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PUBLISHER'S NOTE

JEE (Main), previously known as All India Engineering Entrance Examination (AIEEE), is considered as one of the most esteemed engineering entrance examinations in India conducted by Central Board of Secondary Education (CBSE). Every year almost 5 lakh students appear in the examinations for admission to the engineering, pharmacy and architecture programmes in different colleges including all the National Institutes of Technology (NITs), Indian Institutes of Information Technology (IIITs), many centrally founded institutions and a number of deemed universities and institutions in States/UT's other than those covered by Joint Entrance Examination/Sate Level Entrance Examination. The number of engineering colleges taking admission on the basis of JEE (Main)/AIEEE score is increasing every year.

After successfully publishing youth-oriented books and getting commendable appreciations from students, teachers and parents alike, V&S Publishers is venturing into the arena of student-oriented books with Crash Course JEE (Main)/AIEEE. There are three separate books on Physics, Chemistry and Mathematics in this series. Upholding the commitment of value and substance, V&S Publishers has given its best effort in these books to explain concepts and theories in a lucid and unambiguous manner. These books aim to help students increase their knowledge on the subjects discussed and equip them with the requisite skills to succeed in any competitive examinations.

Key features of these books:

- Each book is based on the latest pattern and syllabus of JEE (Main)/AIEEE. A comprehensive and holistic revision of the complete syllabus of JEE (Main)/AIEEE is given in the beginning of each book.
- In each chapter, more emphasis is given on concepts, principles and formulas and tips while discussing explanations of theories and problems.
- Numerous solved examples and Practice questions are given to provide rigorous practice to students.
- Fully solved previous years' question papers are given to make students aware of the type of questions asked frequently.

For students reference, the detailed analysis of previous years papers and the complete syllabus for this year along with scheme of examination, pattern etc. is also included herein.

While every effort has been made to minimise printing and other errors, it may possible that a few might have managed to escape the wakeful eyes. We would like to request the readers to bring these errors to our notice so that we can rectify the same in subsequent editions.

CONTENTS

SYLLABUS

PHYSICS

The syllabus contains two Sections - A and B. Section - A pertains to the Theory Part having 80% weightage, while Section - B contains Practical Component (Experimental Skills) having 20% weightage.

SECTION – A

UNIT 1: PHYSICS AND MEASUREMENT
Physics, technology and society, S I units, Fundamental and derived units. Least count, accuracy and precision of measuring instruments, Errors in measurement, Dimensions of Physical quantities, dimensional analysis and its applications.

UNIT 2: KINEMATICS
Frame of reference. Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity Uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion. Scalars and Vectors, Vector addition and Subtraction, Zero Vector, Scalar and Vector products, Unit Vector, Resolution of a Vector. Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.

UNIT 3: LAWS OF MOTION
Force and Inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion; Impulse; Newton's Third Law of motion. Law of conservation of linear momentum and its applications, Equilibrium of concurrent forces.Static and Kinetic friction, laws of friction, rolling friction.Dynamics of uniform circular motion: Centripetal force and its applications.

UNIT 4: WORK, ENERGY AND POWER
Work done by a constant force and a variable force; kinetic and potential energies, Work-energy theorem, power. Potential energy of a spring, conservation of mechanical energy, conservative and non-conservative forces; Elastic and inelastic collisions in one and two dimensions.

UNIT 5: ROTATIONAL MOTION
Centre of mass of a two-particle system, Centre of mass of a rigid body; Basic concepts of rotational motion; moment of a force, torque, angular momentum, conservation of angular momentum and its applications; moment of inertia, radius of gyration. Values of moments of inertia for simple geometrical objects, parallel and perpendicular axes theorems and their applications. Rigid body rotation, equations of rotational motion.

UNIT 6: GRAVITATION
The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Kepler's laws of planetary motion. Gravitational potential energy; gravitational potential.

Escape velocity. Orbital velocity of a satellite. Geo-stationary satellites.

UNIT 7: PROPERTIES OF SOLIDS AND LIQUIDS

Elastic behaviour, Stress-strain relationship, Hooke's Law, Young's modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, Reynolds number. Bernoulli's principle and its applications. Surface energy and surface tension, angle of contact, application of surface tension - drops, bubbles and capillary rise. Heat, temperature, thermal expansion; specific heat capacity, calorimetry; change of state, latent heat. Heat transferconduction, convection and radiation, Newton's law of cooling.

UNIT 8: THERMODYNAMICS

Thermal equilibrium, zeroth law of thermodynamics, concept of temperature. Heat, work and internal energy. First law of thermodynamics. Second law of thermodynamics: reversible and irreversible processes. Carnot engine and its efficiency.

UNIT 9: KINETIC THEORY OF GASES

Equation of state of a perfect gas, work doneon compressing a gas.Kinetic theory of gases - assumptions, concept of pressure. Kinetic energy and temperature: rms speed of gas molecules; Degrees of freedom, Law of equipartition of energy,applications to specific heat capacities of gases; Mean free path, Avogadro's number.

