 1) Define Basic concepts of operators Δ, E, ∇ .
- 2) Find the difference of polynomial.
- 3) Solve problems using Newton forward formula and Newton backward formula.
- 4) Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula. Find maxima and minima for differential difference equation.
- 5) backward formula. Find maxima and minima for differential difference equation.
- 6) Derive Simpson's $1/3, 3/8$ rules using trapezoidal rule.
- 7) Find the solution of the first order and second order equation with constant coefficient.
- 8) Find the summation of series finite difference technique.
- 9) Find the solution of ordinary differential equation of first by Euler, Taylor and Runge-Kutta Methods.

Probability and Statistics (MATH313TH)

- 1) Basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
- 2) Able to define Probability, Conditional probability. Derive Baye's theorem.
- 3) How to derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions.
- 4) How to calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.

- 5) Methods of finding the probability distributions by Binomial, Poisson's and Normal distributions.
- 6) How to calculate probabilities of absorption and mathematical expectation.

Transportation and Game Theory (MATH317TH)

- 1) Able to understand the concepts of transportation to how to get maximum profit and minimum cost by using North West Corner method, Least cost entry method and Vogel's approximation method.
- 2) Able to understand the concept of assignment to how get assignment as per their work and capacity by Hungarian's method.
- 3) The course deals with Mathematical game theory. The game theory became a popular tool for analyzing of intelligent entities in many situations of competition or cooperation. Students will go through basic terminology of games by the mechanism of their playing (sequential, strategic), by distribution of payoffs in a game (zero/nonzero sum games), by possible cooperation of players (cooperative, non-cooperative) and also by state of information in a game (complete/incomplete information).
- 4) The games will be extended with possible repetition of moves (repeated games) by different methods and its effect to player's behavior.

GOVERNMENT COLLEGE NALAGARH**DEPARTMENT OF ZOOLOGY****SAR: 2024-25**

1. ANNUAL TEACHING PLANS
2. SWOC ANALYSIS
3. LEARNING OUTCOMES

1. ANNUAL TEACHING PLANS**Subject: Zoology (Session 2024-2025)****Title: Animal Diversity****Code: ZOOL 101TH****Teacher's Name: Ms. Vandana Sharma**

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1st	Bridge course	Lecture		
	2nd	Bridge course	Lecture		
	3rd	Bridge course	Lecture		
	4th	Unit 1: Kingdom Protista General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa	Blackboard teaching assisted by use of 3D images on Epson Projector.		Task completed
August,2024	1st	Unit 2: Phylum Porifera General characters and classification up to classes; Canal System in Sycon	”	Class test	Task completed
	2nd	Unit 3: Phylum Cnidaria General characters and classification up to classes; Polymorphism in Hydrozoa	”	Class test	Task completed

	3rd	Unit 4: Phylum Platyhelminthes General characters and classification up to classes; Life history of Taenia solium Unit 5: Phylum Nematelminthes General characters and classification up to classes; Life history of Ascaris lumbricoides and its parasitic adaptations		Class test	Task completed
	4th	Unit 6: Phylum Annelida General characters and classification up to classes; Metamerism in Annelida	„	Class test	Task completed
September,2024	1st	Unit 7: Phylum Arthropoda General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects		Practical / Class test	Task completed
	2nd	Unit 8: Phylum Mollusca General characters and classification up to classes; Torsion in gastropods	„	Practical / Class test	Task completed
	3rd	Unit 9: Phylum Echinodermata General characters and classification up to classes; Water-vascular system in Asteroidea		Practical / Class test	Task completed
	4th	Unit 10: Protochordates General features and Phylogeny of Protochordata	„	Practical / Class test	Task completed
October,2024	1st	Unit 11: Agnatha General features of Agnatha and classification of cyclostomes up to classes	„	Practical / Class test	Task completed
	2nd	Unit 12: Pisces 4 General features and Classification up to orders; Osmoregulation in Fishes		Practical / Class test	Task completed

