सत्यमेव जयते
महाराष्ट्र शासन

अपर पोलीस महासंचालक, गुन्हे अन्वेषण विभाग, महाराष्ट्र राज्य,
चव्हाण नगर, पाषाण रोड, पुणे - ४११ ००८
दुरध्वनी : ०२०-२५६३८४४७ फॅक्स : ०२०-२५६३८४४३
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पुणे, दि.12/06/2026

सुचना पत्र

सहायक शासकीय दस्तऐवज परिक्षक (गट-क), १६ रिक्तपदे भरतीच्या अनुषंगाने आवश्यक असलेला अभ्यासक्रम पुढीलप्रमाणे देण्यात आलेला असुन सदर अभ्यासक्रमा संदर्भात काही आक्षेप असल्यास दिनांक १२/०६/२०२६ ते दिनांक १९/०६/२०२६ रोजी सायंकाळी १७.०० वा. पर्यंत राज्य गुन्हे अन्वेषण विभाग, महाराष्ट्र राज्य, पुणे यांच्या खालील ई-मेल आयडी वरती लेखी स्वरुपात व दुरध्वनी क्रमांकावरती संपर्क साधुन आक्षेप नोंदवावा.

दि.१९/०६/२०२६ रोजी सायंकाळी १७.०० वाजेनंतर प्राप्त आक्षेप विचारात घेतले जाणार नाहीत याची नोंद घ्यावी.

आक्षेप नोंदविणेकरीता ई-मेल आयडी-	sp.cid.adm@mahapolice.gov.in
आक्षेप नोंदविणेकरीता दुरध्वनी क्रमांक	०२०-२५६३८४४४ (१०.०० ते १८.०० वा.पर्यंत) संपर्क साधावा.

Addl. Director General of Police
C.I.D. (Crime) M.S. Pune.

परीक्षेचा अभ्यासक्रम

अ.क्र.	घटक व उपघटक आणि प्रश्नपत्रिकेचा दर्जा	प्रश्न संख्या	एकुण विहीत केलेले गुण	कालावधी
	पेपर - I (एकुण गुण १२०, वेळ ६० मिनीटे)			
१	**मराठी :-** व्याकरण, जोडाक्षरे, संधी- स्वर, व्यंजन आणि विसर्ग संधी, शब्द विचार, नामे, लिंगविचार, वचन विचार, विभक्तीविचार, सामान्यरुप, सर्वनामे, विशेषणे, क्रियापदविचार, क्रियापदविचार- कियापदाचे अन्य प्रकार, क्रियापद विचार- काळ व अर्थ, क्रियापद विचार- क्रियापदाचे अर्थ व आख्यातविकार, क्रियाविशेष अव्यये, शब्दयोगी अव्यये, उभयान्वयी अव्यये, केवलप्रयोगी अव्यये, प्रयोग, समास, शब्दसिध्दी, वाक्यांचे प्रकार, वाक्यपृथक्करण, वाक्यसंश्लेषण किंवा वाक्य संकलन, वाक्यरुपांतर, समानार्थी शब्द, विरुध्दार्थी शब्द, शब्दसमुहाबद्दल एक शब्द, वाक्प्रचार (वाक्यात उपयोगांसह), म्हणी (वाक्यात उपयोगांसह) प्रश्नपत्रिकेचा दर्जा :- उच्च माध्यमिक शालांत परीक्षेच्या (इयत्ता १२ वी) दर्जाच्या समान राहील.	१५	३०	६० मिनिटे
२	**इंग्रजी :-** Grammar, Question tags, Sentences, Parts of speech, Tenses and aspects, Voice, Reported speech, Articles, Degree of comparison, Gerunds, Punctuations, Language proficiency, Para jumbles, Sentence completion, Odd word out, One word substitution, Word segment substitution, Cloze, Reading comprehension, Semantics, Antonyms, Synonyms, Word meaning, Idioms, Phrases, etc. प्रश्नपत्रिकेचा दर्जा :- उच्च माध्यमिक शालांत परीक्षेच्या (इयत्ता १२ वी) दर्जाच्या समान राहील.	१५	३०	
३	**सामान्य ज्ञान :-** राष्ट्रीय चालू घडामोडी, आंतरराष्ट्रीय चालू घडामोडी, भारताचा इतिहास, भारताचा भूगोल, कला आणि संस्कृती, भारतीय राज्यव्यवस्था आणि शासन, भारतीय अर्थव्यवस्था आणि मूलभूत सूक्ष्म व स्थूल अर्थशास्त्र, दैनंदिन जीवनातील विज्ञान, इत्यादी. National Current Affairs, International current affairs, Indian History, Indian geography, Art and culture of India, Indian polity and governance, Indian economy and Basics micro and macro economics, Science in everyday life, etc. प्रश्नपत्रिकेचा दर्जा :- भारतातील मान्यताप्राप्त विद्यापीठांच्या पदवी परीक्षेच्या दर्जाच्या समान राहील.	१५	३०	
४	**बौध्दिक चाचणी:-** आसन व्यवस्था व कोडी, मालिका- शाब्दिक व संख्यात्मक, नातेसंबंध, सांकेतिक भाषा, शाब्दिक आणि संख्यात्मक साम्य, अंतर, तर्कशास्त्र, तार्किक क्रिया, साम्य व भेद, इत्यादी. (Seating arrangements and puzzles, Series- verbal and number, Relationships, Coding-decoding, Verbal and numerical analogy, Distance, Syllogism, Logical operations, Similarities and dissimilarities, etc.) प्रश्नपत्रिकेचा दर्जा :- भारतातील मान्यताप्राप्त विद्यापीठांच्या पदवी परीक्षेच्या दर्जाच्या समान राहील.	१५	३०	
	एकुण	**६०**	**१२०**	**६० मिनिटे**

परीक्षेचा अभ्यासक्रम

पेपर-II

(प्रश्नसंख्या-४०, एकुण गुण-८०, वेळ-६० मिनीटे)

१. रसायनशास्त्र (प्रश्नसंख्या-१०, गुण-२०)

CHEMISTRY

Physical Chemistry

Introduction to Physical Chemistry: Atom and its structure, Thomson model, Rutherford model, Bohrs model, Quantum model, Atomic number, atomic mass, Isotope, Isobar, Quantum numbers; Chemical bonding: Valency, Types of bonding, Dipole moment, Fajan rule, VSEPR, VBT, MOT, Hydrogen bond; Concept of matter: Classification of matter, Gas laws, change of states, latent heat, Specific heat capacity, Temperature.

Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom, concept of atomic orbitals; shapes, radial and angular probability diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitations. Electronic configurations of the atoms; Stability of half-filled and completely filled orbitals, concept of exchange energy.

Chemical Kinetics: Rate of chemical reaction, order of reaction, integrated rate law: zero-order, first order, second order, Third-order reactions, Derivation of integrated rate law for third order reactions with equal initial concentrations, characteristics and examples of third-order reaction. Methods to determine the order of reaction using: Integrated rate equation method, Graphical method, Half-life method and Differential method. Effect of temperature on reaction rate and Arrhenius parameters.

Chemical Thermodynamics: Terminology of thermodynamics, thermodynamic equilibrium, properties, thermodynamic processes, First law of thermodynamics, Enthalpy, Heat capacity, Relation between Cp and Cv, Expansion of ideal gas and changes in thermodynamic properties: Isothermal process, Adiabatic process, Limitations of the first law: Need for the second law, Cyclic process, Carnot cycle, Second law of thermodynamics. Concept of entropy, Entropy change in isothermal expansion, Reversible and irreversible processes, Phase change and entropy of mixing of ideal gases, Work and free energy function.

Electrolytic Conductance: Electrolytes, Ohm's law and Electrical units, electrolytic conductance, resistance and specific resistance, measurement of electrolytic conductance, Specific, molar and equivalent conductance, ionic conductance and transport number.

Phase Equilibrium: Phase, Components and Degree of Freedom of a system, Stability of Phases, Criteria of Phase equilibrium, Gibb's Phase rule and its thermodynamic derivation, Phase Diagrams of One Component system: Water, Carbon Dioxide and Sulphur system.