UNIT 10: OSCILLATIONS AND WAVES

Periodic motion - period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M.) and its equation; phase; oscillations of a spring -restoring force and force constant; energy in S.H.M. - kinetic and potential energies; Simple pendulum - derivation of expression for its time period; Free, forced and damped oscillations, resonance.Wave motion. Longitudinal and transverse waves, speed of a wave. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, Standing waves in strings and organ pipes, fundamental mode and harmonics, Beats, Doppler effect in sound

UNIT 11: ELECTROSTATICS

Electric charges: Conservation of charge, Coulomb's law-forces between two point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electricfield: Electric field due to a point charge, Electric field lines, Electric dipole, Electric field due to a dipole, Torque on a dipole in a uniform electric field. Electric flux, Gauss's law and its applications to find field due to infinitely long uniformly charged straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Electric potentialand its calculation for a point charge, electric dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of two point charges in an electrostatic field. Conductors and insulators, Dielectrics and electric polarization, capacitor, combination of capacitors in series and in parallel,capacitance of a parallel plate capacitor with and without dielectric medium between the plates, Energy stored in a capacitor.

UNIT 12: CURRRENT ELECTRICITY

Electric current, Drift velocity, Ohm's law, Electrical resistance, Resistances of different materials, V-I characteristics of Ohmic and non-ohmic conductors, Electrical energy and power, Electrical resistivity, Colour code for resistors; Series and parallel combinations of resistors; Temperature dependence of resistance.

Electric Cell and its Internal resistance, potential difference and emf of a cell, combination of cells in series and in parallel. Kirchhoff's laws and their applications. Wheatstone bridge, Metre bridge. Potentiometer - principle and its applications.

UNIT 13: MAGNETIC EFFECTS OF CURRENT AND MAGNETISM

Biot - Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long current carrying straight wire and solenoid. Force on a moving charge in uniform magnetic and electric fields. Cyclotron. Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors-definition of ampere. Torque experienced by a current loop in uniform magnetic field; Moving coil galvanometer, its current sensitivity and conversion to ammeter and voltmeter. Current loop as a magnetic dipole and its magnetic dipole moment. Bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements. Para-, dia- and ferro- magnetic substances. Magnetic susceptibility and permeability, Hysteresis, Electromagnets and permanent magnets.

UNIT 14: ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS

Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance. Alternating currents, peak and rms value of alternating current/ voltage; reactance and impedance; LCR series circuit, resonance; Quality factor, power in AC circuits, wattless current. AC generator and transformer.

UNIT 15: ELECTROMAGNETIC WAVES

Electromagnetic waves and their characteristics. Transverse nature of electromagnetic waves. Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, Xrays, gamma rays). Applications of e.m. waves.

UNIT 16: OPTICS

Reflection and refraction of light at plane and spherical surfaces, mirror formula, Total internal reflection and its applications, Deviation and Dispersion of light by a prism, Lens Formula, Magnification, Power of a Lens, Combination of thin lenses in contact, Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers.

Wave optics: wavefront and Huygens' principle, Laws of reflection and refraction using Huygen's principle. Interference, Young's double slit experiment and expression for fringe width. Diffraction due to a single slit, width of central maximum. Resolving power of microscopes and astronomical telescopes, Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroids.

UNIT 17: DUAL NATURE OF MATTER ANDRADIATION

Dual nature of radiation. Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation; particle nature of light. Matter waves-wave nature of particle, de Broglie relation. DavissonGermer experiment.

UNIT 18: ATOMS AND NUCLEI

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity-alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, nuclear fission and fusion.

UNIT 19: ELECTRONIC DEVICES

Semiconductors; semiconductor diode: I-V characteristics in forward and reverse bias; diode as a rectifier; I-V characteristics of LED, photodiode, solar cell and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

UNIT 20: COMMUNICATION SYSTEMS

Propagation of electromagnetic waves in the atmosphere; Sky and space wave propagation, Need for modulation, Amplitude and Frequency Modulation, Bandwidth of signals, Bandwidth of Transmission medium, Basic Elements of a Communication System (Block Diagram only).

SECTION –B

UNIT 21: EXPERIMENTAL SKILLS

Familiarity with the basic approach and observations of the experiments and activities:

1. Vernier callipers-its use to measure internal and external diameter and depth of a vessel.
2. Screw gauge-its use to determine thickness/diameter of thin sheet/wire.
3. Simple Pendulum-dissipation of energy by plotting a graph between square of amplitude and time.
4. Metre Scale - mass of a given object by principle of moments.
5. Young's modulus of elasticity of the material of a metallic wire.
6. Surface tension of water by capillary rise and effect of detergents.
7. Co-efficient of Viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body.
8. Plotting a cooling curve for the relationship between the temperature of a hot body and time.
9. Speed of sound in air at room temperature using a resonance tube.
10. Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures.