	3 rd	Unit 13: Amphibia General features and Classification up to orders; Parental care	”	Practical / Class test	Task completed
	4 th	Unit 14: Reptiles General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes		Practical / Class test	Task completed
November,2024	1 st	Unit 15: Aves General features and Classification up to orders; Flight adaptations in birds	”	Practical / Class test	Task completed
	2 nd	Unit 17: Mammals Classification up to orders; Origin of mammals	”	Practical / Class test	Task completed
	3 rd	Pending topics if any	”	Revision, class tests, quizzes, seminars etc.	Mid Term Exam, revision & preparation
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparation
December, 2024	1 st	MTT	Mid Term Exam		Task completed
	2 nd	Tutorials		-----	-----
	3 rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4 th	Tutorials	”	Assignment/ Seminar	
January, 2025		Winter Vacations			
February, 2025	1 st	Winter Vacations			

	2nd	Pending topics if any	”	Revision, class tests, quizzes, seminars etc.	Task completed
	3rd	Tutorials			
		Pending topics if any	”	Revision, class tests, quizzes, seminars etc.	Task completed

Title: Comparative Anatomy and Developmental Biology of Vertebrates

Code: ZOOL 102TH

Teacher's Name: Dr. Vandana Sharma

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1st	Bridge course	Lecture		
	2nd	Bridge course	Lecture		
	3rd	Bridge course	Lecture		
	4th	Unit 1: Integumentary System Derivatives of integument w.r.t. glands and digital tips	Blackboard teaching assisted by use of 3D images on Epson Projector.		Task completed
August,2024	1st	Unit 2: Skeletal System Evolution of visceral arches		Class test	Task completed
	2nd	Unit 3: Digestive System Brief account of alimentary canal and digestive glands	”	Class test	Task completed
	3rd	Unit 4: Respiratory System Brief account of Gills, lungs, air sacs and swim bladder	”	Class test	Task completed
	4th	Unit 5: Circulatory System Evolution of heart and aortic arches	”	Class test	Task completed

September,2024	1st	Unit 6: Urinogenital System Succession of kidney, Evolution of urinogenital ducts		Practical / Class test	Task completed
	2nd	Unit 7: Nervous System Comparative account of brain Unit 8: Sense Organs Types of receptors	„	Practical / Class test	Task completed
	3rd	Vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula);types of morphogenetic movements; Fate of germ layers;		Practical / Class test	Task completed
	4th	Unit 9: Early Embryonic Development Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy;	„	Practical / Class test	Task completed
October,2024	1st	Early development of frog (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula);types of morphogenetic movements; Fate of germ layers;	„	Practical / Class test	Task completed
	2nd	Early development of humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula);types of morphogenetic movements; Fate of germ layers;		Practical / Class test	Task completed

	3 rd	Unit 10: Late Embryonic Development Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology;	„	Practical / Class test	Task completed
	4 th	Metamorphic events in frog life cycle and its hormonal regulation.		Practical / Class test	Task completed
November,2024	1 st	Unit 11: Control of Development Intercellular communication, cell movements and cell death.	„	Practical / Class test	Task completed
	2 nd	Unit 11: Control of Development Intercellular communication, cell movements and cell death.	„	Practical / Class test	Task completed
	3 rd	Tutorials	„		Mid Term Exam, revision & preparation
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparation
December,2024	1 st	MTT	Mid Term Exam		Task completed
	2 nd	Tutorials		-----	-----
	3 rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4 th	Tutorials	„	Assignment/ Seminar	
January, 2025		Winter Vacations			
February, 2025	1 st	Winter Vacations			
	2 nd	Pending topics if any		Revision, class	Task completed

			”	tests, quizzes, seminars etc.	
	3 rd	Pending topics if any		Revision, class tests, quizzes, seminars etc.	Task completed
		Pending topics if any	”	Revision, class tests, quizzes, seminars etc.	Task completed

ANNUAL TEACHING PLANS

Subject: Zoology (Session 2024-2025)

Title: Animal Physiology

Code: ZOOL 201 TH

Teacher's Name: Dr. Harvinder Singh

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1 st	Mentor- Mentee classes			
	2 nd	Mentor- Mentee classes			
	3 rd	Mentor- Mentee classes			
	4 th	Structure of a neuron, Resting membrane potential, Graded potential, myelinated and non-myelinated nerve fibres	Blackboard teaching assisted by use of 3D images on Epson Projector.	Practical -Study of permanent slides of spinal cord	Task completed
August,2024	1 st	Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres			Task completed
	2 nd	Ultrastructure of skeletal muscle,	”	Practical -Study of permanent slides of bone and cartilage.	Task completed

