BLOW UP SYLLABUS
II PUC PHYSICS - 33
(THEORY)

UNIT-I

Chapter 1: ELECTRIC CHARGES AND FIELDS (9 hours)

Electric charges and their properties: Additivity of charges, quantisation of charges and conservation of charges - Coulomb's law: Statement, explanation (only in free space) and expression in vector form - Definition of SI unit of charge - Superposition principle: Statement, application to find the force between multiple charges.

Electric field: Definition of electric field - Mention of expression for electric field due to a point charge -Application of superposition principle to find electric field for a system of charges.

Continuous charge distribution: Definitions of surface, linear and volume charge densities - Mention of expression for electric field due to a continuous charge distribution.

Electric dipole: Definition of electric dipole and dipole moment - Derivation of electric field due to a dipole (a) at any point on its axis (b) at any point on its equatorial plane -Derivation of the torque on an electric dipole in an uniform electric field and expression in vector form.

Electric field lines: Properties and representation - Electric flux: Concept of electric flux - Area element vector, electric flux through an area element - Gauss's Law: Statement and its applications to find electric field due to (a) infinitely long straight charged wire, (b) uniformly charged infinite plane sheet and (c) uniformly charged thin spherical shell (field inside and outside), Numerical Problems.

UNIT-II

Chapter 2: ELECTROSTATIC POTENTIAL AND CAPACITANCE (9 hours)

Electric potential: Definition of electric potential at a point - Definition of potential difference - Derivation of electric potential due to a point charge - Mention of expression for electric potential due a short electric dipole at any point - Comparison of the variation of electric potential with distance between a point charge and an electric dipole - Application of superposition principle to find electric potential due to a system of charges.

Equipotential surfaces: Properties - Derivation of the relation between electric field and potential,

Electric potential energy: Definition of electric potential energy of a system of charges - Derivation of electric potential energy of a system of two point charges in the absence of external electric field - Mention of expression for electric potential energy of a system of two point charges in presence of external electric field. Mention of the expression for the electric potential energy of an electric dipole placed in a uniform electric field.

Electrostatics of conductors - Dielectrics and electric polarisation: Polar and non-polar dielectrics and their behavior in the absence and presence of an external electric field.
Capacitors and capacitance - Parallel plate capacitor - Derivation of the capacitance of a capacitor without dielectric medium - Mention of expression for capacitance of a capacitor with dielectric medium - Definition of dielectric constant.
Combination of capacitors: Derivation of effective capacitance of two capacitors (a) in series combination and (b) in parallel combination,
Derivation of energy stored in a capacitor.
Van de Graaff generator: Principle, labeled diagram and use, Numerical Problems.

UNIT-III

Chapter 3: CURRENT ELECTRICITY (15 hours)

Definition of electric current - Electric currents in a conductor - Definition of current density - Ohm's law: Statement and explanation - Dependence of electrical resistance on the dimensions of conductor and mention of $R = \rho l/A$ - Electrical resistivity and conductivity - Derivation of the relation $\vec{j} = \sigma\vec{E}$ (equivalent form of Ohm's law) - Limitations of Ohm's law.
Drift of electrons and origin of resistivity: Definitions of drift velocity, relaxation time and mobility - Derivation of expression for conductivity of a material $(\sigma = ne^2\tau/m)$.
Color code of carbon resistors; Temperature dependence of resistivity of metals and semiconductors.
Electrical energy and power: Mention of expression for power loss.
Combination of resistors: Derivation of effective resistance of two resistors (a) in series combination and (b) in parallel combination.
Cells: Definitions of internal resistance of a cell, terminal potential difference and emf of a cell -Derivation of current drawn by external resistance.
Combination of cells: Derivation of expressions for equivalent emf and equivalent internal resistance (a) in series and (b) in parallel combination.
Kirchhoff's rules: Statements and explanation.
Wheatstone bridge: Derivation of balancing condition – Metre Bridge.
Potentiometer: Principle - Mention of applications (a) to compare emf of two cells and (b) to measure internal resistance of a cell, Numerical Problems.

UNIT-IV

Chapter 4: MOVING CHARGES AND MAGNETISM (10 hours)

Concept of magnetic field - Oersted's experiment – Force on a moving charge in uniform magnetic and electric fields: Lorentz force - Derivation of magnetic force on a current carrying conductor $\vec{F} = I\,(\vec{l} \times \vec{B})$.
Motion of a charge in a uniform magnetic field: Nature of trajectories - Derivation of radius and angular frequency of circular motion of a charge in uniform magnetic field.

Velocity selector: Crossed electric and magnetic fields serve as velocity selector. Cyclotron: Principle, construction, working and uses.
Biot–Savart law: Statement, explanation and expression in vector form - Derivation of magnetic field on the axis of a circular current loop - Right hand thumb rule to find direction.
Ampere's circuital law: Statement and explanation - Application of Ampere's circuital law to derive the magnetic field due to an infinitely long straight current carrying wire: Solenoid and toroid - Mention of expressions for the magnetic field at a point inside a solenoid and a toroid.
Derivation of the force between two parallel current carrying conductors - Definition of ampere.
Current loop as a magnetic dipole - Qualitative explanation and definition of magnetic dipole moment -Mention of expression for torque experienced by a current loop in a magnetic field - Derivation of magnetic dipole moment of a revolving electron in a hydrogen atom and to obtain the value of Bohr magneton.
Moving coil galvanometer: Mention of expression for angular deflection - Definitions of current sensitivity and voltage sensitivity - Conversion of galvanometer to ammeter and voltmeter, Numerical Problems.

UNIT-V

Chapter 5: MAGNETISM AND MATTER (8 hours)

Bar magnet: Properties of magnetic field lines - Bar magnet as an equivalent solenoid with derivation - Dipole in a uniform magnetic field: Mention of expression for time period of oscillation of small compass needle in a uniform magnetic field -Gauss law in magnetism: Statement and explanation.
Earth's magnetic field and its elements: Declination, Dip and Earth's horizontal component B_H and their variation - Definitions of magnetisation (M), magnetic intensity (H), magnetic susceptibility (χ) and permeability (μ, μ_o *and* μ_r).
Magnetic properties of materials: Paramagnetic, diamagnetic and ferromagnetic substances, examples and properties - Curie's law and Curie temperature - Hysteresis, Hysteresis loop, definitions of retentivity and coercivity - Permanent magnets and electromagnets.

Chapter 6: ELECTROMAGNETIC INDUCTION (7 hours)

Experiments of Faraday and Henry - Magnetic flux $\phi_B = \vec{B} \cdot \vec{A}$ Faraday's law of electromagnetic induction: Statement and explanation - Lenz's law: Statement, explanation and its significance as conservation of energy.
Motional emf - Derivation of motional emf - Eddy currents -Advantages of eddy currents with common practical applications.
Inductance - Mutual inductance: Mention of expression for mutual inductance of two coaxial solenoids – Mention of expression for induced emf $E = -M \frac{dI}{dt}$.
Self-inductance: Mention of expression for self-inductance of solenoid - Mention of expression for induced emf $E = -L \frac{dI}{dt}$ - Derivation of energy stored in the coil.

AC generator: Labeled diagram - Derivation of instantaneous emf in an ac generator, Numerical Problems.

UNIT-VI

Chapter 7: ALTERNATING CURRENT (8 hours)

Mention of expression for instantaneous, peak and rms values of alternating current and voltage.

AC voltage applied to a resistor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation.

AC voltage applied to an inductor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation and mention of expression for inductive reactance.

AC voltage applied to a capacitor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation and mention of expression for capacitive reactance.

AC voltage applied to series LCR circuit: Derivation of expression for impedance, current and phase angle using phasor diagram - Electrical resonance - Derivation of expression for resonant frequency - Mention of expressions for bandwidth and sharpness (quality factor).

Mention of expression for power in ac circuit - Power factor and qualitative discussion in the case of resistive, inductive and capacitive circuit-Meaning of wattless current.

LC oscillations: Qualitative explanation - Mention of expressions for frequency of LC oscillations and total energy of LC circuit.

Transformer: Principle, construction and working - Mention of expression for turns ratio - Sources of energy losses, Numerical Problems.

Chapter 8: ELECTROMAGNETIC WAVES (2 hours)

Displacement current - Mention the need for displacement current (inconsistency of Ampere's circuital law) -Mention of expression for displacement current - Mention of expression for Ampere-Maxwell law.

Electromagnetic waves: Sources and nature of electromagnetic waves – Characteristics - Mention of expression of speed of light.

Electromagnetic spectrum: Wavelength range and their uses.

UNIT-VII

Chapter 9: RAY OPTICS AND OPTICAL INSTRUMENTS (9 hours)

Reflection of light by spherical mirrors: Sign convention (Cartesian rule) - Focal length of spherical mirrors: Derivation of the relation $f = R/2$ in the case of a concave mirror -Mirror equation: Derivation of mirror equation in the case of concave mirror producing a real image - Definition and expression for linear magnification.

Refraction of light: Explanation of phenomenon - Laws of refraction - Consequences.