11. Resistivity of the material of a given wire using metre bridge.
12. Resistance of a given wire using Ohm's law.
13. Potentiometer –
    (i) Comparison of emf of two primary cells.
    (ii) Determination of internal resistance of a cell.
14. Resistance and figure of merit of a galvanometer by half deflection method.
15. Focal length of:
    (i) Convex mirror
    (ii) Concave mirror, and
    (iii) Convex lensusing parallax method.
16. Plot of angle of deviation vs angle of incidence for a triangular prism.
17. Refractive index of a glass slab using a travelling microscope.
18. Characteristic curves of a p-n junction diode in forward and reverse bias.
19. Characteristic curves of a Zener diode and finding reverse break down voltage.
20. Characteristic curves of a transistor and finding current gain and voltage gain.
21. Identification of Diode, LED, Transistor, IC, Resistor, Capacitor from mixed collection of such items.
22. Using multimeter to:
    (i) Identify base of a transistor
    (ii) Distinguish between npn and pnp type transistor
    (iii) See the unidirectional flow of current in case of a diode and an LED.(iv) Check the correctness orotherwise of a given electronic component (diode, transistor or IC).

CHEMISTRY

SECTION: A

PHYSICAL CHEMISTRY

UNIT 1: SOME BASIC CONCEPTS IN CHEMISTRY

Matter and its nature, Dalton's atomic theory; Concept of atom, molecule, element and compound; Physical quantities and their measurements in Chemistry, precision and accuracy, significant figures, S.I. Units, dimensional analysis; Laws of chemical combination; Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae; Chemical equations and stoichiometry.

UNIT 2: STATES OF MATTER

Classification of matter into solid, liquid and gaseous states.

Gaseous State: Measurable properties of gases; Gas laws - Boyle's law, Charle's law, Graham's

law of diffusion, Avogadro's law, Dalton's law of partial pressure; Concept of Absolute scale of temperature; Ideal gas equation; Kinetic theory of gases (only postulates); Concept of average, root mean square and most probable velocities; Real gases, deviation from Ideal behaviour, compressibility factor and van der Waals equation.

Liquid State: Properties of liquids - vapour pressure, viscosity and surface tension and effect of temperature on them (qualitative treatment only).

Solid State: Classification of solids: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea); Bragg's Law and its applications; Unit cell and lattices, packing in solids (fcc, bcc and hcp lattices), voids, calculations involving unit cell parameters, imperfection in solids; Electrical, magnetic and dielectric properties.

UNIT 3: ATOMIC STRUCTURE

Thomson and Rutherford atomic models and their limitations; Nature of electromagnetic radiation, photoelectric effect; Spectrum of hydrogen atom, Bohr model of hydrogen atom - its postulates, derivation of the relations for energy of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de-Broglie's relationship, Heisenberg uncertainty principle. Elementary ideas of quantum mechanics, quantum mechanical model of atom, its important features, ?? and ??2, concept of atomic orbitals as one electron wave functions; Variation of ?? and ??2 with r for 1s and 2s orbitals; various quantum numbers (principal, angular momentum and magnetic quantum numbers) and their significance; shapes of s, p and d - orbitals, electron spin and spin quantum number; Rules for filling electrons in orbitals – aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.

UNIT 4: CHEMICAL BONDING AND MOLECULAR STRUCURE

Kossel - Lewis approach to chemical bond formation, concept of ionic and covalent bonds.

Ionic Bonding: Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy.

Covalent Bonding: Concept of electronegativity, Fajan's rule, dipole moment; Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules.Quantum mechanical approach to covalent bonding: Valence bond theory - Its important features, concept of hybridization involving s, p and d orbitals; Resonance.

Molecular Orbital Theory - Its important features, LCAOs, types of molecular orbitals (bonding, anti-bonding), sigma and pi-bonds, molecular orbital electronic configurations of homonuclear diatomic molecules, concept of bond order, bond length and bond energy. Elementary idea of metallic bonding. Hydrogen bonding and its applications.

UNIT 5: CHEMICAL THERMODYNAMICS

Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes.

First law of thermodynamics - Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess's law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionization and solution.

Second law of thermodynamics; Spontaneity of processes; DS of the universe and DG of the system as criteria for spontaneity, Dgo (Standard Gibbs energy change) and equilibrium constant.

UNIT 6: SOLUTIONS

Different methods for expressing concentration of solution - molality, molarity, mole fraction, percentage (by volume and mass both), vapour pressure of solutions and Raoult's Law – Ideal and non-ideal solutions, vapour pressure - composition, plots for ideal and non-ideal solutions; Colligative properties of dilute solutions - relative lowering of vapour pressure, depression of freezing point, elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Abnormal value of molar mass, van't Hoff factor and its significance.