	3 rd	Molecular and chemical basis of muscle contraction			Task completed
	4 th	Physiology of digestion in the alimentary canal;	”	Practical- Study of permanent slides of duodenum, Study of activity of salivary amylase under optimum conditions	Task completed
September,2024	1 st	Absorption of carbohydrates, proteins, lipids			Task completed
	2 nd	Pulmonary ventilation, Respiratory volumes and capacities,	”	Practical- Study of permanent slides of lung.	Task completed
	3 rd	Transport of Oxygen and carbon dioxide in blood			Task completed
	4 th	Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism	”	Practical- Study of permanent slides of kidney.	Task completed
October,2024	1 st	Cardiovascular system Composition of blood, Hemostasis,	”	Practical- Preparation of hemin and hemochromogen crystals	Task completed
	2 nd	Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle.			Task completed
	3 rd	Physiology of male reproduction: hormonal control of spermatogenesis;	”		Task completed

	4 th	Physiology of female reproduction: hormonal control of menstrual cycle			Task completed
November,2024	1 st	Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal	”	Practical- Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland	Task completed
	2 nd	Carbohydrate Metabolism Glycolysis, Gluconeogenesis, Glycogen metabolism	”	Practical- Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose).	Task completed
	3 rd	Krebs Cycle, Pentose phosphate pathway,	”		Task completed
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparation
December,2024	1 st	MTT	Mid Term Exam		Task completed
	2 nd	Tutorials		-----	-----
	3 rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4 th	Tutorials	”	Assignments / Seminars	
January, 2025		Winter Vacations			
February, 2025	1 st	Winter Vacations			

	2 nd	Review of electron transport chain, β oxidation of palmitic acid ,		Revision, class tests, quizzes, seminars etc.	Task completed
	3 rd	Protein metabolism Transamination, Deamination and Urea Cycle	„	Practical- Estimation of total protein in given solutions by Lowry's method.	Task completed
	4 th	Enzymes Introduction, Mechanism of action, Inhibition and Regulation	„	Revision, class tests, quizzes, seminars etc.	

Title: Genetics and Evolutionary Biology Code: ZOOL 202 TH

Teacher's Name: Dr. Harvinder Singh

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1 st	Mentor- Mentee classes			
	2 nd	Mentor- Mentee classes			
	3 rd	Mentor- Mentee classes			
	4 th	Introduction to Genetics Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information	Blackboard teaching assisted by use of 3D images on Epson Projector.		Task completed
August,2024	1 st	Mendelian Genetics and its Extension Principles of Inheritance, Chromosome theory of inheritance.		Practical- Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.	Task completed

	2 nd	Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy,	”		Task completed
	3 rd	Sex linked inheritance, extra-chromosomal inheritance			Task completed
	4 th	Linkage, Crossing Over and Chromosomal Mapping	”	Practical- Study of Linkage, recombination, gene mapping using the data	Task completed
September,2024	1 st	Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy		.	Task completed
	2 nd	Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations	”		Task completed
	3 rd	Sex Determination Chromosomal mechanisms, dosage compensation		Practical- Study of Human Karyotypes (normal and abnormal).	Task completed
	4 th	History of Life Major Events in History of Life Introduction to Evolutionary Theories Lamarckism,	”		Task completed
October,2024	1 st	Darwinism, Neo-Darwinism	”		Task completed
	2 nd	Types of fossils, Incompleteness of fossil record,		Practical- Study of fossil evidences from plaster cast models and pictures Study of homology and analogy from suitable specimens/ pictures	Task completed

	3 rd	Dating of fossils, Phylogeny of horse	”		Task completed
	4 th	Processes of Evolutionary Change Organic variations; Isolating Mechanisms;			Task completed
November,2024	1 st	Species Concept Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)	”		Task completed
	2 nd	Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection	”		Task completed
	3 rd	Macro-evolution Macro-evolutionary Principles (example: Darwin’s Finches) Extinction-	”	Practical- Darwin’s Finches with diagrams/ cut outs of beaks of different species	Task completed
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparation
December,2024	1 st	MTT	Mid Term Exam		Task completed
	2 nd	Tutorials		-----	-----
	3 rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4 th	Pending topics if any	”	Assignments / Seminars	
January, 2025		Winter Vacations			

February, 2025	1st	Winter Vacations			
	2nd	Pending topics if any		Revision, class tests, quizzes, seminars etc.	Task completed
	3rd	Tutorials	„	Revision, class tests, quizzes, seminars etc.	Task completed