Electrochemical Cells: Electrochemical cells, reversible and irreversible cells, EMF of electrochemical cell, Nernst equation for E.M.F. and its measurement, Weston standard cell, Primary and Secondary reference electrodes, Types of reversible electrodes, sign convention for electrode potentials, Thermodynamics of reversible cells and reversible electrodes, Electrochemical series, equilibrium constant of cell reaction, Types of concentration cells, liquid junction potential, salt bridge, Batteries: Primary and Secondary batteries and its applications, Fuel Cells: Types of fuel cells, advantages, disadvantages of fuels cells, comparison of battery Vs fuel cell.

Crystal structure: Types of Solids: Isotropy and Anisotropy, Laws of crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of crystal symmetry, Weiss indices and Miller indices, Crystal Structure: Parameters of the Unit Cells, Cubic Unit Cells: Three Types of Cubic Unit Cells, Calculation of Mass of the Unit Cell, Methods of Crystal structure analysis: The Laue method and Braggs method: Derivation of Bragg's equation, Determination of crystal structure of NaCl by Bragg's method, X ray analysis of NaCl crystal system, Calculation of d and λ for a crystal system.

Microwave Spectroscopy: Classification of molecules on the basis of moment of Inertia, Rotational spectra of rigid diatomic molecules, relative intensities of spectral lines, effect of isotopic substitution on the rotational spectra, Determination of bond length and moment of inertia from rotational spectra.

Infrared Spectroscopy: Simple Harmonic oscillator, Modes of vibration, force constant, Vibrational spectrum of a diatomic molecule: Vibrational Energy expression, Allowed vibrational energies, zero-point energy, Selection rule, Vibrational energy level diagram with transitions, spectrum depiction, Vibration-rotation Spectra: Born-Oppenheimer approximation, Energy expression for vibrational rotor, Selection rules, Vibrational-rotational energy level diagram with transitions, Nature of vibrational spectra, P, Q and R branches of lines of the IR spectra.

Raman Spectroscopy: Classical and Quantum theory of Raman effect, Rayleigh, Stokes and anti-stokes lines, Pure rotational Raman spectra of linear diatomic molecules

Photochemistry: Difference between thermal and photochemical processes, Laws of photochemistry: i) Grothus - Draper law ii) Stark-Einstein law, Quantum yield, Reasons for high and low quantum yield., Factors affecting Quantum yield, Experimental method for the determination of quantum yield, types of photochemical reactions-photosynthesis, photolysis, photocatalysis, photosensitization, Jablonski diagram depicting various processes occurring in the excited state: Qualitative Chemiluminescence.

Nuclear Chemistry: Radioactivity, Types of Radiations, Properties of Radiations, Detection and Measurement of Radioactivity: Cloud chamber, Ionization Chamber, Geiger-Muller Counter, Scintillation Counter and Film Badges, Nuclear structure, Classification of nuclides, Types of Radioactive Decay, Group Displacement Law, Kinetics of Radioactive Decay, Half-life, average life, Energy released in nuclear reaction, Mass Defect, Nuclear Binding Energy.

Polymers: Introduction, Brief History, Polymer definition, Preparation, Classification, Structures, Chemical bonding & Molecular forces in Polymers; Number & Weight Average Molecular weight, Molecular weight & degree of polymerisation, Practical significance of polymer molecular weights.

Colligative properties: Vapour pressure, relative lowering of vapour pressure, elevation of boiling point of solvent, depression of freezing point of the solvent, determination of molecular mass of solute by different techniques, Van't Hoff factor, degree of dissociation and association of solute.

Inorganic Chemistry

Introduction to Inorganic Chemistry: Periodic Table, Dobereiner triads, Newlands octaves, Mendeleeves periodic law, modern periodic table, s, p, d, f block elements, Detailed discussion of the following properties of the elements, with reference to s & p-blocks. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic radii. (d) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (e) Electron gain enthalpy; trends of electron gain enthalpy. (f) Electronegativity, Pauling's/ Mullikan's electronegativity scales. (g) Oxidation states of elements. Perodic properties of element; Classification of Elements: Metals, non-metal, Metalloids and its properties, uses, Important Reactions with metals; Acid, Base and Salt: Acid, Bases and its properties, Effect of indicator on acid and bases, pH Scale, Salts, definitions of Acid and Bases, Buffer,

Transition elements: electronic configuration, trends in properties w.r.t.(a) size of atoms and ions (b) reactivity (c) catalytic activity (d) oxidation state (e) complex formation ability (f) colour (g) magnetic properties (h) non-stoichiometry (i) density, melting & boiling points.

Chemistry of f-block elements: electronic configurations, occurrence and reactivity, F-block elements as Lanthanide and Actinide series; Lanthanides: Position in periodic table, Name and electronic configuration of lanthanides, Oxidation States, atomic and ionic radii, Lanthanide contraction, its causes and consequences on chemistry of Lanthanides and post lanthanide elements, Occurrence and separation: Bulk separation, Individual separation by modern methods viz., Ion exchange and solvent extraction method, applications of lanthanides; Actinides: Position in periodic table, names and their electronic configurations. IUPAC nomenclature system for super heavy elements, Oxidation States, Occurrence and general methods of preparation of transuranic elements viz., Neutron Bombardment, Accelerated projectile bombardment and Heavy ion bombardment. Nuclear Fuels-Nuclear fission and fusion fuels, comparison between Lanthanides and Actinides.

Chemistry of Coordination Compounds: Definition and difference between Double salt and coordination compound, basic definitions: coordinate bond, ligand, types of ligands, chelate, central metal ion, charge on complex ion, calculation of oxidation state of central metal ion, metal ligand ratio; Werner's work and theory, Effective atomic number, equilibrium constant, chelate effect, IUPAC nomenclature. Valance Bond Theory of Coordination Compounds.

Molecular Orbital Theory of Coordination Compounds: Electro-neutrality principle, multiple bonding ($d\pi$-$p\pi$ and $d\pi$-$d\pi$), Nephelauxetic effect and Nephelauxetic series, VBT and CFT, Need of MOT, Assumptions, MO treatment to octahedral complexes with sigma bonding, Formation of MO's from metal orbitals and Composite Ligand Orbitals (CLO), MO correlation diagram for octahedral complexes with sigma bonding, effect of π bonding on MO correlation diagram, Charge transfer spectra, Advantages of MOT over VBT and CFT.

Metals, Semiconductors and Superconductors: Metallic bonding, Band theory in metals with respect to Na along with n (E) and N(E) diagrams, Electrical conductivity of metals (Na, Mg, Al), Valence electrons and conductivity of metals, Effect of temperature and impurity on electrical conductivity of metals, Semiconductors, types of Semiconductors: I. Intrinsic II. Extrinsic, effect of temperature and impurity on semiconductivity, n & p type semiconductors ZnO and NiO, Superconductivity: Discovery, property, models, structure and superconductivity, low and high temperature superconductors, applications of superconductors.

Organic Chemistry

Introduction of organic chemistry: Structure, bonding and IUPAC nomenclature of organic molecules; Structure and reactivity of organic molecules, Structural effects- Inductive Effect, Resonance Effect, Hyperconjugation Effect, Steric Effect, Hydrogen bonding and Tautomerism. Comparative study of strength of acids and bases based on Inductive and Resonance effect. HSAB principle, homolytic and heterolytic bond fission, Aromaticity: Huckel's rule and Benzenoids.

Stereochemistry: Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, Racemic mixture and resolution, Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature; Geometric isomerism, configuration of geometric isomers, E & Z system of nomenclature.

Structure, Acidity and Basicity: Arrehenius, Lowry-Brønsted and Lewis acids and bases, concept of conjugate acids and bases, pKa, simple and substituted aliphatic acids, phenols, aromatic carboxylic acids, bases, pKb, aliphatic and aromatic bases.