UNIT 7: EQUILIBRIUM

Meaning of equilibrium, concept of dynamic equilibrium.

Equilibria involving physical processes: Solid -liquid, liquid - gas and solid – gas equilibria, Henry's law, general characterics of equilibrium involving physical processes.

Equilibria involving chemical processes: Law of chemical equilibrium, equilibrium constants (Kp and Kc) and their significance, significance of DG and DGo in chemical equilibria, factors affecting equilibrium concentration, pressure, temperature, effect of catalyst; Le Chatelier's principle.

Ionic equilibrium: Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius, Br??nsted - Lowry and Lewis) and their ionization, acid - base equilibria (including multistage ionization) and ionization constants, ionization of water, pH scale, common ion effect, hydrolysis of salts and pH of their solutions, solubility of sparingly soluble salts and solubility products, buffer solutions.

UNIT 8: REDOX REACTIONS AND ELECTROCHEMISTRY

Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number, balancing of redox reactions. Electrolytic and metallic conduction, conductance in electrolytic solutions, specific and molar conductivities and their variation with concentration: Kohlrausch's law and its applications.

Electrochemical cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard electrode potential, half - cell and cell reactions, emf of a Galvanic cell and its measurement; Nernst equation and its applications; Relationship between cell potential and Gibbs' energy change; Dry cell and lead accumulator; Fuel cells.

UNIT 9 : CHEMICAL KINETICS

Rate of a chemical reaction, factors affecting the rate of reactions: concentration, temperature, pressure and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its units, differential and integral forms of zero and first order reactions, their

characteristics and half - lives, effect of temperature on rate of reactions – Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation).

UNIT-10 : SURFACE CHEMISTRY

Adsorption- Physisorption and chemisorption and their characteristics, factors affecting adsorption of gases on solids - Freundlich and Langmuir adsorption isotherms, adsorption from solutions.

Colloidal state - distinction among true solutions, colloids and suspensions, classification of colloids - lyophilic, lyophobic; multi molecular, macromolecular and associated colloids (micelles), preparation and properties of colloids - Tyndall effect, Brownian movement, electrophoresis, dialysis, coagulation and flocculation; Emulsions and their characteristics.

SECTION – B

INORGANIC CHEMISTRY

UNIT 11: CLASSIFICATON OF ELEMENTS AND PERIODICITY IN PROPERTIES

Modem periodic law and present form of the periodic table, s, p, d and f block elements, periodic trends in properties of elements atomic and ionic radii, ionization enthalpy, electron gain enthalpy, valence, oxidation states and chemical reactivity.

UNIT 12: GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF METALS

Modes of occurrence of elements in nature, minerals, ores; Steps involved in the extraction of metals - concentration, reduction (chemical and electrolytic methods) and refining with special reference to the extraction of Al, Cu, Zn and Fe; Thermodynamic and electrochemical principles involved in the extraction of metals.

UNIT 13: HYDROGEN

Position of hydrogen in periodic table, isotopes, preparation, properties and uses of hydrogen; Physical and chemical properties of water and heavy water; Structure, preparation, reactions and uses of hydrogen peroxide; Hydrogen as a fuel.

UNIT 14: S - BLOCK ELEMENTS (ALKALI AND ALKALINE EARTH METALS)
Group - 1 and 2 Elements

General introduction, electronic configuration and general trends in physical and chemical properties of elements, anomalous properties of the first element of each group, diagonal relationships.

Preparation and properties of some important compounds - sodium carbonate and sodium hydroxide; Industrial uses of lime, limestone, Plaster of Paris and cement; Biological significance of Na, K, Mg and Ca.

UNIT 15: P - BLOCK ELEMENTS
Group - 13 to Group 18 Elements

General Introduction: Electronic configuration and general trends in physical and chemical properties of elements across the periods and down the groups; unique behaviour of the first element in each group.

Groupwise study of the p – block elements

Group – 13

Preparation, properties and uses of boron and aluminium; properties of boric acid, diborane, boron trifluoride, aluminium chloride and alums.

Group – 14

Allotropes of carbon, tendency for catenation; Structure & properties of silicates, and zeolites.

Group – 15

Properties and uses of nitrogen and phosphorus; Allotrophic forms of phosphorus; Preparation, properties, structure and uses of ammonia, nitric acid, phosphine and phosphorus halides, (PCl_3, PCl_5); Structures of oxides and oxoacids of phosphorus.

Group – 16

Preparation, properties, structures and uses of ozone; Allotropic forms of sulphur; Preparation, properties, structures and uses of sulphuric acid (including its industrial preparation); Structures of oxoacids of sulphur.

Group – 17

Preparation, properties and uses of hydrochloric acid; Trends in the acidic nature of hydrogen halides; Structures of Interhalogen compounds and oxides and oxoacids of halogens.