Total internal reflection: Explanation of phenomenon - Mention of conditions - Definition of critical angle - Mention the relation between n and i_c - Mention of its applications (mirage, total reflecting prisms and optical fibers).
Refraction at spherical surfaces: Derivation of the relation between u, v, n and R.
Refraction by a Lens: Derivation of lens-maker's formula - Mention of thin lens formula - Definition and expression for linear magnification.
Power of a lens and mention of expression for it.
Combination of thin lenses in contact – Derivation of equivalent focal length of two thin lenses in contact.
Refraction of light through a prism: Derivation of refractive index of the material of the prism - Dispersion by prism.
Scattering of light: Rayleigh's scattering law - Blue colour of the sky and reddish appearance of the sun at sunrise and sunset.
Optical instruments: Eye: Accommodation and least distance of distinct vision - Correction of eye defects (myopia and hypermetropia) using lenses.
Simple microscope: Ray diagram for image formation - Mention of expression for the magnifying power - Compound microscope: Ray diagram for image formation - Mention of expressions for the magnifying power when the final image is at (a) least distance of distinct vision and (b) infinity.
Telescope: Ray diagram for image formation - Mention of expression for the magnifying power and length of the telescope ($L = f_o + f_e$) - Schematic ray diagram of reflecting telescope, Numerical Problems.

UNIT-VIII

Chapter 10: WAVE OPTICS (9 hours)

Wave front: plane, spherical and cylindrical – Huygens principle - Refraction of plane wave (rarer to denser), derivation of Snell's law - Reflection of a plane wave by a plane surface, derivation of the law of reflection.
Explanation of refraction of a plane wave by (a) a thin prism, (b) by a convex lens and (c) by a concave mirror, using diagrams.
Coherent sources - Theory of interference, (with equal amplitude) arriving at the conditions for constructive and destructive interference.
Young's experiment: Brief description - Derivation of fringe width.
Diffraction: Explanation of the phenomenon - Diffraction due to a single slit -Mention of the conditions for diffraction minima and maxima - Intensity distribution curve.
Resolving power of optical instruments: Mention of expressions for limit of resolution of (a) microscope and (b) telescope - Methods of increasing resolving power of microscope and telescope.
Polarisation: Explanation of the phenomenon - Plane polarised light - Polaroid and its uses - Pass axis – Malus' law - Polarisation by reflection: Brewster's angle - Arriving at Brewster's law - Statement of Brewster's law, Numerical Problems.

UNIT-IX

Chapter 11: DUAL NATURE OF RADIATION AND MATTER (6 hours)

Electron emission: Definition of electron volt (eV) - Types of electron emission.
Photoelectric effect: Mention of Hertz's observations - Mention of Hallwachs' and Lenard's observations - Explanation of the phenomenon of Photoelectric effect – Definition of work function, threshold frequency and stopping potential - Experimental setup to study Photoelectric effect: Observations - Mention of effect of (a)intensity of light on photocurrent, (b) potential on photocurrent and (c) frequency of incident radiation on stopping potential.
Einstein's photoelectric equation: Explanation of experimental results.
Particle nature of light: Characteristics of photon.
Wave nature of matter: de-Broglie hypothesis - Mention of de-Broglie relation- Mention of expression for de-Broglie wavelength in terms of kinetic energy and acceleration potential - Davisson and Germer experiment: (No experimental details) Brief explanation of conclusion - wave nature of electrons on the basis of electron diffraction, Numerical Problems.

Chapter 12: Atoms (5 hours)

Alpha particle scattering: Schematic diagram of Geiger-Marsden experiment, observations and conclusion - Rutherford's model of an atom - Derivation of total energy of electron in hydrogen atom in terms of orbit radius.
Atomic spectra: Spectral series of hydrogen - Mention of empirical formulae for $1/\lambda$(wave number) of different series.
Bohr model of hydrogen atom: Bohr's postulates - Derivation of Bohr radius - Derivation of energy of electron in stationary states of hydrogen atom - Line spectra of hydrogen atom: Derivation of frequency of emitted radiation - Mention of expression for Rydberg constant - Energy level diagram - de-Broglie's explanation of Bohr's second postulate - Limitations of Bohr model, Numerical Problems.

UNIT-X

Chapter 13: NUCLEI (7 hours)

Definition of atomic mass unit (u) - Isotopes, isobars and isotones - Composition, size, mass and density of the nucleus - Einstein's mass energy relation - Nuclear binding energy: Brief explanation of mass defect and binding energy - Binding energy per nucleon -Binding energy curve - Nuclear force and its characteristics.
Nuclear fission and nuclear fusion with examples.
Radioactivity: Law of radioactive decay - Derivation of $N = N_o e^{-\lambda t}$ - Activity (decay rate) and its units - becquerel and curie - Definition and derivation of half-life of radioactive element - Definition of mean life and mention its expression.
Alpha decay, beta decay (negative and positive) and gamma decay with examples - Q value of nuclear reaction, Numerical Problems.

Chapter 14: SEMICONDUCTOR ELECTRONICS (12 hours)

Energy bands in solids: Valance band, conduction band and energy gap - Classification of solids on the basis of energy bands.

Semiconductors: Intrinsic semiconductors - Extrinsic semiconductors (p-type and n-type); p-n junction: p-n junction formation.

Semiconductor diode: Forward and reverse bias - I-V characteristics - Definitions of cut-in-voltage, breakdown voltage and reverse saturation current.

Diode as a rectifier: Circuit diagram, working, input and output waveforms of a) half-wave rectifier and (b) full-wave rectifier.

Zener diode: I-V characteristics - Zener diode as a voltage regulator.

Optoelectronic junction devices: Working principles and mention of applications of photodiode, LED and solar cell.

Junction transistor: Types of transistor - Transistor action - Common emitter characteristics of a transistor: Drawing of input and output characteristics - Definitions of input resistance, output resistance and current amplification factor.

Transistor as a switch: Circuit diagram and working.

Transistor as an amplifier (CE - configuration): Circuit diagram and working - Derivation of current gain and voltage gain.

Transistor as an oscillator: principle and block diagram.

Logic gates: Logic symbol and truth table of NOT, OR, AND, NAND and NOR gates.

Chapter 15: COMMUNICATION SYSTEMS (4 hours)

Block diagram of generalized communication system - Basic terminology used in electronic communication systems : Transducer, Signal, Noise, Transmitter, Receiver, Attenuation, Amplification, Range, Bandwidth, Modulation, Demodulation, Repeater - Mention of bandwidth of signals for speech, TV and digital data - Mention of bandwidth of transmission medium for coaxial cable, free space and optical fibers - Propagation of electromagnetic waves: Brief explanation of ground wave, sky wave and space wave - Need for modulation - Amplitude modulation: Meaning - Block diagram of AM transmitter and AM receiver.

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BLOW UP SYLLABUS
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UNIT-IV

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Concept of magnetic field - Oersted's experiment – Force on a moving charge in uniform magnetic and electric fields: Lorentz force - Derivation of magnetic force on a current carrying conductor $\vec{F} = I\,(\vec{l} \times \vec{B})$.
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Earth's magnetic field and its elements: Declination, Dip and Earth's horizontal component B_H and their variation - Definitions of magnetisation (M), magnetic intensity (H), magnetic susceptibility (χ) and permeability (μ, μ_o *and* μ_r).
Magnetic properties of materials: Paramagnetic, diamagnetic and ferromagnetic substances, examples and properties - Curie's law and Curie temperature - Hysteresis, Hysteresis loop, definitions of retentivity and coercivity - Permanent magnets and electromagnets.

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Experiments of Faraday and Henry - Magnetic flux $\phi_B = \vec{B} \cdot \vec{A}$ Faraday's law of electromagnetic induction: Statement and explanation - Lenz's law: Statement, explanation and its significance as conservation of energy.
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Inductance - Mutual inductance: Mention of expression for mutual inductance of two coaxial solenoids – Mention of expression for induced emf $E = -M \frac{dI}{dt}$.
Self-inductance: Mention of expression for self-inductance of solenoid - Mention of expression for induced emf $E = -L \frac{dI}{dt}$ - Derivation of energy stored in the coil.

AC generator: Labeled diagram - Derivation of instantaneous emf in an ac generator, Numerical Problems.

UNIT-VI

Chapter 7: ALTERNATING CURRENT (8 hours)

Mention of expression for instantaneous, peak and rms values of alternating current and voltage.

AC voltage applied to a resistor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation.

AC voltage applied to an inductor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation and mention of expression for inductive reactance.

AC voltage applied to a capacitor: Derivation of expression for current, mention of phase relation between voltage and current, phasor representation and mention of expression for capacitive reactance.

AC voltage applied to series LCR circuit: Derivation of expression for impedance, current and phase angle using phasor diagram - Electrical resonance - Derivation of expression for resonant frequency - Mention of expressions for bandwidth and sharpness (quality factor).

Mention of expression for power in ac circuit - Power factor and qualitative discussion in the case of resistive, inductive and capacitive circuit-Meaning of wattless current.

LC oscillations: Qualitative explanation - Mention of expressions for frequency of LC oscillations and total energy of LC circuit.

Transformer: Principle, construction and working - Mention of expression for turns ratio - Sources of energy losses, Numerical Problems.