Organic Reactions and their mechanism: Types of reagents – electrophiles and nucleophiles, Types of organic reactions, concept of Reaction Mechanisms, energetics of reaction, Reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Nucleophilic substitution reactions: S_N1 and S_N2, Factors affecting S_N1 and S_N2 reactions, Elimination reactions: 1,1; 1,2 elimination, Mechanism with evidences of E1and E2, E1cB reactions, stereochemistry of E1 and E2 elimination, Orientations and reactivity in E1 and E2 elimination- Hoffmann and Saytzeff's orientation, Factors affecting the reactivity- effect of structure, attacking base and leaving groups; comparative study of substitution and elimination reactions of alkyl halides, Aromatic electrophilic and nucleophilic substitution reactions.

Stereochemistry of mono and di-substituted cyclohexane: Conformation of cyclohexanes, energy profile diagrams and stability of conformations, Mono and di-substituted cyclohexanes, 1, 3 diaxial and butane-gauche interactions, cis and trans stereochemistry, optical activity.

Heterocyclic Chemistry: Properties, synthesis, electrophilic and nucleophilic substitution: Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.

Rearrangement Reactions: Rearrangement – Beckmann, Baeyer-Villiger, Favorskii, Curtius, Lossen, Schmidt and Pinacol-Pinacolone, Claisen, Cope and Mc-Lafferty rearrangements with mechanism.

Organometallic Chemistry: Basic concept, 18 electron rule, Hapticity, Organometallic compounds, CO as a π-acid donor ligand, binary metal carbonyls, classification of metal carbonyls, synthesis of metal carbonyls; Molecular and electronic structures of binary metal carbonyls.

3/6/26

Homogeneous and Heterogeneous catalysis: Basic concept, activity and selectivity in catalysis, Types of catalysis, homogeneous vs. heterogeneous catalysis, importance of catalysis in the synthesis of high value chemicals. Homogeneous catalysis: catalytic cycles for following reactions: a) Hydrogenation of olefins using Wilkinson complex, b) Hydroformylation of olefins using Cobalt and Rhodium complexes, c) Carbonylation reaction, Monsanto processes and d) C-C coupling reactions: Heck reaction; Classification of heterogeneous catalysts, supported metal catalyst, Role of support, Promoters and Poisons. Catalytic processes viz., a) Hydrogenation of olefins using Raney Nickel catalyst, b) Zeolites in catalysis

Ultra Violet and Visible Spectroscopy: Interaction of electromagnetic radiation with matter, essential terms-radiant power, transmittance, absorbance, Lambert's Law, Beer's Law, Lambert's-Beer's Law, molar absorptivity, deviations from Beer's law, types of electronic transitions, λmax and εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts, Application of visible, ultraviolet spectroscopy in organic molecules; Woodward rules for calculating λmax of conjugated dienes and α, β – unsaturated compounds.

Infra-Red Spectroscopy: Infrared radiation and types of molecular vibrations, functional group and fingerprint region. Infra-red spectroscopy in organic molecules, IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives, factors affecting carbonyl stretching absorptions, Interpretation of spectrum.

Nuclear Magnetic Resonance Spectroscopy (^{1}H-NMR): Principles, Magnetic and nonmagnetic nuclei, nuclear resonance, chemical shift, shielding, and deshielding effect. Measurement of chemical shift, TMS and its advantages, peak area, integration, spin-spin coupling, coupling constants, *J*-value, Interpretation of spectrum.

Retrosynthetic Analysis: Different terms used – Disconnection, Synthons, Synthetic equivalence, FGI, TM. One group disconnection, Retrosynthesis and Synthesis of target molecules: Acetophenone, Crotonaldehyde, Cyclohexene, Benzylbenzoate.

Reaction and reagents in Organic Synthesis: Wolff rearrangement (Step up), Hofmann rearrangement (Step down), Simmons-Smith reaction, Michael reaction, Wittig reaction and McMurry reaction, Diels-Alder reaction.

Reducing Reagents: $LiAlH_4$, $NaBH_4$, DIBAL-H, $Li(tBuO)_3AlH$ & Lindlar's catalyst and Na/NH_3, Clemmensen reduction, Wolff-Kishner reduction

Oxidizing Reagents: Jones oxidation, $KMnO_4$, m-CPBA, O_3, Dess Martin reagent, OsO_4, DDQ.

Analytical Chemistry

Introduction of Analytical Chemistry: What is analytical Chemistry, the analytical perspectives, Common analytical problems. Importance in various fields, Units of measurements-SI units, distinction between mass and weight, mole, millimole and Calculations, Solution and their concentrations- Molar, Normal and Molar concentrations, percent Concentration, part per million, part per billion, part per thousand, density and specific gravity of solutions, problems. Empirical and Molecular Formulas, Stoichiometric Calculations, errors, limitations of analytical methods, classifications of errors, accuracy, precision, minimization of errors, significant figures and computation.

Volumetric Analysis: Classification of reaction in volumetric analysis, standard solutions, equivalents, normalities, oxidation numbers, primary and secondary solutions, Various types of volumetric analysis: Neutralization titrations, Complexometric Titrations, Redox Titrations, Precipitation Titrations.

Solvent extraction: Introduction, organic phase, Partition the theory of extraction (distribution coefficient, Distribution ratio, solute remaining unextracted, Separation coefficient), Factors favoring solvent extraction, Quantitative treatment to solvent extraction equilibrium, Ion association complexes, synergic extraction, some extraction reagent specifically used for inorganic ions (Acetylacetone, 8-Hydroxyquinoline, Diphenylthiocarbazone, Sodium diethyldithiocarbamate, Ammonium pyrrolidine dithiocarbamate), some practical aspects, Applications: determination of copper as the diethyldithiocarbamate complex, Determination of Fe(III) with 8-hydroxyquinoline, determination of nickel by synergistic extraction. Solid phase extraction.

Obai 7/6/26

Chromatography: Principle, Types of chromatography, Paper Chromatography- Principle, Migration parameters, Types of paper chromatography and its applications. Thin layer chromatography- Principle, Applications of TLC, Limitations.

Instrumental Methods of Chromatographic Analysis: Principles of Chromatographic Separations, classification, Theory of Column Efficiency in Chromatography, (theoretical plate, rate theory of chromatography - the Van Deemter equation, efficiency and particle size in HPLC, retention factor efficiency and resolution.

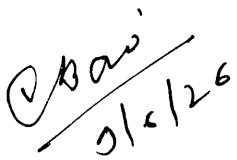
High Performance Liquid Chromatography: Types of liquid chromatography (liquid-solid, liquid-liquid, bonded phases), Choice of mode of separation, Equipment for HPLC: mobile phase, sample injection and column design (mobile phase, optimization of mobile phase, gradient elution, solvent delivery and sample injection, sample injection system, the column (effect of column length and column diameter), Choosing the Detector, Ultraviolet detector, Luminescence detector, RI detector, electrochemical detector, Column efficiency, HPLC chromatogram and its characteristics (retention time, peak height, peak area), method of quantitative analysis by HPLC, Example: determination of aspirin, phenacetin and caffeine in a mixture, numerical,

Gas Chromatography: Instrumental principle, Sample injection system and derivatization, the column (Packed columns, Open tubular columns), the detector (properties, hot wire detector or TCD, FID, ECD), Quantitative analysis by GC.

Atomic Absorption Spectroscopy: Elementary theory, Instrumentation, flames, the nebulizer-burner system, non-flame techniques (graphite furnace, cold vapour technique), resonance line sources, monochromator, detectors, interferences, chemical interferences, background correction methods, Atomic absorption spectrophotometers, Detection limits, Estimation of Ca and Mg in water.

Flame Emission Spectroscopy: emission spectra, instrumentation, flame photometers. Evaluation methods, calibration curve procedure, the standard addition technique, Applications: determination of alkali metals by flame photometry.

Current questions to related subjects.



२. भौतिकशास्त्र- (प्रश्न संख्या-१०, गुण-२०)

Physics:

1. Rotational Dynamics:
Torque, Angular velocity and angular acceleration; Principle of conservation of angular momentum; Centre of mass in uniformly distributed object; Statement of parallel axis and perpendicular axis theorem; Moment of inertia and radius of gyration; Calculation of moment of inertia for solid cylindrical and spherical; Kinetic energy of rotation; Rolling motion on inclined plane; Moment of inertia of a flywheel.