Group –18

Occurrence and uses of noble gases; Structures of fluorides and oxides of xenon.

UNIT 16: D – AND F – BLOCK ELEMENTS

Transition Elements

General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first row transition elements - physical properties, ionization enthalpy, oxidation states, atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation; Preparation, properties and uses of $K_2Cr_2O_7$ and $KMnO_4$.

Inner Transition Elements

Lanthanoids - Electronic configuration, oxidation states and lanthanoid contraction.

Actinoids - Electronic configuration and oxidation states.

UNIT 17: CO-ORDINATION COMPOUNDS

Introduction to co-ordination compounds, Werner's theory; ligands, co-ordination number, denticity, chelation; IUPAC nomenclature of mononuclear co-ordination compounds, isomerism; Bonding-Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties; Importance of co-ordination compounds (in qualitative analysis, extraction of metals and in biological systems).

UNIT 18:   ENVIRONMENTAL CHEMISTRY

Environmental pollution - Atmospheric, water and soil. Atmospheric pollution - Tropospheric and Stratospheric

Tropospheric pollutants - Gaseous pollutants: Oxides of carbon, nitrogen and sulphur, hydrocarbons; their sources, harmful effects and prevention; Green house effect and Global warming; Acid rain;

Particulate pollutants: Smoke, dust, smog, fumes, mist; their sources, harmful effects and prevention.

Stratospheric pollution- Formation and breakdown of ozone, depletion of ozone layer -its mechanism and effects.

Water Pollution - Major pollutants such as, pathogens, organic wastes and chemical pollutants; their harmful effects and prevention.

Soil pollution - Major pollutants such as: Pesticides (insecticides,, herbicides and fungicides), their harmful effects and prevention.

Strategies to control environmental pollution.

SECTION-C

ORGANIC CHEMISTRY

UNIT 19: PURIFICATION AND CHARACTERISATION OF ORGANIC COMPOUNDS

Purification - Crystallization, sublimation, distillation, differential extraction and chromatography - principles and their applications.

Qualitative analysis - Detection of nitrogen, sulphur, phosphorus and halogens.

Quantitative analysis (basic principles only) - Estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus.

Calculations of empirical formulae and molecular formulae; Numerical problems in organic quantitative analysis.

UNIT 20:   SOME BASIC PRINCIPLES OF ORGANIC CHEMISTRY

Tetravalency of carbon; Shapes of simple molecules - hybridization (s and p); Classification of organic compounds based on functional groups: - C = C -, - C h C -and those containing halogens, oxygen, nitrogen and sulphur; Homologous series; Isomerism - structural and stereoisomerism.

Nomenclature (Trivial and IUPAC)

Covalent bond fission - Homolytic and heterolytic: free radicals, carbocations and carbanions; stability of carbocations and free radicals, electrophiles and nucleophiles.

Electronic displacement in a covalent bond - Inductive effect, electromeric effect, resonance and hyperconjugation.

UNIT 21:   HYDROCARBONS

Classification, isomerism, IUPAC nomenclature, general methods of preparation, properties and reactions.

Alkanes - Conformations: Sawhorse and Newman projections (of ethane); Mechanism of halogenation of alkanes.

Alkenes - Geometrical isomerism; Mechanism of electrophilic addition: addition of hydrogen, halogens, water, hydrogen halides (Markownikoff's and peroxide effect); Ozonolysis and polymerization.

Alkynes - Acidic character; Addition of hydrogen, halogens, water and hydrogen halides; Polymerization.

Aromatic hydrocarbons - Nomenclature, benzene - structure and aromaticity; Mechanism of electrophilic substitution: halogenation, nitration, Friedel - Craft's alkylation and acylation, directive influence of functional group in mono-substituted benzene.

UNIT 22: ORGANIC COMPOUNDS CONTAINING HALOGENS
General methods of preparation, properties and reactions; Nature of C-X bond; Mechanisms of substitution reactions.

Uses; Environmental effects of chloroform and iodoform.

UNIT 23: ORGANIC COMPOUNDS CONTAINING OXYGEN
General methods of preparation, properties, reactions and uses.

ALCOHOLS, PHENOLS AND ETHERS

Alcohols: Identification of primary, secondary and tertiary alcohols; mechanism of dehydration.

Phenols: Acidic nature, electrophilic substitution reactions: halogenation, nitration and sulphonation, Reimer - Tiemann reaction.

Ethers: Structure.

Aldehyde and Ketones: Nature of carbonyl group;Nucleophilic addition to >C=O group, relative reactivities of aldehydes and ketones; Important reactions such as - Nucleophilic addition reactions (addition of HCN, NH3 and its derivatives), Grignard reagent; oxidation; reduction (Wolff Kishner and Clemmensen); acidity!] of hydrogen, aldol condensation, Cannizzaro reaction, Haloform reaction; Chemical tests to distinguish between aldehydes and Ketones. CARBOXYLIC ACIDS Acidic strength and factors affecting it.