Chapter 8: ELECTROMAGNETIC WAVES (2 hours)

Displacement current - Mention the need for displacement current (inconsistency of Ampere's circuital law) -Mention of expression for displacement current - Mention of expression for Ampere-Maxwell law.

Electromagnetic waves: Sources and nature of electromagnetic waves – Characteristics - Mention of expression of speed of light.

Electromagnetic spectrum: Wavelength range and their uses.

UNIT-VII

Chapter 9: RAY OPTICS AND OPTICAL INSTRUMENTS (9 hours)

Reflection of light by spherical mirrors: Sign convention (Cartesian rule) - Focal length of spherical mirrors: Derivation of the relation $f = R/2$ in the case of a concave mirror -Mirror equation: Derivation of mirror equation in the case of concave mirror producing a real image - Definition and expression for linear magnification.

Refraction of light: Explanation of phenomenon - Laws of refraction - Consequences.

Total internal reflection: Explanation of phenomenon - Mention of conditions - Definition of critical angle - Mention the relation between n and i_c - Mention of its applications (mirage, total reflecting prisms and optical fibers).
Refraction at spherical surfaces: Derivation of the relation between u, v, n and R.
Refraction by a Lens: Derivation of lens-maker's formula - Mention of thin lens formula - Definition and expression for linear magnification.
Power of a lens and mention of expression for it.
Combination of thin lenses in contact – Derivation of equivalent focal length of two thin lenses in contact.
Refraction of light through a prism: Derivation of refractive index of the material of the prism - Dispersion by prism.
Scattering of light: Rayleigh's scattering law - Blue colour of the sky and reddish appearance of the sun at sunrise and sunset.
Optical instruments: Eye: Accommodation and least distance of distinct vision - Correction of eye defects (myopia and hypermetropia) using lenses.
Simple microscope: Ray diagram for image formation - Mention of expression for the magnifying power - Compound microscope: Ray diagram for image formation - Mention of expressions for the magnifying power when the final image is at (a) least distance of distinct vision and (b) infinity.
Telescope: Ray diagram for image formation - Mention of expression for the magnifying power and length of the telescope ($L = f_o + f_e$) - Schematic ray diagram of reflecting telescope, Numerical Problems.

UNIT-VIII

Chapter 10: WAVE OPTICS (9 hours)

Wave front: plane, spherical and cylindrical – Huygens principle - Refraction of plane wave (rarer to denser), derivation of Snell's law - Reflection of a plane wave by a plane surface, derivation of the law of reflection.
Explanation of refraction of a plane wave by (a) a thin prism, (b) by a convex lens and (c) by a concave mirror, using diagrams.
Coherent sources - Theory of interference, (with equal amplitude) arriving at the conditions for constructive and destructive interference.
Young's experiment: Brief description - Derivation of fringe width.
Diffraction: Explanation of the phenomenon - Diffraction due to a single slit -Mention of the conditions for diffraction minima and maxima - Intensity distribution curve.
Resolving power of optical instruments: Mention of expressions for limit of resolution of (a) microscope and (b) telescope - Methods of increasing resolving power of microscope and telescope.
Polarisation: Explanation of the phenomenon - Plane polarised light - Polaroid and its uses - Pass axis – Malus' law - Polarisation by reflection: Brewster's angle - Arriving at Brewster's law - Statement of Brewster's law, Numerical Problems.

UNIT-IX

Chapter 11: DUAL NATURE OF RADIATION AND MATTER (6 hours)

Electron emission: Definition of electron volt (eV) - Types of electron emission.
Photoelectric effect: Mention of Hertz's observations - Mention of Hallwachs' and Lenard's observations - Explanation of the phenomenon of Photoelectric effect – Definition of work function, threshold frequency and stopping potential - Experimental setup to study Photoelectric effect: Observations - Mention of effect of (a)intensity of light on photocurrent, (b) potential on photocurrent and (c) frequency of incident radiation on stopping potential.
Einstein's photoelectric equation: Explanation of experimental results.
Particle nature of light: Characteristics of photon.
Wave nature of matter: de-Broglie hypothesis - Mention of de-Broglie relation- Mention of expression for de-Broglie wavelength in terms of kinetic energy and acceleration potential - Davisson and Germer experiment: (No experimental details) Brief explanation of conclusion - wave nature of electrons on the basis of electron diffraction, Numerical Problems.

Chapter 12: Atoms (5 hours)

Alpha particle scattering: Schematic diagram of Geiger-Marsden experiment, observations and conclusion - Rutherford's model of an atom - Derivation of total energy of electron in hydrogen atom in terms of orbit radius.
Atomic spectra: Spectral series of hydrogen - Mention of empirical formulae for $1/\lambda$(wave number) of different series.
Bohr model of hydrogen atom: Bohr's postulates - Derivation of Bohr radius - Derivation of energy of electron in stationary states of hydrogen atom - Line spectra of hydrogen atom: Derivation of frequency of emitted radiation - Mention of expression for Rydberg constant - Energy level diagram - de-Broglie's explanation of Bohr's second postulate - Limitations of Bohr model, Numerical Problems.

UNIT-X

Chapter 13: NUCLEI (7 hours)

Definition of atomic mass unit (u) - Isotopes, isobars and isotones - Composition, size, mass and density of the nucleus - Einstein's mass energy relation - Nuclear binding energy: Brief explanation of mass defect and binding energy - Binding energy per nucleon -Binding energy curve - Nuclear force and its characteristics.
Nuclear fission and nuclear fusion with examples.
Radioactivity: Law of radioactive decay - Derivation of $N = N_o e^{-\lambda t}$ - Activity (decay rate) and its units - becquerel and curie - Definition and derivation of half-life of radioactive element - Definition of mean life and mention its expression.
Alpha decay, beta decay (negative and positive) and gamma decay with examples - Q value of nuclear reaction, Numerical Problems.

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Energy bands in solids: Valance band, conduction band and energy gap - Classification of solids on the basis of energy bands.

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Semiconductor diode: Forward and reverse bias - I-V characteristics - Definitions of cut-in-voltage, breakdown voltage and reverse saturation current.

Diode as a rectifier: Circuit diagram, working, input and output waveforms of a) half-wave rectifier and (b) full-wave rectifier.

Zener diode: I-V characteristics - Zener diode as a voltage regulator.

Optoelectronic junction devices: Working principles and mention of applications of photodiode, LED and solar cell.

Junction transistor: Types of transistor - Transistor action - Common emitter characteristics of a transistor: Drawing of input and output characteristics - Definitions of input resistance, output resistance and current amplification factor.

Transistor as a switch: Circuit diagram and working.

Transistor as an amplifier (CE - configuration): Circuit diagram and working - Derivation of current gain and voltage gain.

Transistor as an oscillator: principle and block diagram.

Logic gates: Logic symbol and truth table of NOT, OR, AND, NAND and NOR gates.

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Block diagram of generalized communication system - Basic terminology used in electronic communication systems : Transducer, Signal, Noise, Transmitter, Receiver, Attenuation, Amplification, Range, Bandwidth, Modulation, Demodulation, Repeater - Mention of bandwidth of signals for speech, TV and digital data - Mention of bandwidth of transmission medium for coaxial cable, free space and optical fibers - Propagation of electromagnetic waves: Brief explanation of ground wave, sky wave and space wave - Need for modulation - Amplitude modulation: Meaning - Block diagram of AM transmitter and AM receiver.

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II PUC CHEMISTRY SYLLABUS BLOW-UP

UNIT-I Solid State 8 hrs

General characteristics of solids: amorphous and crystalline solids – examples, differences. Classification of crystalline solids – based on binding forces: molecular solids – (non-polar, polar, H-bonded), ionic solids, metallic solids, covalent or network solids – examples for all.

Definitions – lattice point, crystal lattice, unit cell, coordination number. Parameters of a unit cell, names of seven crystal systems , calculation of number of atoms in a cubic unit cell – simple cubic, bcc, fcc. Close packing in two dimensional and three dimensional lattices - brief information, voids - types of voids, tetrahedral and octahedral and their relative numbers, calculation of the formula of the compounds based on the number of voids filled. Packing in solids - calculation of packing efficiency- fcc/ccp, bcc, simple cubic. Formula to calculate the density of the unit cell to be assumed- use the formula to calculate a, d , z , M , N_A. Numerical problems.

Point defects-types, a brief account of Frenkel and Schottky defects, metal excess defect and metal deficiency defect with examples.

Electrical properties: classification into conductors, insulators and semiconductors - their comparison based on band theory of metals, n- type and p-type semiconductors – differences and examples. Magnetic properties of substances – paramagnetism, diamagnetism and ferromagnetism, examples.

UNIT-II Solutions 9 hrs

Types of Solutions – binary – gaseous, liquid and solids, expressing the concentration of a solution of a solid in a liquid – mole fraction, molarity and molality. Solubility, solubility of a gas in a liquid – Henry's law, graph of partial pressure of a gas *v*s its mole fraction in solution, effect of pressure, temperature, applications of Henry's law.