2. Fluid Mechanics:

2.1: Fluid Statics
Definition of a Fluid; Pressure, absolute pressure and gauge pressure; Variation of pressure with depth; Pascal's Laws; Buoyancy and Archimedes principle.

2.2: Fluid Dynamics
Equation of continuity; Bernoulli's theorem; Application based on Bernoulli's equation: Torricelli's theorem and venturimeter; Viscosity, Viscous force and effect of temperature; Stokes' law and terminal velocity; Surface tension, Surface energy and angle of contact; Excess pressure inside liquid drop and soap bubble; Determination of surface tension by Jaeger's method.

3. Atomic Spectra:
Inadequacy of classical physics; Brief Review of Black body Radiation; Photoelectric effect; Compton Effect; Dual nature of radiation and matter; atomic spectra; Line spectra of hydrogen atom; Ritz Rydberg combination principle; Alpha particle scattering; Rutherford scattering formula; Rutherford model of atom and its limitations.

4. Atomic Models:
Bohr's model of hydrogen atom; Explanation of atomic spectra; Correction for finite mass of the nucleus; Bohr correspondence principle; Limitations of Bohr model; Discrete energy exchange by atom; Frank-Hertz experiment; Sommerfeld's modification of Bohr's theory.

5. Thermal Physics:
Concepts of heat and temperature; Zeroth law of thermodynamics; Thermodynamic variables and equation of state; Van der Waal's equation of state; First law of thermodynamics and its differential form; Application of the first law of thermodynamics; Second law of thermodynamics; Carnot's cycle and its efficiency; Concept of entropy, Principle of increase of entropy, Entropy of steam; Applications of second law of thermodynamics; Third law of thermodynamics; Applications of third law of thermodynamics.

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6. Electrostatics:

Concept of electric charge, Electrostatic forces (Coulomb's law); Electric field lines & its Physical significance; Concept of electric flux; Gauss's law in electrostatics and its applications; Concept of electric potential; Concept of electrostatic energy; the four quantities for point charges; Relationship between electric field, Electric force, Electric potential and Electric potential energy; Concept of electric dipole & dipole moment; Torque on a dipole placed in an electric field; Concept of dielectric & polarization; Relation between electric field (E), electric displacement (D) & polarization (P); Gauss law in dielectric; Concept of capacitor, Capacitance and it applications.

7. Magneto statics:

Magnetic field lines, Magnetic force & its properties; Biot-Savart's law and its applications; Ampere's circuital law and its applications; Introduction to magnetization; Types of magnetic materials.

8. Physics in Earth's Atmosphere:

Sun, Earth's atmosphere as an ideal gas; Pressure, temperature and density, Pascal's law and Archimedes' principle, Corioli's acceleration and weather systems, Rayleigh scattering, the red sunset, Reflection, refraction and dispersion of light, Total internal reflection, Rainbow.

9. Physics in Human Body and Sports:

The eyes as an optical instrument, Vision defects, Rayleigh criterion and resolving power, Sound waves and hearing, Sound intensity, Decibel scale, Energy budget and temperature control, Physics in sports: The sweet spot, Dynamics of rotating objects, Running, Jumping and pole vaulting, Motion of a spinning ball, Continuity and Bernoulli equations, Turbulence and drag.

10. Physics in Technology:

Microwave ovens, Lorentz force, Global Positioning System, CCDs, Lasers, Displays, Optical recording, CD, DVD Player, Tape records, Electric motors, Hybrid car, Telescope, Microscope, Projector etc.

11. Cell Organization:

Cell as the basic structural unit, Origin & organization of Prokaryotic and Eukaryotic cell, Cell size & shape, Fine structure of Prokaryotic & Eukaryotic cell organization, Internal architecture of cells, cell organelles, compartment & assemblies membrane system, Ribosome, Polysomes, Lysosomes & Peroxisomes, Connection between cell & its environment, Extracellular Matrix, Structure & function of Nucleic acids, Amino acids & Proteins, Carbohydrates, Lipids, Vitamins & hormones.

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12. Photosynthesis:
Photosynthesis phenomenon, Chlorophyll molecules, Chloroplasts, Photochemical systems, Interaction of photons with chemical compounds, photosensitive chemicals, photo induced electronic transitions in organic molecules, quantum yield, photo induced chemical reactions, Electron transport processes, Molecular mechanism of Photoreception, Bioluminescence, Bacteriorodopsin.

13. Physical Concepts in Biophysics:
Thermodynamics of biological system: First and second laws of thermodynamics, activation energy, Biological systems as open, non-equilibrium systems, Concept of free energy, unavailable energy and entropy, heat content of food, bomb calorimetry, Enthalpy, Negative entropy as applicable to biological systems; Thermodynamics of passive and active transport, glycolytic oscillations, biological clocks; Bioenergetics: Concept of energy coupling in biological processors, Energy requirements in cell metabolism, structure and role of mitochondria, high energy phosphate bond, energy currency of cell, Biological oxidation, Electron-transport chain, Oxidative Phosphorylation including chemiosmotic hypothesis.

14. Semiconductor Devices:
Introduction to Diodes; Transistors: construction, symbol and its types; Bipolar Junction Transistor (BJT): operation of BJT, BJT circuit configuration, common base (CB) configuration, common emitter (CE) configuration, common collector (CC) configuration, Current gain factors (α and β) and their relations; Input and Output characteristics of CE configuration; Biasing method: Voltage divider Bias method (Load line and Operating point (Q-point)); *Applications:* Transistor as a switch, Transistor as an amplifier; Uni-junction Transistor (UJT): Construction, symbol, working principle of UJT, Application of UJT.

15. Digital Electronics:
Introduction to Analog and Digital Signals: Logic Levels and Digital Waveforms.
Number System and Interconversion: Binary, Octal and Hexadecimal.
Binary Arithmetic: Addition, Subtraction.
Boolean Algebra and Logic Gates:
Basic gates with truth table: ORand, NOT; Boolean algebra laws; Derived gates: NOR, NAND, EX-OR, EX-NOR; De-Morgan theorem (first and second).

16. Fundamentals of Measurement:
Aims of measurement; Functional elements of typical measurement system (block diagram and its explanation); Standard measurements and types of calibration methods; Static characteristics (accuracy, precision, sensitivity, linearity, repeatability, reproducibility, drift, hysteresis, resolution, range, span and dead zone); Dynamic characteristics: concepts, first and second order systems, examples of first-order resistance thermometer and thermal element; Examples of second order: U-tube manometer and seismic motion; Errors in measurement.

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17. Measurement of Pressure and Temperature:

Unit of pressure, concept of vacuum, absolute gauge and differential pressure; Elastic transducer- diaphragm, corrugated diaphragm, bellows, Bourdon tube; Electric type - strain gauge, Pressure transducer- calibration by dead weight tester method, Temperature measurement: Scales for temperature (Celsius, Kelvin and Fahrenheit);

Temperature Measurement Techniques:

(a) Non-electrical: Liquid filled thermometer and bimetallic thermometer;

(b) Electrical Methods: Platinum Resistance Thermometer; Thermistor: PTC and NTC with characteristics; Thermocouple: Seebeck effect and Peltier effect; Types of Thermocouple.

18. Wave Motion (Introduction to Wave Motion):

Definition of waves; Longitudinal and Transverse Waves; Characteristics of Waves.

Gravitational Waves - Qualitative Discussion and Applications

Standing Waves -Qualitative Discussion, Applications: Structural Engineering (Vibrations in Buildings and Bridges); Microwaves in Ovens, Musical Instruments (Strings and Air Columns).

19. Sound and Doppler Effect:

Introduction to sound, Types of sound waves: Audible, Infrasonic, Ultrasonic; Musical Sound versus. Noise.

Doppler Effect: Explanation of the Doppler effect, Applications: Red Shift and Blue Shift, Medical imaging, Radar and speed trap guns.