UNIT 24: ORGANIC COMPOUNDS CONTAINING NITROGEN
General methods of preparation, properties, reactions and uses.

Amines: Nomenclature, classification, structure, basic character and identification of primary, secondary and tertiary amines and their basic character.

Diazonium Salts: Importance in synthetic organic chemistry.

UNIT 25: POLYMERS
General introduction and classification of polymers, general methods of polymerization-addition and condensation, copolymerization;

Natural and synthetic rubber and vulcanization; some important polymers with emphasis on their monomers and uses - polythene, nylon, polyester and bakelite.

UNIT 26:   BIOMOLECULES

General introduction and importance of biomolecules.

CARBOHYDRATES - Classification: aldoses and ketoses; monosaccharides (glucose and fructose) and constituent monosaccharides of oligosacchorides (sucrose, lactose and maltose).

PROTEINS - Elementary Idea oEH - amino acids, peptide bond, polypeptides; Proteins: primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of proteins, enzymes.

VITAMINS - Classification and functions.

NUCLEIC ACIDS - Chemical constitution of DNA and RNA. Biological functions of nucleic acids.

UNIT 27:   CHEMISTRY IN EVERYDAY LIFE

Chemicals in medicines - Analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamins - their meaning and common examples.

Chemicals in food - Preservatives, artificial sweetening agents - common examples. Cleansing agents - Soaps and detergents, cleansing action.

UNIT 28:   PRINCIPLES RELATED TO PRACTICAL CHEMISTRY

- ♦ Detection of extra elements (N,S, halogens) in organic compounds; Detection of the following functional groups: hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketone), carboxyl and amino groups in organic compounds.
- ♦ Chemistry involved in the preparation of the following:
  Inorganic compounds: Mohr's salt, potash alum.
  Organic compounds: Acetanilide, pnitroacetanilide, aniline yellow, iodoform.
- ♦ Chemistry involved in the titrimetric excercises - Acids bases and the use of indicators, oxalic-acid vs $KMnO_4$, Mohr's salt vs $KMnO_4$.
- ♦ Chemical principles involved in the qualitative salt analysis:
  Cations - Pb^{2+} , Cu^{2+}, AI^{3+}, Fe^{3+}, Zn^{2+}, Ni^{2+}, Ca^{2+}, Ba^{2+}, Mg^{2+}, NH_4^+.
  Anions- CO_3^{2-}, S^{2-}, SO_4^{2-}, NO_2^-, NO_3^-, Cl^-, Br, I.
  (Insoluble salts excluded).
- ♦ Chemical principles involved in the following experiments:
  1. Enthalpy of solution of $CuSO_4$
  2. Enthalpy of neutralization of strong acid and strong base.
  3. Preparation of lyophilic and lyophobic sols.
  4. Kinetic study of reaction of iodide ion with hydrogen peroxide at room temperature.

SYLLABUS FOR APTITUDE TEST B. ARCH./B. PLANNING

Part -1 Awareness of persons, places, Buildings, Materials.) Objects, Texture related to Architecture and build~environment. Visualising three dimensional objects from two dimensional drawings. Visualising, different sides of three dimensional objects. Analytical Reasoning Mental Ability (Visual, Numerical and Verbal).

Part - II Three dimensional - perception: Understanding and appreciation of scale and proportion of objects, building forms and elements, colour texture, harmony and contrast. Design and drawing of geometrical or abstract shapes and patterns in pencil. Transformation of forms both 2 D and 3 D union, substraction, rotation, development of surfaces and volumes, Generation of Plan, elevations and 3 D views of objects. Creating two dimensional and three dimensional compositions using given shapes and forms.

Sketching of scenes and activities from memory of urbanscape (public space, market, festivals, street scenes, monuments, recreational spaces etc.), landscape (river fronts, jungles, gardens, trees, plants etc.) and rural life.

Note: Candidates are advised to bring pencils, own geometry box set, erasers and colour pencils and crayons for the Aptitude Test.

MATHEMATICS

UNIT 1 : SETS, RELATIONS AND FUNCTIONS:

Sets and their representation; Union, intersection and complement of sets and their algebraic properties; Power set; Relation, Types of relations, equivalence relations, functions;. one-one, into and onto functions, composition of functions.

UNIT 2 : COMPLEX NUMBERS AND QUADRATIC EQUATIONS:

Complex numbers as ordered pairs of reals, Representation of complex numbers in the form a+ib and their representation in a plane, Argand diagram, algebra of complex numbers, modulus and argument (or amplitude) of a complex number, square root of a complex number, triangle inequality, Quadratic equations in real and complex number system and their solutions. Relation between roots and co-efficients, nature of roots, formation of quadratic equations with given roots.