Solution of liquid in liquid – Raoult's law- statement, mathematical expression, numerical problems, ideal solution – characteristics, graph, non - ideal solution –types - their characteristics and differences, examples, azeotropes – types, examples.

Solution of a solid in a liquid – Raoult's law – colligative properties – relative lowering of vapour pressure, elevation in boiling point, depression in freezing point, graphs for elevation in boiling point and depression in freezing point, SI units for K_b, K_f , osmosis – osmotic pressure, isotonic, hypertonic, hypotonic solutions, reverse osmosis – application in desalination of water. Numerical problems on determination of molar mass using colligative properties.

Abnormal molar mass, van't Hoff factor *i*, value of *i* for non-electrolytes and solutes that associate or dissociate in dilute solution.

UNIT-III Electrochemistry 9 hrs

Redox reaction – As fundamental reaction in electrochemical cells, electronic and electrolytic conductors – differences, strong and weak electrolytes, examples-Ionic conductance- factors affecting ionic conductance, conductivity and molar conductivity of electrolytic solutions- definitions, mathematical expressions, relationship between them, SI units, numerical problems. Variation of conductivity and molar conductivity with concentration, graph for variation of Λ_m *vs* $\sqrt{c}$ for strong and weak electrolytes using equation $\Lambda_m = \Lambda_m^0 - A\sqrt{c}$ (measurement of conductivity from Wheatstone network not included), limiting molar conductivities, Kohlrausch law and applications, numerical problems on calculation of Λ_m^0 for weak electrolytes. Electrolysis –Faraday's laws of electrolysis (elementary idea) , concept of nF required to discharge one mole of M^{n+} ions, numerical problems on I law.

Galvanic cells **:** Electrode potential , half cell concept, standard electrode potential, galvanic cell, Daniell cell, cell potential, EMF (emf), $E^0 = E_R^0 - E_L^0$. Measurement of electrode potential – SHE - diagram, half cell representation, half cell reaction, E^0 taken as ± 0.0 V (at all temperatures). Measurement of E^0 of Zn and Cu using SHE (experimental details not expected) numerical problems on $E^0 = E_R^0 - E_L^0$, importance of standard electrode potentials- to decide and compare the strengths of oxidizing and reducing agents . Nernst equation (derivation not required) **:** Nernst equation at 298 K for single electrode potential and cell potential, numerical problems to calculate half cell and cell potentials (only for metal electrodes). Relationship between equilibrium constant and E_{cell}^0 (derivation not required), numerical problems. Relationship between standard Gibbs energy and E_{cell}^0 ,numerical problems.

Factors affecting the products of electrolysis, examples – molten and aqueous solution of NaCl only.

Batteries**:** types-difference, examples, Leclanche cell (dry cell) and Lead acid battery–anode, cathode, electrolyte, reactions at anode and cathode (diagram not required), Fuel cell – definition – examples, H_2-O_2 fuel cell – schematic diagram, anode, cathode, electrolyte, reactions at anode and cathode.

Corrosion – rusting of iron- anodic, cathodic reactions, composition of rust, methods of prevention.

UNIT-IV Chemical Kinetics 9 Hrs

Rate of a reaction – average and instantaneous ,with graphs, SI unit, rate of a reaction expressed as rate of change in molar concentration of reactants and products using balanced equation, factors affecting rate of a reaction, dependence of rate on concentration – rate expression (rate law),specific rate constant, order, units for rate constant of zero, first and, second order reactions. Molecularity – uni, bi and termolecular reactions – examples.

Derivation of integrated rate equation for the rate constant of zero and first order reactions, graphs for zero and first order reactions-analysis, half life – derivation of relationship between $t_{1/2}$ and k for zero and first order reactions. Numerical problems on first order and half life, Pseudo first order reaction- examples.

Temperature dependence: Arrhenius equation – activation energy, energy distribution curve showing temperature dependence of the rate of the reaction, problems based on

log $\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$, graph of $\ln k$ *vs* $\frac{1}{T}$ with intercept and slope. Effect of catalyst, explanation with graph. An elementary idea of collision theory, criteria for effective collision – threshold energy and orientation factor.

UNIT-V Surface chemistry 6 hrs

Adsorption: adsorbate, adsorbent, examples, distinction between adsorption and absorption. ΔH, ΔS and ΔG for adsorption of gas on a solid. Physisorption and chemisorption-characteristics and differences. Factors affecting adsorption of a gas on a solid. Applications (to be mentioned).

Catalysis: homogeneous and heterogeneous catalysis, examples, activity and selectivity of a catalyst ,examples, shape selective catalysis, examples. Enzyme catalysis: examples, characteristics (to be mentioned), mechanism.

Colloids: colloidal state-distinction of true solution, colloids, and suspension based on particle size.

Classification of colloids-types of colloidal systems- examples, lyophilic and lyophobic—differences and examples, macromolecular, multimolecular and associated colloids, examples, formation of micelle, cleansing action of soaps. Preparation of colloids-chemical methods-sulphur and ferric hydroxide sols, Bredig's arc method for metal sols, peptisation. Purification–dialysis, electro-dialysis, ultrafiltration (in brief).

Properties of colloids: Tyndall effect, Brownian movement, charge on colloidal particles, examples, electrophoresis, coagulation – methods of coagulation of lyophobic sols, Hardy-Schulze rule-examples, coagulating value. Protective colloid - example. Applications: In industries, medicines, purification of drinking water.

Emulsions : types , examples.

UNIT–VI General Principles and Processes of Isolation of Elements 5 hrs

Principles and methods of extraction: concentration of ores – hydraulic washing, magnetic separation, froth floatation, leaching -of alumina from bauxite, roasting and calcination – examples. Occurrence (ores) of Al, Cu, Zn and Fe. Principles of extraction of aluminium, copper, zinc, iron: highlight the principle of extraction of iron from its oxide using Ellingham diagram.

Extraction of iron from its oxides - blast furnace – diagram, reactions, equations as:

$C + O_2 \longrightarrow CO_2$ $CO_2 + C \longrightarrow 2CO,$

$Fe_2O_3 + CO \longrightarrow 2FeO + CO_2,$ $FeO + CO \longrightarrow Fe + CO_2$

$CaCO_3 \longrightarrow CaO + CO_2,$ $CaO + SiO_2 \longrightarrow CaSiO_3.$

Extraction of copper from sulphide ore containing iron impurity, extraction of zinc from zinc oxide, extraction of aluminium from purified alumina, oxidation-reduction - extraction of gold.

Refining: principles and examples each for distillation, liquation, electrolytic method, zone refining, vapour phase refining- details for Mond's and Van Arkel processes.

UNIT – VII p-Block Elements 11 hrs

Group 15 elements - General introduction, occurrence, electronic configuration, oxidation states, anomalous behavior of nitrogen with reasons, trends in physical and chemical properties - reactivity towards hydrogen and oxygen.

Dinitrogen: preparation- from $(NH_4)_2Cr_2O_7$, laboratory method from NH_4Cl, properties and uses. Compounds of nitrogen: ammonia – manufacture by Haber's process, properties – basic character, reaction with $ZnSO_4$ and Cu^{2+} ion. Nitric acid – manufacture by Ostwald's process , laboratory method – from $NaNO_3$, properties – oxidizing properties – dilute HNO_3 with Zn and Cu, concentrated HNO_3 with Cu, Zn, I_2 and carbon , passivity with Al and Cr with reason, Brown ring test. Oxides of nitrogen – structures for NO, NO_2 and N_2O_5 only.

Phosphorus: allotropic forms – white and red (brief account), phosphine – laboratory preparation, properties – basic nature, PCl_3 and PCl_5 – preparation from dry chlorine, properties- action on water (hydrolysis). Oxoacids: hypophosphorous acid, orthophosphorous acid, orthophosphoric acid –formula, structure, reducing property, basicity.

Group 16 elements - General introduction, occurrence, electronic configuration, oxidation states, anomalous behaviour of oxygen with reasons, trends in physical and chemical properties, reactivity with hydrogen and halogen.

Dioxygen - preparation from $KClO_3$, properties- reaction with Al, CH_4, C, uses. Oxides – simple oxides – classification – acidic, basic and amphoteric, examples.

Ozone: preparation, properties, oxidising properties - with PbS and NO.

Sulphur: **a**llotropic forms - brief account of rhombic and monoclinic.

Compounds of sulphur : SO_2 - laboratory preparation from SO_3^{2-}, properties – reaction with NaOH, Cl_2, reducing property – with Fe^{3+} and MnO_4^-, uses, sulphuric acid: manufacture by contact process – flow chart and equations, properties- acidic, dehydrating and oxidizing, reaction with metal halides (halide = F,C*l*), uses.

Oxoacids of sulphur: sulphurous acid, sulphuric acid, peroxodisulphuric acid and pyrosulphuric acid – formula, structure.

Group 17 elements: General introduction, occurrence, electronic configuration, oxidation states, trends in physical and chemical properties, anomalous behaviour of fluorine with reasons, reactivity towards hydrogen and oxygen.

Chlorine: preparation– from HCl with $KMnO_4$, properties – reaction with Al, S_8, H_2S, NH_3, NaOH, $Ca(OH)_2$, oxidising property – with $FeSO_4$, Na_2SO_3, bleaching property, uses. Hydrogen chloride: laboratory preparation, properties – acidic nature, reaction with NH_3, aqua regia, uses.