20. Interference and Diffraction:

Interference: Introduction to interference, Phase change on reflection, Optical Path, Interference due to wedge shaped thin film, Applications of interference : Newton's ring.

Diffraction: Introduction to Fresnel's and Fraunhoffer's diffraction, Fraunhoffer's diffraction at single slit, Rayleigh criterion for resolution, Applications of Diffraction: Security holograms, medical imaging, etc.

21. Polarization and Optical Instruments:

Introduction to polarization, Brewster's law, Law of Malus, Polarization by double refraction, Nicol Prism, Microscope: Simple and Compound Microscope, Eye piece : Ramsden's and Huygens's eye piece.

22. LASERS and its Applications:

Introduction to LASER, Principles of LASER action, Types of LASER, Applications of LASER.

23. Physics basis of Life:

Introduction to Biophysics: Definition and Scope, Importance of physics principles in understanding biological systems, Applications of biophysics in medicine, biology and technology.

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Molecular Basis of Life :
Structure and function of proteins, DNA and RNA, Water as a biological solvent: Properties and significance, Concept of molecular interactions: Hydrogen bonding, Van der Waals forces and hydrophobic interactions.

24. Space Mission:
Natural and Artificial Satellite, Geosyncronysed and Geostationary Satellite, Different organization working in Space Mission, Purpose, Indian Organization-ISRO, Different Mission of ISRO and their purpose; Targets achieved by ISRO; Applications of Space Missions to human beings.

25. Artificial Intelligence in Physics:
Introduction to AI, Machine learning, deep learning and neural networks, Current research and applications of AI in Physics such as Materials Physics, Astrophysics etc.; Ethics and limitations of AI in Physics research and applications.

26. Instrumentation:
Types of instruments (analog, digital and hybrid); Measurement principles (accuracy, precision, resolution).

27. Indian Physicists and their contributions:
C.V. Raman: Raman Effect: Scattering of light and its implications in spectroscopy, Nobel Prize-winning work and its applications.
Satyendra Nath Bose: Bose-Einstein statistics and its role in quantum mechanics; Collaboration with Albert Einstein.
Contemporary Indian Contributions:
Space and Astrophysics: Contributions of ISRO in space exploration and physics; Astrosat and its role in multi-wavelength astronomy; Indian contributions to the study of Higgs boson.

28. Introduction to Renewable Energy:
Conventional and Non-conventional energy sources; Renewable energy; Needs and importance of renewable energy sources.

Current questions to related subjects.

३. न्यायसहायक विज्ञान- (प्रश्न संख्या-२०, गुण-४०)

Forensic Science

Introduction to Forensic Science-Introduction to Forensic Science, Laws and principles of forensic science, Criminal justice system in India, Organizational set-up and functions of police, prosecution, and courts in India, Domains of Forensic Science.

Organization related to Forensic Science-Forensic Science Laboratory in India, Central and State Forensic Science Laboratories, Regulatory bodies: Directorate of Forensic Science Services, Bureau of Police Research and Development, National Crime Record Bureau, Intelligence agencies: Intelligence Bureau and Research and Analysis wing, Law enforcement agencies: CID, CBI, NIA, Interpol, Ethics in Forensic Science.

Crime Scene Investigation- Crime Scene and its types, First responding officer at the crime scene, Crime Scene Management, Crime Scene Processing: protection of crime scene, documentation, evidence search, collection, preservation, packaging, and forwarding of evidence to FSL, Physical evidence.

Reflection, refraction, and dispersion of light- Laws of reflection, real and virtual image, Laws of refraction, Physical significance of refractive index, refraction through several media, Total internal reflection, Dispersion and dispersive power, Deviation without dispersion and dispersion without deviation, Fermat's principle, Refraction through thin and thick lenses, combination of two thin lenses (including derivation for focal length and cardinal point)

Interference and Aberration- Interference: Introduction, Conditions for interference of light, Interference in thin film, Newton's ring, Wedge-shaped film, Determination of refractive index of a liquid, Applications of interference-interference filters, thickness of thin film coating, anti-reflecting coating. Aberration: Achromatic and chromatic aberration, Types of Achromatic aberration and their reduction- Spherical aberration, Coma, Astigmatism, Curvature of field, Distortion, Types of chromatic aberration-achromatism (lenses in contact and separated by finite distance).

Polarization and Diffraction-Polarization: Introduction, Polarization of light waves, Types of polarization, Plane of polarization, Brewster's law, Law of Malus, Production of polarized light, Polarizer and analyzer. Diffraction: Introduction to Fresnel and Fraunhoffer's of diffraction, Difference between interference and diffraction, Plane diffraction grating. Resolving power: Rayleigh's criterion of resolution, resolving power of grating and microscope, Huygen's and Ramden's eye pieces and their comparison.

Atomic Structure and periodicity of elements- Periodicity of the elements: General discussion of the following properties of the elements with reference to s block elements: a) electronic configuration b) atomic radii c) ionic radii d) ionization energy e) electron affinity f) electronegativity g) metallic characters h) reactivity i) oxidation state j) melting and boiling points k) chemical properties.

Chemical Bonding and Molecular Structure- Types of Chemical Bonds: a) Ionic bond b) Covalent Bond c) Co-ordinate bond d) metallic bond e) Hydrogen Bond f) Van-der walls force. Definition and formation Of ionic bond. General characteristics of ionic bonding. Energetic in Ionic bond formation. Born-Haber cycle for NaCl and its applications. Fajan 's Rule, Applications of Fajan 's rule

for i) Polarizing power and polarizability ii) Ionic character in covalent compounds iii) Bond moment, dipole moment and percentage ionic character.

Acid and Bases-Theories of Acids and Bases — Arrhenius concept, Bronsted — Lowry concept, Lewis's concept, LuxFlood concept. (Definition and examples only). Hard and Soft Acids and Bases (HSAB concept), Classification of Acids and Bases as hard soft and borderline. Pearson's HSAB concept. Acid —Base strength and hardness-softness. Application and limitations of HSAB concept.

Position of elements in periodic table. Characteristics of group 13th, 14th and 15th elements with special reference to electronic configuration and periodic properties. Compounds of group13th, 14th and 15th elements. Boron —diborane (only structure). Allotropes of carbon and phosphorus. Oxyacids Of Nitrogen (HN02, HN03).

Biochemistry- Carbohydrates: Classification, types and functions, isomerism and optical activity, Carbohydrate metabolism: Glycolysis, Kreb's Cycle and oxidative phosphorylation, Pentose phosphate pathway, Gluconeogenesis, Glyoxylate cycle. Oils and Fats: classification, properties. Significance of saturated and unsaturated fatty acids and essential fatty acids, Vitamins: significance and deficiencies. Hormones: importance and functions in brief

Basics of Photography- Electromagnetic radiation, Image formation through lenses, Analog and digital photography, Analog Camera and its component, Digital camera and sensors,Terms related to photography: aperture, shutter speed, film speed, etc.

Photography in forensic setup- Crime Scene Photography: Overall, mid-range and close-up, Evidence photography, Document photography, Photography of evidence on challenging surface.

Introduction to Criminal procedure and Drafting-Introduction to criminal proceedings, stages of criminal proceedings, hierarchy of criminal courts, compoundable and non-compoundable offenses, cognizable and non-cognizable offences, authorities and role of police in investigation of a case, Introduction of FIR, process to lodge and FIR, format of FIR, role of an advocate in FIR, Search of already registered FIR, Quashing of FIR.

Criminal Complaints and other Drafting-Introduction to complaints and difference between FIR and Complaints, Applications under Section 125 crpc, 156 (3) crpc, 256 and 317 crpc, Section 12 of Domestic Violence Act.

Trial: procedure before court, stages of trial, chargesheet, framing of chargesheet, evidence in trial process: examination, cross-examination, burden of proof.

Crime and criminal behavior-Crime and its elements, Classification of crime, Victim and its classification, Criminal and its classification, Criminology: definition and historical development, Criminal behavior: classical and non-classical theories, biological theories, physiological theories, psychogenic theory, economic theory, geographical theories, sociological and multifactor theories.