Title: Medical Diagnostics & Apiculture Code: ZOOL 203 TH& ZOOL204 TH Teacher's Name: Dr. Harvinder Singh

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1st	Mentor- Mentee classes			
	2nd	Mentor- Mentee classes			
	3rd	Mentor- Mentee classes			
	4th	Unit 1: Introduction to Medical Diagnostics and its Importance	Blackboard teaching assisted by use of 3D images on Epson Projector.		Task completed
August,2024	1st	Unit 2: Diagnostics Methods Used for Analysis of Blood Blood composition,			Task completed
	2nd	Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain,	„	Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer,	Task completed

	3 rd	Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)			Task completed
	4 th	Unit 3: Diagnostic Methods Used for Urine Analysis Urine Analysis: Physical characteristics; Abnormal constituents	„		Task completed
September,2024	1 st	Unit 4:Non -infectious Diseases Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Testing of blood glucose using Glucometer/Kit		Testing of blood glucose using Glucometer/Kit	Task completed
	2 nd	Unit 4:Non -infectious Diseases Causes, types, symptoms, complications, diagnosis and prevention of Hypertension (Primary and secondary.	„		Task completed
	3 rd	Unit 5: Infectious Diseases Causes, types, symptoms, diagnosis and prevention of Tuberculosis			Task completed
	4 th	Unit 5: Infectious Diseases Causes, types, symptoms, diagnosis and prevention of Hepatitis	„		Task completed
October,2024	1 st	Unit 6: Tumours Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).	„		Task completed
	2 nd	Unit 1: Biology of Bees History, Classification and Biology of Honey Bees			Task completed
	3 rd	Social Organization of Bee Colony	„		Task completed

	4 th	Unit 2: Rearing of Bees Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth			Task completed
November,2024	1 st	Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)	„	Revision, class tests, quizzes, seminars etc.	Task completed
	2 nd	Unit 3: Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures	„		Task completed
	3 rd	Unit 3: Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures	„		Task completed
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparation
December,2024	1 st	MTT	Mid Term Exam		Task completed
	2 nd	Tutorials		-----	-----
	3 rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4 th	Tutorials	„	Assignment / Seminar	
January, 2025		Winter Vacations			

February, 2025	1st	Winter Vacations			
	2nd	Unit 4: Bee Economy Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen Etc		Revision, class tests, quizzes, seminars etc.	Task completed
	3rd	Unit 5: Entrepreneurship in Apiculture Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens	„	Revision, class tests, quizzes, seminars etc.	Task completed
	4th	Complete syllabus	„	Revision, class tests, quizzes, seminars etc.	Task completed

ANNUAL TEACHING PLANS

Subject: Zoology (Session 2024-2025)

Title: Animal Biotechnology

Code: ZOOL 303 TH

Teacher's Name: Dr. Anuj Sawhney

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1st	Mentor- Mentee classes			
	2nd	Mentor- Mentee classes			
	3rd	Mentor- Mentee classes			
	4th	Unit 1: Introduction Concept and scope of biotechnology	Blackboard teaching assisted by use of 3D images on Epson Projector.		Task completed

August,2024	1st	Unit 2: Molecular Techniques in Gene manipulation Cloning vectors: Plasmids, Cosmids,		Class test	Task completed
	2nd	Unit 2: Molecular Techniques in Gene manipulation Cloning vectors: Phagemids, Lambda	„	Class test	Task completed
	3rd	Unit 2: Molecular Techniques in Gene manipulation Cloning vectors: Bacteriophage, M13.		Class test	Task completed
	4th	Unit 2: Molecular Techniques in Gene manipulation Cloning vectors: BAC, YAC,	„	Class test	Task completed
September,2024	1st	MAC and Expression vectors (characteristics)		Practical / Class test	Task completed
	2nd	Restriction enzymes: Nomenclature, detailed study of Type II Transformation techniques: Calcium chloride method and electroporation.	„	Practical / Class test	Task completed
	3rd	Construction of genomic and cDNA libraries and screening by colony and plaque hybridization Southern,		Practical / Class test	Task completed
	4th	Northern and Western blotting; DNA sequencing: Sanger method	„	Practical / Class test	Task completed
October,2024	1st	Polymerase Chain Reaction, DNA Finger Printing and DNA micro array	„	Practical / Class test	Task completed
	2nd	Unit 3: Genetically Modified Organisms Production of cloned and transgenic animals:		Practical / Class test	Task completed