Oxoacids of halogen: names, formulae and structures of oxoacids of chlorine only.

Interhalogen compounds: Preparation of ClF_3, ICl, BrF_5, properties- reactivity compared with halogens, hydrolysis – general equation.

Group 18 elements: General introduction, occurrence, electronic configuration, trends in physical and chemical properties – reason for their inertness, formation and formula of Bartlett compound, preparation of XeF_6 and XeO_3, XeO_2F_2(by hydrolysis of XeF_6), uses of noble gases.

UNIT VIII d and f Block Elements 9 hrs

General introduction, electronic configuration, characteristics of transition metals (d-block) - variation in atomic and ionic size.

Electronic configuration of 3d series elements, general trends in properties of the first row transition metals (3d series) – metallic character, ionization enthalpies, oxidation states, magnetic properties, colour, catalytic properties, formation of interstitial compounds, alloy formation.

Potassium dichromate: preparation from chromite ore ($FeCr_2O_4$). Properties – oxidizing property – with I^-, H_2S, Sn^{2+}, Fe^{2+}, interconversion of chromates and dichromates in aqueous solution depending on pH.

Potassium permanganate: Preparation from MnO_2 by fusion with KOH and acidification. Properties-action of heat, oxidising property- oxidation of I^-, Fe^{2+}, $C_2O_4^{2-}$, H_2S in acidic medium, $S_2O_3^{2-}$, I^-, in neutral / alkaline medium.

f-block elements: Lanthanoids-electronic configuration, atomic size- lanthanoid contraction and its consequences ,oxidation states, chemical reactivity –general characteristics.

Actinoids: electronic configuration, ionic size – actinoid contraction – compared to lanthanoid contraction, oxidation states– general characteristics compared with lanthanoids.

UNIT-IX Coordination Compounds 7 hrs

General introduction to salts, difference between double salt and coordination (complex salt) compound with respect to their ionization in water, with an example.

Coordination entity, central metal ion, coordination number, coordination sphere, oxidation state of central metal ion, homoleptic and heteroleptic complexes , examples. Ligands -types- unidentate, didentate, polydentate, ambidentate, examples.

Nomenclature of coordination compounds – mononuclear compounds.

Werner's theory – postulates, limitations. VBT : salient features, application of VBT for the formation of - $[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$, $[NiCl_4]^{2-}$, $[Ni(CN)_4]^{2-}$, magnetic properties – low spin and high spin complexes with examples, limitations of VBT.

CFT (crystal field theory): crystal field splitting-meaning, crystal field splitting in octahedral and tetrahedral coordination entities using energy level diagram and their comparison. Spectrochemical series, compare weak field ligand – strong field ligand with respect to d^4 ions in octahedral field ($\Delta_0 < P$, $\Delta_0 > P$). Explanation for colour of complexes using CFT, examples.

Isomerism: Structural – linkage, ionization, solvate, coordination – definition and examples. Stereoisomerism – geometrical and optical, examples, facial and meridional as geometrical isomers- example.

Importance of coordination compounds: In biological systems, qualitative analysis, extraction of metals, examples.

UNIT-X Haloalkanes and Haloarenes 7 hrs

Classification based on hybridization of carbon to which halogen is bonded-alkyl halides (haloalkane), allylic, benzylic, vinylic, aryl halides. Primary, secondary and tertiary alkyl halides, nomenclature, nature of C–X bond.

Preparation - From alcohols- using HCl / $ZnCl_2$, PX_3 (Cl, Br), PCl_5, $SOCl_2$ - general reactions and examples with R = CH_3, C_2H_5, Halogen exchange method- Finkelstein reaction – general equation and examples with R = CH_3, C_2H_5, X = Cl, Br, Swarts reaction – statement, example. Physical properties – density, melting point, boiling point, solubility.

Reactions of haloalkanes: Nucleophilic substitution reactions: with aqueous KOH / NaOH, alcoholic KCN, alcoholic AgCN, R′COOAg , general reactions, examples (R as CH_3 and C_2H_5).

Mechanisms - S_N1 and S_N2 - HO^- and CH_3Cl for S_N2, ^-OH and tertiary butyl bromide for S_N1 as examples. Trend in reactivity towards S_N1 and S_N2 - 1°, 2°, 3° haloalkanes and R–I, R–Br , R–Cl, with reasons. Optical isomerism - optical activity, d form (+) and *l* form (–) isomers,

chirality, enantiomers, racemic mixture, racemisation, examples. Reaction at a chiral carbon – inversion, retention, racemisation . Stereochemistry of 2-bromobutane and 2-bromooctane in S_N1 and S_N2 reaction, respectively.

Elimination reaction (β elimination)- dehydrohalogenation- general reaction, Zaitsev rule – statement, example taking 2-bromopentane. Reaction with metals – organo - metallic compounds - Grignard reagent,(RMgX) ,general reaction, its preparation fromCH_3Br and C_2H_5Br, importance of **dry** ether.

Haloarenes: Nucleophilic substitution reactions: reasons for haloarenes to be less reactive , replacement of Cl by hydroxyl group in chlorobenzene and nitro substituted chlorobenzenes to compare the reactivity when $–NO_2$ group/s are in *o*- and *p*- positions .

Electrophilic substitution reactions for chlorobenzene - chlorination, nitration, sulphonation, Friedel-Crafts reaction (alkylation, acetylation).

Reaction with metals - Wurtz-Fittig reaction – statement – general reaction, example (R= CH_3 and C_2H_5). Fittig reaction – statement, example – formation of biphenyl.

Uses and environmental effects of dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons and DDT.

UNIT – XI Alcohols, Phenols and Ethers 8 hrs

Classification: mono, di, tri ,allylic, and benzylic alcohols, mono, di and trihydric phenols and cresols. Ethers – simple and mixed, nomenclature of alcohols, phenols, ethers.

Preparation of alcohols: by acid catalysed hydration of alkene, general reaction and examples, by hydroboration-oxidation of propene, from carbonyl compounds: hydrogenation of aldehydes, ketones, reduction of carboxylic acids and using Grignard reagent- general reactions and examples (R as H, CH_3 and C_2H_5 wherever applicable.

Preparation of phenol: From i) benzene via sulphonation ii) diazonium salt iii) cumene.

Physical properties of **primary alcohols** and phenol: Boiling point and solubility.

Chemical properties of **primary alcohols** and phenol: discuss and compare acidic nature of alcohol and phenol ,with reasons. Effect of electron withdrawing groups(EWG) E.g.:$–NO_2$ and electron donating groups (EDG) E.g.; $–CH_3$, on acid strength of phenol, with reasons. Esterification and acylation of alcohols/phenols- general reactions, examples with R=CH_3, C_2H_5, conversion of salicylic acid into aspirin. Dehydration of alcohols, oxidation using PCC -general reactions, examples with R = CH_3, C_2H_5. Mechanism of dehydration of ethanol into ethene.

Identification of 1°, 2°, 3° alcohols: Lucas test–observation and inference, reaction in presence of heated copper, equations .Uses: methanol and ethanol

Reactions of phenol: 1) Electrophilic substitution: a) with dil. HNO_3 and conc. HNO_3 b) Br_2 in CS_2 (0°C) and Br_2 / water c) Kolbe's reaction d) Riemer-Tieman reaction 2) Reaction of phenol with zinc dust 3) Oxidation of phenol by air and by chromic acid.

Uses of phenols.

Ethers: Preparation - by dehydration of ethanol, Williamson's ether synthesis – general reaction - for aliphatic and phenolic ethers, examples- giving reason for proper choice of reactants wherever applicable.

Physical Properties: boiling points and solubility.

Chemical reactions: discuss the reaction of ethers with HX (reactivity of HX to be compared).

Electrophilic substitution reaction for anisole: bromination, nitration, acetylation, alkylation (methylation). Uses of ethers.

UNIT-XII Aldehydes, Ketones and Carboxylic acids 9 hrs

Aldehydes and ketones: nomenclature, nature of carbonyl group.

Methods of preparation: Aldehydes- Stephen reduction – general reaction and examples (R=CH_3 and C_2H_5). Preparation of benzaldehyde -Rosenmund reduction, Etard reaction and Gatterman Koch reaction. Ketones-from RCOCl with dialkyl cadmium, Friedel-Crafts reaction – general reactions and examples (R=CH_3 and C_2H_5).

Physical properties: boiling points and solubility.

Chemical properties: Nucleophilic addition reactions- HCN and $NaHSO_3$- general reaction, and examples, -mechanism of addition (HCN) .

Condensation reactions with derivatives of ammonia- NH_2OH, NH_2NH_2, $NH_2NHC_6H_5$, 2,4-DNPH, Clemmensen and Wolff-Kishner reductions -general equations and examples by taking HCHO, CH_3CHO, CH_3COCH_3, C_6H_5CHO. Tests to distinguish aldehydes from ketones - Tollens' reagent and Fehling's solution (equation not required). Addition of alcohol to aldehyde (to form an acetal) and ethylene glycol to ketone –general equations and examples.