Organization related to Forensic Science-Forensic Science Laboratory in India Regulatory bodies: Directorate of Forensic Science Services, Bureau of Police Research and Development, National Crime Record Bureau, Intelligence agencies: Intelligence Bureau and Research and Analysis wing, Law enforcement agencies: CID, CBI, NIA, Interpol. Research Organizations: CDFD, CCMB,

DRDO. Training Institutions: CDTI, NPA. Drug testing organizations: World/National Antidoping Agency, N ational Drug Testing Laboratory

Physical evidence and their analysis- Classification of physical evidence Glass: composition, types, and forensic examination Paint: composition, types, and forensic examination, Soil: composition, types, and forensic examination, Restoration of an erased number

Fingerprint and impression evidence- Fingerprints: Definition, history, and development, terms related to fingerprint: Type line, core, delta, fingerprint patterns, fingerprint at the crime scene, the composition of sweat, development of fingerprints, comparison of fingerprints, Other impressions: footprint, shoeprint, tire marks, and tool marks: introduction, collection, and preservation, forensic examination.

Forensic Ballistics-Introduction to forensic ballistics and its classification, Firearms: definition, types and working mechanism, Ammunitions: definition, types, nomenclature, composition, and constituents, Estimation of the range of fire, Gun Shot residue and its examination

Mechanics- Acceleration: equation of uniformly accelerated motion, speed time graph, equation of motion for freely falling bodies, distance covered by the body in nth second.

Fluid Dynamics- Streamline and turbulent flow, Viscosity and coefficient of viscosity, Temperature dependence of viscosity, Stoke's law and terminal velocity, Determination of coefficient of viscosity by falling sphere method and Poiseuille's method.

Thermodynamics-Laws of thermodynamics, Thermodynamic process (reversible and irreversible), Cycles, Heat engine, Thermal efficiency of heat engines, Carnot's cycle and Carnot's engine, Efficiency of Carnot's cycle, Otto cycle, Thermodynamic variables, Thermal equilibrium and temperature, Zeroth law of thermodynamic, Entropy, Two stroke and four stroke engine principle and their comparison, Types of engines: Petrol, Diesel and CNG

Fundamentals of Organic Chemistry- Introduction, Curved arrow notations, Cleavage of Bonds: Homolysis and Heterolysis. Organic molecular species: Nucleophiles and electrophiles. Electronic Displacements: Inductive Effect, Electrometric Effect, Resonance and Hyper conjugation effect, Reactive Intermediates: Generation, Structure, Stability and Reactions of Carbocations, Carbanions, Carbon free radicals, Carbene and Nitrene.

Diversity of life forms and procaryotes- Systematics: general scheme, Binomial nomenclature. Plant, animal and microbial diversity, carl Woese 16S-rRNA classification. Prokaryotic cell structure: cell wall, slime layer, cell membrane, flagella, cytoplasmic content, plasmids. General structure and classification of viruses. Lytic and lysogenic life cycle.

Introduction to C Programming- Problem-solving using computers: Algorithms and Flowcharts History, Structure of a C program, Functions as building blocks, Tokens Keywords, Identifiers, Variables, Constants ,Types of Data types, Operators and Expressions Operator types (arithmetic, relational, logical, assignment, bitwise, conditional, other operators), precedence and associatively rules. Input output functions, Control structure: Branching (if, if else, switch), Looping (for, do-while, while).

Signal Generators and Analysis Instruments- Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a QMeter. Digital LCR bridges.

Digital Instruments- Digital Instruments: Principle and working of digital meters. Comparison of analog and digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. Digital Multimeter: Block diagram and working ofa digital multimeter. Working principle of time interval, frequency, and period measurement using universal counter/ frequency counter, timebased stability, accuracy, and resolution.

Handling Chemicals/instruments and Minimizing Hazards in Laboratory- Introduction to handling hazardous chemical waste, storing flammable and corrosive liquids, maintaining a safe and secure laboratory, managing chemicals in the laboratory. Safety measures for common laboratory operations. Managing risk- decision about safety, eye and face, skin protection- clothes, gloves and tools, chemical hoods, contamination and ventilation, safety measures for common laboratory operations, radiation, laser and biological safety cabinets. Lab waste management. Instruments handling: Heating Devices and thermal safety, Ovens, Hot plates, heating mantles, Oil, salt and sand baths, High pressure vessels, vacuum pumps, rotary evaporators, refrigerators and freezers.

Blood Pattern Analysis- Introduction and objectives of Blood Pattern, Analysis (BPA), History of BPA, Classification of Bloodstains and bloodstain pattern Biological and Physical properties of human blood, Determination of the angle of impact.

Dynamics of BPA- Impact of height and surface on the shape and size of bloodstains, Spatter associated with secondary and projection mechanism, Altered bloodstain patterns, Determination of area of convergence and area of origin, Detection and Enhancement of latent bloodstains

Forensic Handwriting Identification- Basis of handwriting identification. Characteristics of handwriting, scope and application, Class and individual characteristics. Arrangement, alignment, margin, slant, speed, pressure, spacing, line quality, embellishments, movement and pen lifts, Factors influencing handwriting-physical, mechanical, genetic and physiological

Handwriting Examination- Basis of handwriting comparison, Collection of handwriting samples, Forgery detection, Counterfeiting, Examination of altered and erased documents. Tool used in handwriting examination.

Handwriting Recognition- Basis of handwriting recognition, Off-line and on-line handwriting recognition, Steps involved in handwriting recognition pre processing, feature extraction and classification, Applications of handwriting recognition

Thermodynamics and Chemical Equilibrium- Thermodynamics: Basic concepts of thermodynamics: system, surrounding and boundary, type of systems, state and path functions, thermodynamics process, intensive and extensive properties, first law of thermodynamics, Carnot cycle, entropy,

statement of second law of thermodynamics, Statement of third law, Hess's law of constant heat summation, Kirchhoffs equation, Chemical Equilibrium: Free energy change in chemical reactions, Le Chatelier's principle

Plant Systems- Overview of root, stem, leaves, Flowers and its whorls, Palynology, Pollination, Monocot and Dicot plants, Plant tissues: Dermal tissue, ground tissues and vascular tissues, Secondary growth in plants, dendrochronology, Limnology: use of diatoms in pre-mortem and post-mortem drowning, Introduction to plant fibers (Cotton, Jute, and Hemp).

Human Systems-Overview of structure and function of human system: Digestive system; Excretory system; Respiratory system; Circulatory system; nervous system, Reproductive system; Muscular system and Endocrine system. Human hair vs animal hair.

Graphs, sorting, searching and Hashing- Graphs- Basic terminology, types of graphs, representing graphs in memory. Graph Traversals- Breadth First Search, Depth First Search. Finding shortest path in graphs- Dijkstra's algorithm, Bellman Ford algorithm. Minimum Spanning Tree- definition, constructing minimum spanning tree Kruskal's algorithm, Prim's Algorithm, Application of graphs in real world, Sorting: Bubble sort, insertion sort, quick sort, heap sort. radix sort, shell sort. Comparison of sorting techniques, Searching: Linear search, binary search, Hashing- concept, examples, collision, resolving collision, applications of hashing. Indexing.

LASER:-Lasers: Introduction, Spontaneous and stimulated emission, Interaction of light with matter and quantum processes, Population inversion, Pumping system, Production of laser, Types of lasers-The Ruby laser, gas laser, semiconductor laser, Uses of laser, Properties of laser.

Fibre Optics:-Fiber optics: Introduction, Principle, structure and classification of optical fiber, Numerical aperture, Fiber optic communication system, Losses in optical fiber, Applications of optical fiber, Holography: Principle, Recording of a hologram, Applications of holography.

Study of Water-Hydrosphere- Water resources, Properties of water-colour, Odor, turbidity, total salt content, total suspended water, Water pollution-Definition of water pollution, types of water pollutants, sources of water pollutants, trace element in water, water quality parameters and standards, Purification of water-Treatment of domestic and industrial water, Sources of Pollution - Physical, Chemical, Organic Biological properties of Industrial Waste water, Difference between industrial; municipal waste waters, Effects of industrial effluents on sewers and Natural water Bodies.