	3 rd	Nuclear Transplantation, Retroviral Method, DNA microinjection	”	Practical / Class test	Task completed
	4 th	Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.		Practical / Class test	Task completed
November,2024	1 st	Production of transgenic plants: Agrobacterium mediated transformation. Applications of transgenic plants: insect and herbicide resistant plants.	”	Practical / Class test	Task completed
	2 nd	Unit 4: Culture Techniques and Applications Animal cell culture, Expressing cloned genes in mammalian cells,	”	Practical / Class test	Task completed
	3 rd	Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)	”	Revision, class tests, quizzes, seminars etc.	Task completed
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparation
December,2024	1 st	MTT	Mid Term Exam		Task completed
	2 nd	Tutorials		-----	-----
	3 rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4 th	Tutorials	”	Assignment/ Seminar	

January, 2025		Winter Vacations			
February, 2025	1st	Winter Vacations			
	2nd	Pending topics if any		Revision, class tests, quizzes, seminars etc.	
	3rd	Pending topics if any	”		Task completed
	4th	Complete syllabus	”	Revision, class tests, quizzes, seminars etc.	Task completed

Title: Reproductive Biology

Code: ZOOL 302 (C) TH

Teacher's Name: Dr. Anuj Sawhney

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1st	Mentor- Mentee classes			
	2nd	Mentor- Mentee classes			
	3rd	Mentor- Mentee classes			
	4th	Unit 1: Reproductive Endocrinology Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins,	Blackboard teaching assisted by use of 3D images on Epson Projector.		Task completed
August,2024	1st	Unit 1: hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female;		Class test	Task completed
	2nd	Unit 1: Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.	”	Class test	Task completed

	3rd	Unit 2: Functional anatomy of male reproduction outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract		Class test	Task completed
	4th	Unit 2: Functional anatomy of male reproduction outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract	„	Class test	Task completed
September,2024	1st	Unit 2: Functional anatomy of male reproduction outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract		Practical / Class test	Task completed
	2nd	Unit 3: Functional anatomy of female reproduction Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of	„	Practical / Class test	Task completed

		implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation			
	3rd	Unit 3: Functional anatomy of female reproduction Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation		Practical / Class test	Task completed
	4th	Unit 3: Functional anatomy of female reproduction Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation	„	Practical / Class test	Task completed

October,2024	1st	Unit 3: Functional anatomy of female reproduction Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation	”	Practical / Class test	Task completed
	2nd	Unit 4: Reproductive Health Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning .		Practical / Class test	Task completed
	3rd	Unit 4: Reproductive Health Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning .	”	Practical / Class test	Task completed

	4 th	Unit 4: Reproductive Health Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning .		Practical / Class test	Task completed
November,2024	1 st	Unit 4: Reproductive Health Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning .	„	Practical / Class test	Task completed
	2 nd	Pending topics if any	„	Practical / Class test	Task completed
	3 rd	Pending topics if any	„	Revision, class tests, quizzes, seminars etc.	Task completed
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparation
December,2024	1 st	MTT	Mid Term Exam		Task completed
	2 nd	Tutorials		-----	-----

	3 rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4 th	Tutorials	”	Assignment/ Seminar	
January, 2025		Winter Vacations			
February, 2025	1 st	Winter Vacations			
	2 nd	Pending topics if any		Revision, class tests, quizzes, seminars etc.	
	3 rd	Pending topics if any	”		Task completed
	4 th	Complete syllabus	”	Revision, class tests, quizzes, seminars etc.	Task completed

Title : Sericulture & Aquarium Fish Keeping Code: ZOOL 303 & ZOOL 304(A) Teacher's Name: Dr. Anuj Sawhney

Month's Name	Week	Topic	Instructional Procedure	Homework/ Assignment/ Practical etc.	Remarks
July,2024	1 st	Mentor- Mentee classes			
	2 nd	Mentor- Mentee classes			
	3 rd	Mentor- Mentee classes			
	4 th	Unit 1: Introduction Sericulture: Definition, history and present status; Silk route	Blackboard teaching assisted by use of 3D images on Epson Projector.		Task completed