For ketones: Haloform reaction for methyl ketones – general reaction, examples with $CH_3COC_6H_5$, CH_3COCH_3.

Reactions due to α-hydrogen:

1. Reason for acidic nature of α-hydrogen
2. Aldol reaction: addition and condensation for CH_3CHO, CH_3COCH_3
3. Crossed aldol condensation: between benzaldehyde and acetophenone

Cannizzaro's reaction (disproportionation reaction) for HCHO and C_6H_5–CHO.

Electrophilic substitution reaction: nitration of C_6H_5CHO. Uses of aldehydes and ketones.

Carboxylic acids:

Nomenclature, acidic nature of –COOH group (reaction with Na, NaOH, $NaHCO_3$)- with reasons, effect of EDG, e.g.: –CH_3 and EWG, e.g.: –Cl on acid strength, with reasons.

Compare acid strengths among: i) formic acid, acetic acid, propanoic acid
ii)formic acid, acetic acid, benzoic acid
iii)chloro, fluoro, bromoacetic acids
iv) acetic acid, mono, di, and trichloroacetic acids

Methods of preparation: oxidation of primary alcohols and toluene using alkaline $KMnO_4$/ H_3O^+, hydrolysis of nitriles, amides and esters and from Grignard reagent - general reactions and examples (R=CH_3, C_2H_5,C_6H_5).

Physical properties: boiling points and solubility.

Chemical properties: reaction with PCl_3, PCl_5, $SOCl_2$, with ammonia, decarboxylation, halogenation (X = Cl ,Br)– HVZ reaction- general reactions for all and examples with R=CH_3, C_2H_5, C_6H_5 (wherever applicable).Nitration and bromination of benzoic acid.

Uses of carboxylic acids.

UNIT-XIII Organic Compounds Containing Nitrogen 6 hrs

Amines:

Structure of amines, classification- 1°, 2°, 3° and aryl amines, nomenclature

Methods of preparation: Reduction of nitrobenzene, reduction of nitrile and amide - general reactions and examples (R=CH_3, C_2H_5), ammonolysis of alkyl halides -general reactions only – upto quaternary ammonium salt, Gabriel phthalimide synthesis -general reaction and example with R=CH_3**,** Hoffmann bromamide degradation reaction -general reaction and examples (R=CH_3, C_6H_5)

Physical properties:

1. Compare boiling point and solubility of 1°, 2°, 3° amines ,with reasons
2. Compare base strength of NH_3, CH_3NH_2 and $C_6H_5NH_2$ in aqueous medium,with reasons
3. Compare the trends in the base strength of methyl substituted amines in gaseous state and in aqueous medium ,with reasons

Chemical properties: Acylation – acetylation for 1° and 2° amine using CH_3COCl, Carbylamine reaction (test for 1° amine), and reaction with nitrous acid – general reaction and examples (R=CH_3, C_2H_5 ,C_6H_5)

Reaction with Hinsberg's reagent to identify/ distinguish 1°, 2°, 3° amines.

Electrophilic substitution reactions for aniline: bromination, nitration (significance of acetylation) and sulphonation.

Cyanides and isocyanides- will be mentioned at relevant places in context

Diazonium salts: General formula $ArN_2^+X^-$. Example: $C_6H_5N_2^+Cl^-$, $C_6H_5N_2^+HSO_4^-$ Preparation from aniline-diazotisation, chemical reactions: Sandmeyer's reaction -replacement of diazo group by Cl^-, Br^-, CN^- , replacement of diazo group by I^- and H^- (reduction using H_3PO_2).

Retention of diazo group: coupling reaction- formation of azo dyes, example - $C_6H_5N_2Cl$ with aniline and phenol. Importance in synthetic organic chemistry.

UNIT-XIV Biomolecules 7 hrs

Carbohydrates: classification-based on hydrolysis – mono, oligo and polysaccharides-examples, monosaccharides - aldoses and ketoses, examples, reducing and non-reducing sugars-examples.

Glucose: occurrence, some reactions of glucose- with HI, NH_2OH, acetic anhydride, Br_2/ water – their significance with respect to the structure of glucose. Open chain structure of glucose-compared with glyceraldehyde for D and L configuration. Haworth's (pyranose) structure of α and β-D (+) glucose. Fructose: occurrence, Haworth's (furanose) structure for α and β-forms.

Disaccharide: examples, glycosidic linkage - α and β.

Maltose, lactose and sucrose- monosaccharide units, type of glycosidic linkage, reducing property with reasons, Haworth's structures. Invert sugar – composition.

Polysaccharides: Starch – monomer units, glycosidic linkage, components-difference in their structure (explanation only) and solubility in water. Cellulose and glycogen– monosaccharide, glycosidic linkage, structure (explanation only). Importance of carbohydrate.

Proteins: α- amino acids , general formula, zwitter ion form of α- amino acid, general formula. Classification of α-amino acids: acidic, basic, neutral - examples, essential and non-essential-examples. Configuration of optically active α-amino acids (found in proteins). Peptide bond and dipeptide, formation with equations. Number of peptide bonds in di, tri, tetra and pentapeptides. Polypeptides.

Proteins: classification based molecular shape –fibrous and globular, examples. Structure of protein – qualitative idea about primary, secondary, tertiary, and quaternary structures (diagrams not required). Denaturation of protein – examples. Enzymes as biocatalysts – examples.

Hormones: definition, importance, types, functions, examples

Type	Example	Function
Polypeptide	Insulin, glucagon	Maintains blood sugar level
Amino acid derivatives	Epinephrine	Brings out response to stimuli
	Thyroxine (iodine containing hormone)	Growth and development
Steroids	Estrogen and androgens	Development of secondary sex characters

Vitamins: definition and importance.

Classification: water soluble and fat soluble-examples. Diseases due to deficiency of vitamin- A, D, C, and B_{12} to be mentioned.

Nucleic acids: polynucleotides, components of DNA and RNA, formation of nucleoside and nucleotide, formation of dinucleotide. (structures of these not included)

Poly nucleotides-RNA, DNA. Structure of DNA and RNA (diagram not required)

Biological functions of nucleic acids.

UNIT-XV Polymers 5 hrs

Definitions: Polymer, monomer, polymerization, macromolecule.

Classification: based on – source, structure, types (mode) of polymerization and molecular forces- examples for each type.

Methods of polymerization: Addition, condensation and copolymerization – an example for each with equation.

Name of monomer/s and partial structure for the polymers– polythene, polyamides – nylon 6, nylon-6,6 , polyesters-terylene (Dacron), bakelite .

Rubber: types – natural, synthetic -examples

Natural rubber: monomer, partial structure of natural rubber, Vulcanisation.

Preparation of synthetic rubbers: Neoprene, Buna-N.

Non-biodegradable polymers , biodegradable polymers (examples).

UNIT-XVI Chemistry in Everyday Life 5 hrs

1. Chemicals in medicines: drugs, chemotherapy - different classes of drugs- antacids, tranquilizers, analgesics, antihistamines, antimicrobials, antibiotics, antiseptics, disinfectants, anti-fertility drugs-examples for all.
2. Chemicals in food: artificial sweetening agents, preservatives, antioxidants (elementary idea) - examples for all.
3. Cleansing agents: soaps, process of saponification with equation, synthetic detergents-examples, cleansing action of soap and detergents, biodegradable detergent (soap) – elementary idea.

CLASS II PUC

UNIT I: RELATIONS AND FUNCTIONS

1. Relations and Functions

Types of relations: Reflexive, symmetric, transitive, empty, universal and equivalence relations. Examples and problems.

Types of functions: One to one and onto functions, inverse of a function composite functions, mentioning their properties only , examples and problems.

Binary operations: associative, commutative, identity, inverse with examples

2. Inverse Trigonometric Functions

Definition, range, domain, principal value branches. Mentioning domain and range of trigonometric and inverse trigonometric functions. Graphs of inverse trigonometric functions.

Properties and proofs of inverse trigonometric functions given in NCERT prescribed text book, mentioning formulae for $\sin^{-1}x \pm \sin^{-1} y$, $\cos^{-1}x \pm \cos^{-1} y$,

$2\tan^{-1}x = \tan^{-1}(\frac{2x}{1-x^2}) = \sin^{-1}(\frac{2x}{1+x^2}) = \cos^{-1}(\frac{1-x^2}{1+x^2})$ without proof.

Conversion of one inverse trigonometric function to another w.r.t to right angled triangle. Problems.

UNIT II: ALGEBRA

1. Matrices

Concept, notation, order,

Types of matrices: column matrix, row matrix, rectangular matrix, square matrix, zero matrix, diagonal matrix, scalar matrix and unit matrix.

Algebra of matrices: Equality of matrices, Addition, multiplication, scalar multiplication of matrices, Transpose of a matrix. Mentioning properties with respect to addition, multiplication, scalar multiplication and transpose of matrices.

Symmetric and skew symmetric matrices: Definitions,

properties of symmetric and skew symmetric matrices: proofs of

i) If A is any square matrix $A+A'$ is symmetric and $A-A'$ is skew symmetric

ii) Any square matrix can be expressed as the sum of a symmetric and a skew symmetric matrix.