UNIT 3 : MATRICES AND DETERMINANTS:

Matrices, algebra of matrices, types of matrices, determinants and matrices of order two and three. Properties of determinants, evaluation of determinants, area of triangles using determinants. Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test of consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices.

UNIT 4 : PERMUTATIONS AND COMBINATIONS:

Fundamental principle of counting, permutation as an arrangement and combination as selection, Meaning of P (n,r) and C (n,r), simple applications.

UNIT 5 : MATHEMATICAL INDUCTION:

Principle of Mathematical Induction and its simple applications.

UNIT 6 : BINOMIAL THEOREM AND ITS SIMPLE APPLICATIONS:

Binomial theorem for a positive integral index, general term and middle term, properties of Binomial co-efficients and simple applications.

UNIT 7 : SEQUENCES AND SERIES:

Arithmetic and Geometric progressions, insertion of arithmetic, geometric means between two given numbers. Relation between A.M. and G.M. Sum upto n terms of special series: S n, S n2, Sn3. Arithmetico – Geometric progression.

UNIT 8 : LIMIT, CONTINUITY AND DIFFERENTIABILITY:

Real - valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse functions. Graphs of simple functions. Limits, continuity and differentiability. Differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order upto two. Rolle's and Lagrange's Mean Value Theorems. Applications of derivatives: Rate of change of quantities, monotonic - increasing and decreasing functions, Maxima and minima of functions of one variable, tangents and normals.

UNIT 9 : INTEGRAL CALCULUS:

Integral as an anti - derivative. Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration using trigonometric identities. Evaluation of simple integrals of the type Integral as limit of a sum. Fundamental Theorem of Calculus. Properties of definite integrals. Evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form.

UNIT 10: DIFFERENTIAL EQUATIONS:

Ordinary differential equations, their order and degree. Formation of differential equations. Solution of differential equations by the method of separation of variables, solution of homogeneous and linear differential equations of the type: $dy + p(x) y = q(x)dx$

UNIT 11: CO-ORDINATE GEOMETRY:

Cartesian system of rectangular co-ordinates 10 in a plane, distance formula, section formula, locus and its equation, translation of axes, slope of a line, parallel and perpendicular lines, intercepts of a line on the co-ordinate axes.Straight lines. Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, distance of a point from a line, equations of internal and external bisectors of angles between two lines, co-ordinates of

centroid, orthocentre and circumcentre of a triangle, equation of family of lines passing through the point of intersection of two lines. Circles, conic sections. Standard form of equation of a circle, general form of the equation of a circle, its radius and centre, equation of a circle when the end points of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to a circle, equation of the tangent. Sections of cones, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, condition for $y = mx + c$ to be a tangent and point (s) of tangency.

UNIT 12: THREE DIMENSIONAL GEOMETRY:
Co-ordinates of a point in space, distance between two points, section formula, direction ratios and direction cosines, angle between two intersecting lines. Skew lines, the shortest distance between them and its equation. Equations of a line and a plane in different forms, intersection of a line and a plane, coplanar lines.

UNIT 13: VECTOR ALGEBRA:
Vectors and scalars, addition of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector products, scalar and vector triple product.

UNIT 14: STATISTICS AND PROBABILITY:
Measures of Dispersion: Calculation of mean, median, mode of grouped and ungrouped data calculation of standard deviation, variance and mean deviation for grouped and ungrouped data.Probability: Probability of an event, addition and multiplication theorems of probability, Baye's theorem, probability distribution of a random variate, Bernoulli trials and Binomial distribution.

UNIT 15: TRIGONOMETRY:
Trigonometrical identities and equations. Trigonometrical functions. Inverse trigonometrical functions and their properties. Heights and Distances.

UNIT 16: MATHEMATICAL REASONING:
Statements, logical operations and, or, implies, implied by, if and only if. Understanding of tautology, contradiction, converse and contrapositive.

INTRODUCTION AND SCHEME OF EXAMINATION

It has been decided to hold a Joint Entrance Examination from the year 2013 for admission to the undergraduate programmes in Engineering in two parts -

1. JEE-MAIN (hitherto known as AIEEE - Paper1)
2. JEE-ADVANCED (hitherto known as IIT-JEE)

    ➡ Only the top 150000 candidates (including all categories) based on performance in JEE MAIN will qualify to appear in the JEE ADVANCED examination.

    ➡ Admissions to IITs will be based only on category-wise All India Rank (AIR) in JEE ADVANCED, subject to condition that such candidates are in the top 20 percentile categories.

    ➡ Admission to NITs will be based on 40 % weightage for performance in Class XII board marks (normalized) and the remainder 60 % weightage would be given to performance in JEE Main and a combined All India Rank (AIR) would be decided accordingly.

    ➡ The policy could also be adopted by other Centrally Funded Technical Institutions (CFTIs) and participating Institutions.