August,2024	1st	Unit 1: Types of silkworms, Distribution and Races		Class test	Task completed
	2nd	Exotic and indigenous races. Mulberry and non-mulberry Sericulture	„	Class test	Task completed
	3rd	Unit 2: Biology of Life cycle of Bombyx mori Structure of silk gland and secretion of silk		Class test	Task completed
	4th	Unit 3: Rearing of Silkworms Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances	„	Class test	Task completed
September,2024	1st	Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages Spinning, harvesting and storage of cocoons		Practical / Class test	Task completed
	2nd	Unit 4: Pests and Diseases Pests of silkworm: Uzi fly, dermestid beetles and vertebrates	„	Practical / Class test	Task completed
	3rd	Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases		Practical / Class test	Task completed
	4th	Unit 5: Entrepreneurship in Sericulture Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.	„	Practical / Class test	Task completed
October,2024	1st	Unit1: Introduction to Aquarium Fish Keeping The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes	„	Practical / Class test	Task completed

	2 nd	Unit 2: Biology of Aquarium Fishes common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish		Practical / Class test	Task completed
	3 rd	Unit 2: Biology of Aquarium Fishes common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish	”	Practical / Class test	Task completed
	4 th	Unit 3: Food and feeding of Aquarium fishes Use of live fish feed organisms. Preparation and composition of formulated fish feeds		Practical / Class test	Task completed
November,2024	1 st	Unit 4: Fish Transportation Live fish transport - Fish handling, packing and forwarding techniques.	”	Practical / Class test	Task completed
	2 nd	Unit 5: Maintenance of Aquarium General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry	”	Practical / Class test	Task completed
	3 rd		”	Revision, class tests, quizzes, seminars etc.	Task completed
	4 th	MTT	Mid Term Exam		Mid Term Exam, revision & preparatio

					n
December,2024	1st	MTT	Mid Term Exam		Task completed
	2nd	Tutorials		-----	-----
	3rd	HPU Inter-College shooting (M& W) Championship 2024-25		-----	-----
	4th	Tutorials	”	Assignment/ Seminar	
January, 2025		Winter Vacations			
February, 2025	1st	Winter Vacations			
	2nd	Pending topics if any			
	3rd	Pending topics if any	”	Revision, class tests, quizzes, seminars etc.	Task completed
	4th	Complete syllabus	”	Revision, class tests, quizzes, seminars etc.	Task completed

2. Department of Zoology SWOC Analysis

Date of Establishment of College:	1973
Date of Establishment of College:	1993
Names of Programmes/Courses offered:	UG
Number of teaching posts:	03 (filled)
Number of technical posts:	01 (JLA filled)

Vision

The Zoology Department aims to educate and support students in meeting high academic standards, scientific makeup, practical knowledge, and developing skills to succeed globally. Specifically, the department strives to provide an encouraging environment that enables students to achieve academic excellence, holistic improvement and to inculcate the highest values of biological science.

Mission

1. To motivate the students for their fruitful life.
2. To develop the broad knowledge about the biology of animals.
3. To impart entrepreneurial skills through application-oriented subjects.
4. To provide the best education for students to achieve their goals.
5. To promote research and learning. To create awareness about health-related problems by curriculum.

SWOC Analysis

Strengths:

1. ICT enabled Teaching- Learning
2. Well qualified and experienced faculty
3. Curriculum based on Skill Development Courses viz. Medical Diagnostics, Apiculture, Sericulture and Aquarium Fish Culture.
4. High success rate in exams as compared to other faculty.
5. All sanctioned posts are filled.
6. Harmonious relationship among staff, students and parents.

Weaknesses:

1. Skill Development Courses lacks practical syllabus.
2. No departmental library and Internet facility.
3. Paucity of time for teachers for research work.
4. No special budget for field trips and educational tours.
5. Renovation and up gradation of zoology lab is required.
6. A separate smart class room is required.

Opportunities:

1. Good opportunities for zoology students of placement in lectureship, research, forest department, competitive exams, animal care taker branch, Forensic Medicine, Pest control, animal suppliers etc.
2. Students can start small scale industries such as Apiculture, Fisheries, Aquarium fishes, Poultry, Sericulture, and Aquaculture etc.
3. Good scope for field based activities, if financial support is available.
4. Ease of knowledge exchange between the institutes due to ideal location of institute.
5. Department provides platform to the students to show their potential & knowledge through seminars, interactive sessions, quizzes, routine class tests, practical skills and project work.