Concept of elementary row and column operations and finding inverse of a matrix restricted to 2x2 matrices only.

Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

2. Determinants

Determinant of a square matrix (up to 3 × 3 matrices): Definition, expansion, properties of determinants, minors , cofactors and problems.

Applications of determinants in finding the area of a triangle.

Adjoint and inverse of a square matrix, definition of singular and non-singular matrices, mentioning their properties:

a)If A and B are nonsingular matrices of same order, then AB and BA are nonsingular matrices of same order

b)A square matrix A is invertible if and only if A is non-singular matrix

Consistency, inconsistency and number of solutions of system of linear equations by examples,

Solving system of linear equations in two and three variables (having unique solution) using inverse of a matrix.

UNIT III: CALCULUS

1. Continuity and Differentiability

Continuity: Definition, continuity of a function at a point and on a domain. Examples and problems,

Algebra of continuous functions, problems ,

continuity of composite function and problems

Differentiability: Definition, Theorem connecting differentiability and continuity with a counter example.

Defining logarithm and mentioning its properties ,

Concepts of exponential, logarithmic functions,

Derivative of e^x , log x from first principles,

Derivative of composite functions using chain rule, problems.

Derivatives of inverse trigonometric functions, problems.

Derivative of implicit function and problems.

Logarithmic differentiation and problems .

Derivative of functions expressed in parametric forms and problems.

Second order derivatives and problems

Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric Interpretations and problems

2. Applications of Derivatives

Tangents and normal: Equations of tangent and normal to the curves at a point and problems

Derivative as a Rate of change: derivative as a rate measure and problems

Increasing/decreasing functions and problems

Maxima and minima : introduction of extrema and extreme values, maxima and minima in a closed interval, first derivative test, second derivative test.

Simple problems restricted to 2 dimensional figures only

Approximation and problems

3. Integrals

Integration as inverse process of differentiation: List of all the results immediately follows from knowledge of differentiation. Geometrical Interpretation of indefinite integral, mentioning elementary properties and problems.

Methods of Integration: Integration by substitution, examples. Integration using trigonometric identities, examples,

Integration by partial fractions: problems related to reducible factors in denominators only.

Integrals of some particular functions :

Evaluation of integrals of $\int \frac{dx}{a^2 \pm x^2}$, $\int \frac{dx}{\sqrt{x^2 \pm a^2}}$ $\int \frac{dx}{\sqrt{a^2 - x^2}}$ and problems .

Problems on Integrals of functions like $\int \frac{px+q}{ax^2+bx+c} dx$, $\int \frac{px+q}{\sqrt{ax^2+bx+c}} dx$

Integration by parts : Problems , Integrals of type $\int e^x [f(x) + f'(x)]dx$ and related simple problems.

Evaluation of Integrals of some more types like $\sqrt{x^2 \pm a^2}$, $\sqrt{a^2 \pm x^2}$ and problems

Definite integrals: Definition,

Definite Integral as a limit of a sum to evaluate integrals of the form $\int_0^a f(x)dx$ only.

Fundamental Theorem of Calculus (without proof).

Basic properties of definite integrals and evaluation of definite integrals.

4. Applications of the Integrals:

Area under the curve : area under simple curves, especially lines, arcs of circles/parabolas/ellipses (in standard form only),

Area bounded by two above said curves: problems

5. Differential Equations

Definition-differential equation, order and degree, general and particular solutions of a differential equation.

Formation of differential equation whose general solution containing at most two arbitrary constants is given.

Solution of differential equations by method of separation of variables,

Homogeneous differential equations of first order and first degree.

Solutions of linear differential equation of the type

$\frac{dy}{dx} + py = q$ where p and q are functions of *x* or constant

$\frac{dx}{dy} + px = q$ where p and q are functions of *y* or constant

(Equation reducible to variable separable , homogeneous and linear differential equation need not be considered)

UNIT IV: VECTORS AND THREE-DIMENSIONAL GEOMETRY

1. Vectors

Definition of Vectors and scalars, magnitude and direction of a vector.
Direction cosines/ratios of vectors: direction angles, direction cosines, direction ratios, relation between direction ratio and direction cosines. Problems.
Types of vectors :Equal, unit, zero, parallel and collinear vectors, coplanar vector
position vector of a point, negative of a vector.
Components of a vector,
Algebra of vectors: multiplication of a vector by a scalar
addition of vectors: triangle law, parallelogram law,
properties of addition of vectors,
position vector of a point dividing a line segment in a given ratio(section formula).
Scalar (dot) product of vectors: definition, properties, problems
projection of a vector on a line.
Vector (cross) product of vectors: definition, properties and problems
Scalar triple product: definition, properties and problems.

2. Three-dimensional Geometry:

Direction cosines/ratios of a line joining two points.

Straight lines in space: Cartesian and vector equation of a line passing through given point and parallel to given vector, Cartesian and vector equation of aline passing through two given points, coplanar and skew lines, distance between two skew lines(Cartesian and vector approach), distance between two parallel lines (vector approach). Angle between two lines. Problems related to above concepts.

Plane: Cartesian and vector equation of a plane in normal form, equation of

a plane passing through the given point and perpendicular to given vector,

equation of aplane passing through three non- collinear points, Intercept form of equation of a plane, angle between two planes,

equation of plane passing through the intersection of two given planes,

angle between line and plane, condition for the coplanarity of two lines, distance of a point from a plane (vector approach) ,Problems related to above concepts.

Unit V: Linear Programming

Introduction of L.P.P. definition of constraints, objective function, optimization, constraint equations, non- negativity restrictions, feasible and infeasible region, feasible solutions, Mathematical formulation-mathematical formulation of L.P.P.
Different types of L.P.P: problems namely manufacturing, diet and allocation problems with bounded feasible regions only, graphical solutions for problem in two variables, optimum feasible solution(up to three non-trivial constraints).

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Unit VI: Probability

Conditional probability – definition, properties, problems.
Multiplication theorem, independent events,
Baye's theorem, theorem of total probability and problems.

Probability distribution of a random variable-definition of a random variable, probability distribution of random variable, Mean , variance of a random variable and problems.

Bernoulli trials and Binomial distribution:
Definition of Bernoulli trial, binomial distribution, conditions for Binomial distribution, and simple problems.

Note: **Unsolved miscellaneous problems given in the prescribed text book need not be considered.**

Blow Up Syllabus

II PUC BIOLOGY (36)

UNIT VI : REPRODUCTION – 29 HOURS		
1	**Chapter 1 : Reproduction in Organisations**	**5 Hrs**
	1.1 Asexual Reproduction Budding (yeast), Binary fission, encystation and sporulation (Amoeba) with diagramatic explanation, Zoospore (Chlamydomonas),conidia(penicillium),buds(hydra) gemmules (sponges) and Fragmentation Vegetative propagation - Definition and mentioning the vegetative propagules like runner, sucker rhizome (ginger and banana), tuber (potato), offset(water hyacinth) bulbil (agave) and leaf buds (Bryophyllum)	2Hrs
	1.2 Sexual Reproduction - Definition, phases of life cycle-juvenile, reproductive and senescence phases, oestrus and menstrual cycles. **Events in sexual reproduction** 1.2.1 Pre-fertilization Events 1.2.1.1 Gametogenesis 1.2.1.2 Gamete Transfer 1.2.2 Fertilisation, types (external and internal fertilization); parthenogenesis	2 Hrs
	1.2.3 Post-fertilization events 1.2.3.1 The Zygote 1.2.3.2 Embryogenesis, Oviparous and Viviparous animals	1 Hr
2	**Chapter 2 : Sexual Reproduction in Flowering Plants**	**10 Hrs**
	2.1 Flower L S of flower 2.2 Pre-fertilization : Structure and Events 2.2.1 Stamen, Microsporangium and Pollen Grain 2.2.2 Pistil, Megasporangium (ovule) and Embryo sac	3 ½ Hrs
	2.2.3 Pollination Kinds of pollination, Agents of pollination Out breeding devices, Pollen pistil interaction, Artificial hybridization	3 ½ Hrs
	2.3 Double Fertilization 2.4 Post-fertilization : Structures and events 2.4.1 Endosperm 2.4.2 Embryo 2.4.3 Seed 2.5 Apomixis and Polyembryony	3 Hrs

3	**Chapter 3 : Human Reproduction**	**9 Hrs**
	3.1: The male reproductive system	1 ½ Hrs
	3.2 The female reproductive system	1 ½ Hrs
	3.3 Gametogenesis	3 Hrs
	3.4 Menstrual Cycle	1 Hr
	3.5 Fertilisation and Implantation 3.6 Pregnancy and Embryonic Development	1 Hr
	3.7 Parturition and Lactation	1 Hr

4	**Chapter 4 : Reproductive and Strategies**	**5 Hrs**
	4.1 Reproductive Health Problems and Strategies	1 Hrs
	4.2 Population Explosion and Birth Control	1 ½ Hrs
	4.3 Contraception and Medical Termination of Pregnancy (MTP) 4.4 Sexually transmitted Diseases (STD s)	1 Hr
	4.5 Infertility	1 ½ Hrs