Cyber Crime- Historical perspective on Cyber Crime, Meaning and definitions of Cyber Crimes, Convention v/s Cyber Crimes, Misuse of Technology, factors leading to an increase in Cyber Crimes, Tools and Techniques Used to Commit Cyber Crimes, and Threats to national security.

Classification of cyber crimes- Classification of Cyber Crimes, Cyber Criminals, Relevant Cyber Crimes other than IT Act, 2000, Cyber Crime in Modern Society, Different Kinds of Cyber Crime, measures for prevention of cybercrimes, Impact of cyber warfare on privacy, identity theft, Social Networking Sites Vis-å-vis Human Rights.Digital Forgery, Cyber

Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism and Cyber Defamation.

Malware and Cybercrimes-Malware and its types popular cybercrimes, Some popular cybercrimes : Phishing, Identity/credential theft, Misinformation/ disinformation, Financial frauds, Man-in-the-middle, Social media crimes, Morphing, Grooming, Matrimonial frauds,Career frauds

Institutional Framework in India and Reporting of cyber crime- Cyber security institutions of India: Organizations under PMO, Organizations under Meity, Organizations under MHA, Reporting a cyber crime: National cybercrime portal, Sanchar Sathi, Chakshu, Preventive measures, Tools to safeguard the data Capacity building initiatives by the government

Crime and Criminology- Definition and characteristics of crime, Classification of crime, Definition and classification of criminal, Definition and classification of victim, Criminology and various perspective criminology

Criminal Justice System- Definition and components of criminal justice system Police: Hierarchy and functions, Courts: Definition, types and powers, Corrections: Definition, types and functions

Introduction to Crime Scene- Reporting of a crime: 112 and cybercrime portal Crime Scene: Definition and importance, Classification of crime scene, First Responders: Definition and Duties.

Crime Scene Management- Crime Scene Management: Importance, Components of Crime Scene Management: Information Management, Manpower Management, Technology and Equipment Management, Logistics Management.

Crime Scene Processing-Processing of Crime Scene, Documentation of Crime Scene, Definition and types of physical evidences, Searching and marking of evidences, Collection and Packaging of evidences Forwarding of evidences to the FSL.

Magnetic Field and Dielectric Properties- Magnetic Force, Lorentz Force, Biot Savarts Law, Cur-rent Loop as a Magnetic Dipole and its Dipole Moment (analogy with Electric Dipole), Amperes Circuital Law and its application to (I) Solenoid (2) Toroid (3) Helmhotz coil, Properties of curl and divergence, Vector Potential, Ballistic Galvanometer: Torque on a current Loop, Current and Charge Sensitivity,Electromagnetic damping, Logarithmic damping, CDR.

Dielectric Properties of Matter: Electric Field in matter, Polarization, Polarization Charges, Electrical Susceptibility and Dielectric Constant, Capacitor (parallel plate, spherical, cylindrical) filled with dielectric, Displacement vector D, Relations between E, P and D, Gauss Law in dielectrics. Magnetic Properties of Matter. Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Ferromagnetism, B-H curve and hysteresis. Electromagnetic Induction: Faradays Law, Lenz's Law, Self -Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations.

Colligative Properties of solution and electrochemistry- Colligative Properties of Solutions: Colligative Properties and types of properties, Elevation in boiling point, Relative lowering of vapour pressure, Raoult's law and Henry's law,

Depression of freezing point, Osmosis and osmotic pressure, Problems based on all colligative properties. Electrochemistry: Redox Reaction, Oxidation and reduction Potential; Half-cell, cell potential, Cell constant, specific conductance and molar conductance; Application of conductance measurement; Conductometric titrations; Types of electrochemical cells and examples, cell reactions, emf; Standard cells, different types of electrodes (with examples); Standard electrode potential.

Surface Chemistry-Surface Chemistry: Definition and classification of Colloids- Coagulation of colloids- HardySchulze rule. Stability of colloids, Protection of Colloids, Gold number. Adsorption - Physical and chemical adsorption, Freundlich and Langmuir adsorptionisotherm, applications of adsorption.

Food Analysis and Nutrients- Importance of food analysis and basic principles. Nutrients and their nutritional value in food composition, macronutrients and micronutrients Food Quality and Safety: Principles of food safety and quality assurance, Types of additives, their functions and safety considerations, Importance of pH and use of chemical preservatives (Boric acid, Sodium Benzoate), Introduction to foodborne illnesses and prevention methods.

Analytical Techniques and Case Study- Applications of Chemical and instrumental methods in food analysis, Estimation of Vitamin C in lemon squash by redox titration, Estimation of Calcium in milk powder by complexometric titration, Estimation of Acetic acid in vinegar by potentiometry, Estimation of Iron in the given food sample by colorimetry using KSCN, Case Study (Any One) — Brominated Vegetable Oil (Soft drink) /Nickel in Chocolate / Oxytocin in Milk.

Basics of Fingerprints- Introduction and history, with special reference to India. Biological basis of fingerprints. Formation of ridges. Fundamental principles of finger printing, Types of fingerprints. Fingerprint patterns. Fingerprint characters/minutiae

Recording and Classification of fingerprints- Recording of plain and rolled fingerprints, Classification and cataloguing of fingerprint record, Automated Fingerprint Identification System, Significance of Poros copy and edgeoscopy.

Development of Fingerprints- Latent prints. Constituents of sweat residue. Latent fingerprints' detection by physical and chemical techniques. Mechanism of detection of fingerprints by different developing reagents. Application of light sources in fingerprint detection. Preservation of developed fingerprints, Digital imaging for fingerprint enhancement.

Basics of Fingerprints- Fingerprints: definition and importance, Morphogenesis of fingerprints, Types of fingerprints, Fingerprints at scene of crime, Minutiae and comparison of fingerprints.

Classifications of fingerprints- Classification of fingerprints and its importance Henry-extended classification of fingerprints, Single digit classification of fingerprints.

Development of latent prints- Sweat glands: types and composition, Methods for the development of latent fingerprints, Factors effecting development of fingerprints, Challenges in development of fingerprints.

Basics of Document Forensics-Document: Definition and types, Document Forensics: Introduction and scope, Preliminary examination of documents, Laws related to document examination

Handwriting Examination- Definition of handwriting, Principle and characteristics of handwriting, Features and characteristics of handwriting, Methods of collection of standards, Comparison of handwriting, Signature: types and comparison, Forgery in signatures.

Document Examination- Alteration of documents: types and method of the' detection and decipherment, Examination of writing surfaces and writing materials, Examination of invisible documents and secret writing, Examination of security documents, Examination of printers and printed documents.

Emerging trends in Forensic Science:- Introduction, scope and importance of emerging forensic disciplines: Forensic Engineering, Forensic Radiology, Forensic Accounting, Forensic Nursing, Forensic Nanotechnology, Forensic Archaeology, Forensic Arts, Computational Forensics, Nuclear Forensics, Forensic Journalism, Environmental Forensics, Forensic Pharmacology, and Forensic Biotechnology.

Forensic Photography: Introduction, 35 mm film / Digital SLR camera, Digital photo imaging, ISO number, Exposure Index, Photo imaging evidence; angle, scale, depth of field, light, ambient light, colour temperature, flash/ strobe. Photography of footwear impressions, Crime scene investigation report writing. Forensic image processing and analysis.

Magnetic Measurements: Magnetic susceptibility and it's measurement by Quinck's and Gouy's method, Hall Effect and related measurements.

Electrical Measurements: Resistivity measurement of thin samples by Four probe method, bulk samples by Van-der Pauw method, Resistivity measurement of electrical wires and cables and forensic examination for their source identification, Forensic examination of tampered electric energy meters and various tampering mechanisms adopted by criminals, FET and study of its characteristics, Optical fiber communication system,.

Radiation Detection and measurements: Working principle of Ionization chamber, Proportional counter, Geiger Muller counter, Scintillation counter, Solid State Transducer. Radiation dose and it's unit, Exposure, absorbed and dose equivalent rate and calculation of exposure and dose, Dose rates from natural and man-made sources, Radiation permissible limits, Shielding of radioactive sources.