Challenges:

1. To cope-up with students from rural background.
2. To teach and conduct practical classes of the students with poor foundation and background.
3. To enhance students progression and self-dependence.

Future Plans:

1. To start Certificate course in skill based courses like Medical Diagnostics, Apiculture, Sericulture and Aquarium Fish Culture.
2. To develop the new Zoology lab and a separate Smart Class Room.

Syllabus taught

BSc.I Year

1. DSC IA, Animal Diversity (ZOOL 101)
2. DSC IB, Comparative Anatomy and Developmental Bio. of Vertebrates (ZOOL 102)

BSc.II Year

1. DSC ID, Physiology and Biochemistry (ZOOL 201)
2. DSC ID, Genetics and Evolutionary Biology (ZOOL 202)
3. SEC-I, Medical Diagnostics (ZOOL 203)
4. SEC-II, Apiculture (ZOOL 204)

BSc.III Year

1. DSE IA, Animal Biotechnology (ZOOL 302B)
2. DSE IB, Reproductive Biology (ZOOL 302 C)
3. SEC-III, Sericulture (ZOOL 303)
4. SEC- IV, Aquarium Fish Keeping (ZOOL 304 A)

Department of Zoology		
Plan of Action (Session:2024-25)		
S No.	Activity	Tentative Date/Month
1	Activities- <ol style="list-style-type: none"> 1. Career counseling of students. 2. Talk on “Biosciences and Future Scope”. 3. Club and Societies memberships 4. Class test 	August, 2024 First week of month Second week of month Third week of month Last week of month
2	Activities- <ol style="list-style-type: none"> 1. Setting up of vermicompost unit in the college. 2. Assigning field projects to the students. 3. Class test 	September, 2024 Second week of month Third week of month Last week of month
3	Visits to- <ol style="list-style-type: none"> 1. Medical diagnostic laboratory. 2. Apiary unit. 3. Sericulture unit. 4. Class test 	October, 2024 First week of month Second week of month Third week of month Last week of month
4	Activities- <ol style="list-style-type: none"> 1. Organize medical health check up camp by students of zoology department (BP, HB, Blood Group and Sugar test etc.). 2. Invited talk on “Health and Hygiene in females”. 3. Visit to Natural History Museum and submission of report. 4. Class test 	November, 2024 First week of month Second week of month Third week of month Last week of month
5	Visits to- <ol style="list-style-type: none"> 1. Fish farm. 2. Biotechnology industry / Sewage treatment plant. 3. Mid Term exams. 	December, 2024 First week of month Second week of month Third week & Last week of month or

		as proposed
6	Assigning of Seminar Topics to the students.	January, 2025
7	National Science Day celebration (proposed activities). 1. Invited talks. 2. Inter class quiz competition. 3. Poster making competition. 4. Class test	February, 2025 Last week of month
8	Activities- 1. Students' seminars on the assigned topics from the syllabus. 2. Term end practical exams	March, 2025
9	Term end exams	April, 2025
10	Term end exams	May, 2025

Plan of Action (Session:2025-26)

Activity	Tentative Date/Month
Activities- 1. Career counseling of students. 2. Talk on "Biosciences and Future Scope". 3. Club and Societies memberships 4. Class test	August, 2025 First week of month Second week of month Third week of month Last week of month
Activities- 4. Setting up of vermicompost unit in the college. 5. Assigning field projects to the students. 6. Class test	September, 2025 Second week of month Third week of month Last week of month

Visits to- 5. Medical diagnostic laboratory. 6. Apiary unit. 7. Sericulture unit. 8. Class test	October, 2025 First week of month Second week of month Third week of month Last week of month
Activities- 5. Organize medical health check up camp by students of zoology department (BP, HB, Blood Group and Sugar test etc.). 6. Invited talk on “Health and Hygiene in females”. 7. Visit to Natural History Museum and submission of report. 8. Class test	November, 2025 First week of month Second week of month Third week of month Last week of month
Visits to- 4. Fish farm. 5. Biotechnology industry / Sewage treatment plant. 6. Mid Term exams.	December, 2025 First week of month Second week of month Third week & Last week of month or as proposed
Assigning of Seminar Topics to the students.	January, 2026
National Science Day celebration (proposed activities). 5. Invited talks. 6. Inter class quiz competition. 7. Poster making competition. 8. Class test	February, 2026 Last week of month
Activities- 3. Students’ seminars on the assigned topics from the syllabus. 4. Term end practical exams	March, 2026
Term end exams	April, 2026
Term end exams	May, 2026