UNIT VII : GENETICS AND EVOLUTION – 30 HOURS

5	**Chapter 5 : Principle of Inheritance and Variation**	**12 Hrs**
	5.1 Mendel s Laws of Inheritance	1 Hr
	5.2 Inheritance of One Gene 5.2.1 Law of Dominance 5.2.2 Law of Segregation 5.2.2.1 Incomplete Dominance 5.2.2.2 Co-dominance	3 Hrs
	5.3 Inheritance of Two Genes 5.3.1 Law of Independent Assortment 5.3.2 Chromosomal theory of Inheritance 5.3.3 Linkage and Recombination	4 ½ Hrs
	5.4 Sex Determination 5.4.1 Sex Determination in Human	1 Hr
	5.5 Genetic Disorders 5.6.2 Mendelian Disorders 5.6.3 Chromosomal Disorders	2 ½ Hrs
6	**Chapter 6 : Molecular Basis of Inheritance**	**12 Hrs**
	6.1 The DNA 6.1.1 Structure of Polynucleotide chain 6.1.2 Packaging of DNA Helix	1 Hrs

	6.2 The search for Genetic Material 6.2.1 The Genetic Material is DNA(Griffith and Avery experiments) 6.2.2 Properties of Genetic Material (DNA versus RNA)	2 Hrs
	6.3 RNA World 6.4 Replication 6.4.2 The Machinery and the Enzymes	1 Hr
	6.5 Transcription 6.5.1 Transcription Unit 6.5.2 Transcription Unit and the Gene 6.5.3 Types of RNA and the process of transcription	2 Hrs
	6.6 Genetic Code 6.6.2 t RNA the Adapter Molecule	2 Hrs
	6.7 Translation	1 Hr
	6.8 Regulation of Gene Expression 6.8.1 The Lac Operon	1 Hr
	6.9 Human Genome Project 6.9.1 Salient Features of Human Genome 6.9.2 Application and Future Challenges (excluding methodologies) 6.10 DNA Fingerprinting	1 Hr 1 Hr
7	**Chapter 7 : Evolution**	**6 Hours**
	7.1 Origin of Life	1 Hr
	7.2 Evolution of Life Forms A Theory 7.3 Evidences for Evolution (homology, analogy and embryological: Mentioning the paleontological evidence)	2 Hr
	7.4 Adaptive Radiation in Darwin s Finches	½ Hr
	7.6 Mechanism of Evolution	½ Hr
	7.7 Hardy Weinberg Principle (mentioning of 5 factors affecting Hardy-Weinberg equilibrium)	1 Hr
	7.9 Origin and Evolution of Man (mentioning the stages of human evolution)	1 Hr
	UNIT VIII : BIOLOGY IN HUMAN WELFARE – 25 HRS	
8	**CHAPTER 8 : HUMAN HEALTH AND DISEASE**	**10 Hours**
	8.1 Pathogen definition, Mentioning of diseases, causes and symptoms of Typhoid, Pneumonia, Common cold Malaria (excluding life-cycle of Plasmodium), Amoebiosis, Ascariasis and Filariasis (excluding prevention and control)	2 Hrs

	8.2 IMMUNITY 8.2.1 - Innate immunity 8.2.2 Acquired immunity (including antibody structure) 8.2.4 Vaccination and immunization 8.2.5 Allergies (short notes) 8.2.6 Autoimmunity definition	3 Hrs	
	8.3 AIDS Causes HIV replication in detail Symptoms Diagnostic test Prevention	1 Hr	
	8.4 CANCER Definition Types (Benign and malignant only) Causes Detection Diagnosis Treatment	1 Hr	
	8.5 DRUGS AND ALCOHOL ABUSE Opioids (excluding chemical structure), Cannabinoids (excluding chemical structure). Cocaine Hallucinogens Sedatives Smoking (effects of tobacco smoke) 8.5.1 Adolescence and Drug abuse 8.5.2 Addiction and Dependence (including withdrawal symptoms) 8.5.3 Effects of drug abuse 8.5.4 Prevention and Control	3 Hrs	
9	**CHAPTER 9 – STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION**		**9 Hours**
	9.1 ANIMAL HUSBANDRY 9.1.1 Management of farms and farm animals 9.1.1.1 Dairy farm management 9.1.1.2 Poultry farm management 9.1.2 Animal Breeding Inbreeding Outbreeding Outcrossing Cross breeding Interspecific hybridization Controlled breeding (AI and MOET)	4 Hrs	
	9.2 PLANT BREEDING 9.2.1 Plant breeding detailed account (Steps in breeding to be explained)	4 Hrs	

	9.3 SINGLE CELL PROTEIN	½ Hr	
	9.4 TISSUE CULTURE	½ Hr	
10	**CHAPTER 10 : MICROBES IN HUMAN WELFARE**		**6 Hrs**
	10.1 MICROBES IN HOUSEHOLD PRODUCTS (Curds, Doughening and Alcohol i.e., Toddy)	1 Hr	
	10.2 MICROBES IN INDUSTRIAL PRODUCT 10.2.1 Fermented beverages 10.2.2 Antibodies 10.2.3 Chemicals, Enzymes and other molecules	2 Hrs	
	10.3 MICROBES IN SEWAGES TREATMENT (Detailed account of Primary treatment, Secondary treatment and BOD concept) Ganga Action Plan (To be mentioned) Yamuna Action Plan (To be mentioned) 10.4 MICROBES IN THE PRODUCTION OF BIOGAS (Including a typical biogas plant) 10.5 MICROBES AS BIOCONTROL AGENTS	1 Hr 1 Hr ½ Hr	
	10.6 MICROBES AS BIOFERTILIZERS	½ Hr	
	UNIT IX – BIOTECHNOLOGY : 12 Hours		
11	**CHAPTER 11 : BIOTECHNOLOGY : PRINCIPLES AND PROCESSES**		**7 Hrs**
	11.1 Principles of Biotechnology 11.2 Tools of Recombination DNA Technology 11.2.1 Restriction Enzymes 11.2.2 Cloning Vectors 11.2.3 Competent Host 11.3 Processes of Recombinant DNA Technology 11.3.1 Isolation of the Genetic Material (DNA) 11.3.2 Cutting o DNA at Specific Locations 11.3.4 Insertion of Recombination DNA into the Host cell/Organism 11.3.5 Obtaining the Foreign Gene Product 11.3.6 Downstream Processing		
12	**CHAPTER 12 : BIOTECHNOLOGY AND ITS APPLICATIONS**		**5 Hrs**
	12.1 Biotechnology Applications in Agriculture(Bt cotton only) 12.2 Biotechnological Applications in Medicine 12.2.1 Genetically engineered insulin 12.2.2 Gene Therapy 12.4 Ethical Issues		

UNIT X – ECOLOGY : 24 Hours		
13	CHAPTER 13 : ORGANISMS AND POPULATIONS	7 Hrs
	13.1 Organisms and its environment	½ Hr
	13.1.1 Major abiotic factors	½ Hr
	13.1.2 Responses to abiotic factors 13.1.3 AdAptations	1 Hr ½ Hr
	13.2. Populations 13.2.1 Population attributes	1 Hr
	13.2.2 Population growth	1½ Hrs
	13.2.4 Population interactions	2 Hrs
14	CHAPTER -14 : ECOSYSTEM	6 ½ Hrs
	14.1 Ecosystem structure and function 14.2. Productivity 14.3 Decomposition	1 ½ Hrs
	14.4. Energy flow 14.5 Ecological pyramids	2 Hrs
	14.6 Ecological succession 14.6.1 Succession of plants	1 ½ Hrs
	14.7 Nutrient cycling 14.7.1 Ecosystem carbon cycle 14.7.2 Ecosystem phosphorous cycle Note: Simple schematic representation to be given.	1 Hr
	14.8. Ecosystem services	½ Hr
15	CHAPTER – 15 – BIODIVERSITY AND CONSERVATION	3 ½ Hrs
	15.1 Biodiversity-Types 15.1.1 Biodiversity of world and India	½ Hr
	15.1.3 The importance of species diversity to the ecosystem	1 Hr
	15.1.4 Loss of biodiversity 15.2 Biodiversity conservation	1 Hr
	15.2.1 Why should we conserve biodiversity? 15.2.2 How do we conserve biodiversity?	1 Hr
16	Chapter -16 : Environmental issues	7 Hrs
	16.1. Air pollution and its control.	1 Hr
	16.2. Water pollution and its control. 16.2.1 Domestic sewage and industrial effluents	1 Hr
	16.2.2 A case study of integrated waste water treatment	1 Hr
	16.3 Solid wastes 16.3.1 A case study of remedy for plastic waste 16.4 Agrochemicals and their effects.	1 ½ Hrs

	16.5. Radioactive wastes. 16.6 Green house effect and global warming 16.7 Ozone depletion in the stratosphere	1 ½ Hrs
	16.8. Degradation by improper resource utilization and maintenance. 16.9 Deforestation 16.9.1 A case study of people s participation in conservation of forests.	1 Hr
	Total number of teaching Hours	**120 Hrs**