X-Ray measurements: X-Ray diffraction and crystallography, Brag's condition, Laue method, Debye- Scherrer method, Miller indices, plane spacing, Powder diffraction spectra and analysis, General analysis for cubic structures, X-ray density, Accurate measurement of cell dimensions.

Road Terminologies: Cut, Final Grade, Surface, Existing Grade, Fill, Sub grade, Base, Traffic lane, Travelled way, Shoulders, Roadbed, Roadway, Roadway ditch, Ditch slope, Back slope, Fill slope, Interceptor ditch, Slope ratio, Central line, Crown, Super elevation, Road dividers. Road signs, symbols and traffic control mechanisms.

Vehicular accidents: Primary causes of road accident, Types of road accident, sources of information, eye witnesses, Tire and other marks, Pedestrian impacts

and vehicle speed, vehicle condition, vehicle speed and damage, types of skid marks, curved scuffmarks, speed estimation from skid/scuffmarks. Time and distance, reaction time and peripheral vision of a driver, Photography and plans, Brake system and Steering failure, Motor vehicle examination.

Rail Accidents: Investigation of rail crash: Criminal and safety investigation, Investigation principles, Best Practices: rail company tests, inspection of driving cab, examination of electrical/electronic/technological system and their failure. Necessary equipments required for forensic examination.

General- Energy considerations, Propellants, Initiation, Combustion of propellants, Density of loading, Atmospheric temperature, Shape of the cartridge case. Heat problems, Barrel pressure and its determination, Recoil, facts and measurement, Vibration and jump, Barrel fouling.

Exterior Ballistics- Trajectory formation, Vacuum trajectories, Range, Experimental determination and shape of trajectory, Spin, Drift, Angle of fire, Structure of the projectile, Sectional density, Influence of earth and escape velocity, Air resistance, Retardation, Wind deflection, Firing guns in the air, Ricochet.

Shotgun Ballistics- Shotguns, Strength of the firearm, Jump and vibration, Recoil, Patterns, Stringing, Wounding power.

Casting 3-D Footwear Impressions: Introduction to casting, Importance of casting, Benefits of casts over photographs, Casting materials, Methods of casting with dental stone, Casting footwear impressions in snow.

Treatment of 2-D Footwear Impressions: Lifting 2-D footwear impressions, Lifting impressions electro statically and electrostatic lifting devices, Gelatin and adhesive lifting, Other lifting materials and choices, Powdering impressions, Deformable impressions, Impressions on carpets, cushions, grass and skin.

Enhancement of Footwear Impressions: Specialized lighting and photographic methods, Chemical enhancement, Other enhancement techniques.

Forensic Microscopy-

Basics of microscope, common terms used in microscopy, Construction, working, applications and limitations of -Compound microscope, Comparison microscope, Stereomicroscope, Polarizing microscope ,Micro spectrophotometer, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).

Introduction to: Environmental Scanning Electron Microscope (ESEM), Auger Electron Spectroscopy (AES), X- Ray Photoelectron Spectroscopy (XPS) , Secondary Ion Mass Spectrometer (SIMS), X- Ray Fluorescence (XRF), Atomic Force and Tunneling Scanning Microscope (AF & TS), Phase contrast Microscope and Digital Microscope.

Physical properties of materials: temperature, weight and mass, density, refractive index and their forensic importance.

Glass: Composition of glass, Comparison of glass fragments, Measuring and comparing density and refractive index of glass, classification of glass samples, Glass fractures, Collection and preservation of glass evidence.

Soil: Significance of soil evidence, Variations in soil, Collection and preservation of soil evidence, Forensic examination of soil.

Fibre: Types, Identification and comparison of manufactured fibres (Microscopic examination, Dye composition, Chemical composition, Other properties for examination), Significance of match, Collection and preservation of fibre evidence. Forensic examination of cloth and cloth fibres.

Paint: Composition of paint, Classification of common paints, Pigment Volume concentration number, Microscopic examination of paint, Analytical tools used in paint comparison, significance of paint evidence, collection and preservation of paint evidence. Forensic examination of paint.

Plastic: Classification of plastics according to thermal and mechanical property, Plastics in common use.

DNA profiling and its forensic significance- History of DNA fingerprinting, Human genetics – Heredity, Alleles, Mutations & Population genetic, Molecular biology of DNA. Forensic Application of recombinant DNA technology/ Forensic Biotechnology, Human genome project, Variations, Polymorphism in DNA system – DNA markers RELP, RAPD, VNTRs, SNP, Autosomal – STR, Y-STR, Mitochondrial DNA. Forensic significance of DNA profiling:- Application in disputed paternity cases, child swapping, Missing person's Identity – immigration, veterinary & wild life and Agriculture cases, legal perspectives – legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad. New and future technologies: DNA chips, SNPs and limitations of DNA profiting

Clinical Biochemistry and Genetic Analysis:- Fluid electrolyte homeostasis in the body: Role of water, electrolytes in the body, hydrogen ion concentration and buffer, regulation of blood, pH, disorder of Acid-base balance acidosis and alkolsis Disorders of Metabolism: Carbohydrate metabolism: Diabetes mellitus, glycogen storage disease, Lipids: Hypercholesterolemia, Blood: Thalassemia, sickle cell anemia, Amino acids: phenolketonuria, alkaptonuria, tyrosemia, Purine and pyrimidine: Lesch-Nyan syndrome, Gout diseases, SCID Renal function test, liver function test, pancreatic function test, Gastric function test, thyroid function test, detoxification.

Psychology of crime & Delinquency, Juvenile Delinquency: Definition, Concept,The Developmental perspectives in delinquent behaviour-Developmental theory, Coercion Developmental Model. Risk Factors of Juvenile Delinquency- Biological Factors – Temperament, Genetic influence, Hormones and aggression, Substance abuse. Individual-intelligence, language development, Selfregulation skills & Excutive functions. Family-Family pattern, Rejection in family, Family Conflicts, Family Relationships, Emotional Deprivation. Social factors- Peer Group, Cultural Values, Media. Juvenile Psychopathy, Prevention and Control of Juvenile Delinquency.

Applied Digital and Cyber Forensics- HTML : Introduction, Basic Tags, Elements, Attributes, Attributes, Formatting , Phrase Tags, Meta Tags, Comments, Images, Tables, Lists, Frame, Iframe, Fonts, Colors, Forms, Embed Multimedia, Marquees , Headers. **CSS:** Introduction, Content and Style, CSS 1 Rules, Length, Percentage, Color and URLs, Font Properties, Color and Background Properties, Text Properties, Box Properties, Classification Properties, Structure and Control, Linking Style Sheets to HTML.

JavaScript: Introduction, Syntax, statements, comments, variables, Operators, Data types, control structure, Function, Array, Errors.

PHP : Introduction, Environment, Syntax, Variable Types, Constants, Operator Types, Decision Making, Loop, Arrays, String, Web Concepts, Methods, File System, Functions, Cookies, Sessions, Sending Emails, File Uploading.

MySql: Introduction, Installation, Syntax, Connection, SQL statements (DDL and DML), Temporary Tables, Handing Duplicates, SQL Injection, Data base export, Data base Import

Multimedia Forensics: Introduction to multimedia forensics, basic concepts of image, video and audio, digitization and representation of image, video and audio: Shannon's sampling theorem and nyquist frequency. Various recording devices and its characteristics, concepts of noise and construction of filter for their removal, nature and types of forgery related to multimedia and its authentication. Investigation of crime scene in reference to multimedia evidences.

Information Technology Act (IT Act 2000): Introduction, definitions of computer, computer system, computer network, electronic record, data, secure system, digital signature and certifying authority as per IT Act. Authentication of electronic records (Section-3), legal recognition of electronic records and digital signature (Section-4 and 5), Certifying Authorities and Controller, Offences as per IT Act (Section-65 to Section-78), Special provision in Indian Evidence Act regarding admissibility of electronic records (Section-65B of IEA, 1872).

Current questions to related subjects.