3. COURSE LEARNING OUTCOMES

CLASS	PROGRAMME	COURSE STUDY OUTCOMES
BSc.III	ANIMAL BIOTECHNOLOGY ZOOLOGY 302 (A)	The students will be able to use or demonstrate the basic techniques of biotechnology like DNA isolation, PCR, transformation, restriction digestion etc., Ethical and social issues regarding GMOs and designing a project for research for successful implementation of the ideas and develop solutions to solve problems related to biotechnology keeping in mind safety factor for environment and society.
	REPRODUCTIVE BIOLOGY ZOOLOGY 302 (C)	The students will be able to describe the basic reproductive system mechanisms, and Students can reproduce biology; hormonal changes, various reproductive disorders, reproductive technologies along with their social and ethical aspects of reproductive technologies and research and reproductive health.
	SERICULTURE ZOOLOGY 303	The students will be able to recognize various species of silk moths in India, and exotic and indigenous races, the opportunities and employment in sericulture industry- in public, private and government sector.
	AQUARIUM FISH KEEPING ZOOLOGY 304 (A)	The students will be able to recognize different kinds of fish (commercial, decorative and of scientific studies) their compatibility in aquarium.
BSc.II	PHYSIOLOGY AND BIOCHEMISTRY ZOOLOGY 201	The students will be able to know basic human physiology and correlate with histological structures, Understand how animals maintain an internal homeostatic state in response to changes in their external environment and interdependence of physiological and biomolecules, essentials of the metabolic pathways along with their regulation. Become aware about classical laboratory techniques, use modern instrumentation, design and conduct scientific experiments and analyze the resulting data.
	GENETICS AND EVOLUTIONARY BIOLOGY ZOOLOGY 202	The students will be able to gain knowledge of the basic principles of inheritance, analyze pedigree leading to development of analytical skills and critical thinking, mechanisms of mutations, the causative agents and the harmful impact of various chemicals and drugs being used in day to day life. Gain knowledge about the relationship of the evolution of various species and the environment they live in. Get motivated to work towards mitigating climate change so that well adapted species do not face extinction as a result of sudden drastic changes in environment. Use knowledge gained from study of variations, genetic drift to ensure that conservation efforts for small threatened populations are focused in right direction. Predict the practical implication of various evolutionary forces acting on the human population in the field of human health, agriculture and wildlife conservation.
	MEDICAL	The students will be able to gain knowledge about various infectious, non-infectious and lifestyle diseases,

	DIAGNOSTICS ZOOLOGY 203	tumors and their diagnosis. Develop their skills in various types of tests and staining procedure involved in hematology, clinical biochemistry and will know the basics of instrument handling. Learn scientific approaches/techniques used in the clinical laboratories to investigate Various diseases and will be skilled to work in research laboratories. Gain knowledge about common imaging technologies and their utility in the clinic to diagnose a specific disease.
	APICULTURE ZOOLOGY 204	The students will learn about the various species of honey bees in India, their social organization and Importance. Be aware about the opportunities and employment in apiculture- in public, private and Government sector. Gain thorough knowledge about the techniques involved in bee keeping and honey production. Know about various products obtained from beekeeping sector and their importance. Develop entrepreneurial skills necessary for self-employment in beekeeping sector.
BSc.I	ANIMAL DIVERSITY ZOOLOGY 101	The students will to be able to understand about the importance of systematics, taxonomy and structural organization of animals living in diverse habitats and explore evolutionary history and relationships of different non chordates and chordates, through practical sessions, team work, group discussions, assignments and projects. Comprehend the circulatory, nervous and skeletal system of chordates.
	COMPARATIVE ANATOMY AND DEVELOPMENT BIOLOGY OF VERTEBRATES ZOOLOGY 102	The students will to be able to explain comparative account of the different vertebrate systems, pattern of vertebrate evolution, organization and functions of various systems. Understand the events that lead to formation of a multicellular organism from a single fertilized egg, the zygote. Describe the general patterns and sequential developmental stages during embryogenesis; and understand how the developmental processes lead to establishment of body plan of multicellular organisms.