    ➡ In case any state opts to admit students in the engineering colleges affiliated to state universities where states require separate merit list to be provided based on relative weightages adopted by the states, then the merit list shall be prepared with such relative weightages as may be indicated by states. The examination will be conducted in the regional languages of the state(s) on the requests of such state(s).

ELIGIBILITY CRITERIA AND LIST OF QUALIFYING EXAMINATIONS FOR JEE(MAIN) EXAM 2013

The minimum academic qualification for appearing in JEE(MAIN) 2013 is that the candidate must have passed in final examination of 10+2 (Class XII) or its equivalent referred to as the qualifying examination (see below). Those appearing in 10+2 (Class XII) final or equivalent examination in 2013 may also appear in JEE(MAIN) 2013 provisionally.

However, admission criteria in the concerned institution/university will be followed as prescribed by concerned university/institution and as per the guidelines & criteria prescribed by AICTE.

➡ The candidates who are seeking admission in NITs, IIITs or CFTIs must ensure their eligibility for the admission in NITs, IIITs and CFTIs..

➡ The candidates who are aspirants only for IITs and ISM Dhanbad must ensure their eligibility for dmission in IITs and ISM Dhanbad.

➡ The candidates who are aspirants for NITs, IIITs, CFTIs , IITs and ISM Dhanbad must ensure their eligibility for admission in NITs, IIITs, CFTIs, IITs and ISM Dhanbad.

Note - For eligibility of admission in IITs and ISM Dhanbad please refer JEE(Advanced) website http://jee.iitd.ac.in

List of Qualifying Examinations

i. The +2 level examination in the 10+2 pattern of examination of any recognized Central/State Board of Secondary Examination, such as Central Board of Secondary Education, New Delhi, and Council for Indian School Certificate Examination, New Delhi

ii. Intermediate or two-year Pre-University Examination conducted by a recognized Board/University.

iii. Final Examination of the two-year course of the Joint Services Wing of the National Defence Academy.

iv. Any Public School/Board/University Examination in India or in foreign countries recognized by the Association of Indian Universities as equivalent to 10+2 system.

v. H.S.C. Vocational Examination.

vi. A pass grade in the Senior Secondary School Examination conducted by the National Open School with a minimum of five subjects.

vii. 3 or 4-year diploma recognized by AICTE or a State Board of Technical Education.

Improvement of Marks/Results

If a candidate wants to improve his performance in Board's Exam, he/she can do so but for consideration of that year's result he/she has to appear in all the subjects and not the partial.

PATTERN OF EXAMINATION

Subject combination for each paper and type of questions in each paper are given in the table below:

	Subjects	Type of Questions	Duration
Paper 1	Physics, Chemistry and Mathematics	Objective type questions with equal weightage to Physics, Chemistry and Mathematics	3 Hours
Paper 2	Mathematics - Part I Aptitude Test - Part II Drawing Test - Part III	Objective type questions Objective type questions Questions to test Drawing Aptitude	3 Hour

Requirement of papers for different courses is given in the table below:

Course	Papers
B.E/B.TECH	Paper -1
B.ARCH/B. PLANNING	Paper -2

Scoring and Negative Marking

There will be objective type questions with four options having single correct answer. For each incorrect response, one fourth (1/4) of the total marks allotted to the question would be deducted. No deduction from the total score will, however, be made if no response is indicated for an item in the answer sheet.

NO OF ATTEMPTS IN JEE(MAIN) EXAM

- ➡ The number of attempts which a candidate can avail at JEE(Main) shall be limited to 03 (three) uniformly for all the candidates in consecutive years.
- ➡ The candidates passed +2 exam in 2011 or 2012 or appearing in +2 in 2013 are only eligible to appear in JEE(Main)-2013.
- ➡ Candidates passed +2 in 2010 or before or appearing in 2014 are not eligible to appear in JEE(Main)-2013.

Admissions Criteria including Normalization and Weightage for JEE(Main) Exam 2013

Admission to NITs, and IIITs, will be based on 40 % weightage for performance in Class XII board or other qualifying examinations marks (normalized) and the remainder 60 % weightage would be given to performance in JEE (Main) and a combined All India Rank (AIR) would be decided accordingly. The policy could also be adopted by other Centrally Funded Technical Institutions (CFTIs) and participating Institutions.

Date of Examinations for JEE(Main) Exam 2013

Offline Exam. - 7th April 2013

Online Exam. - Between 8th April to 30th April 2013(the exact dates will be announced soon)

JEE(Advanced) related

Only the top 150000 candidates (including all categories) based on performance in JEE MAIN will qualify to appear in the JEE ADVANCED examination. Admissions to IITs will be based only on category-wise All India Rank (AIR) in JEE ADVANCED, subject to condition that such candidates are in the top 20 percentile categories of their respective class XII board or other qualifying examination. The percentile will vary from year to year and across the Boards.
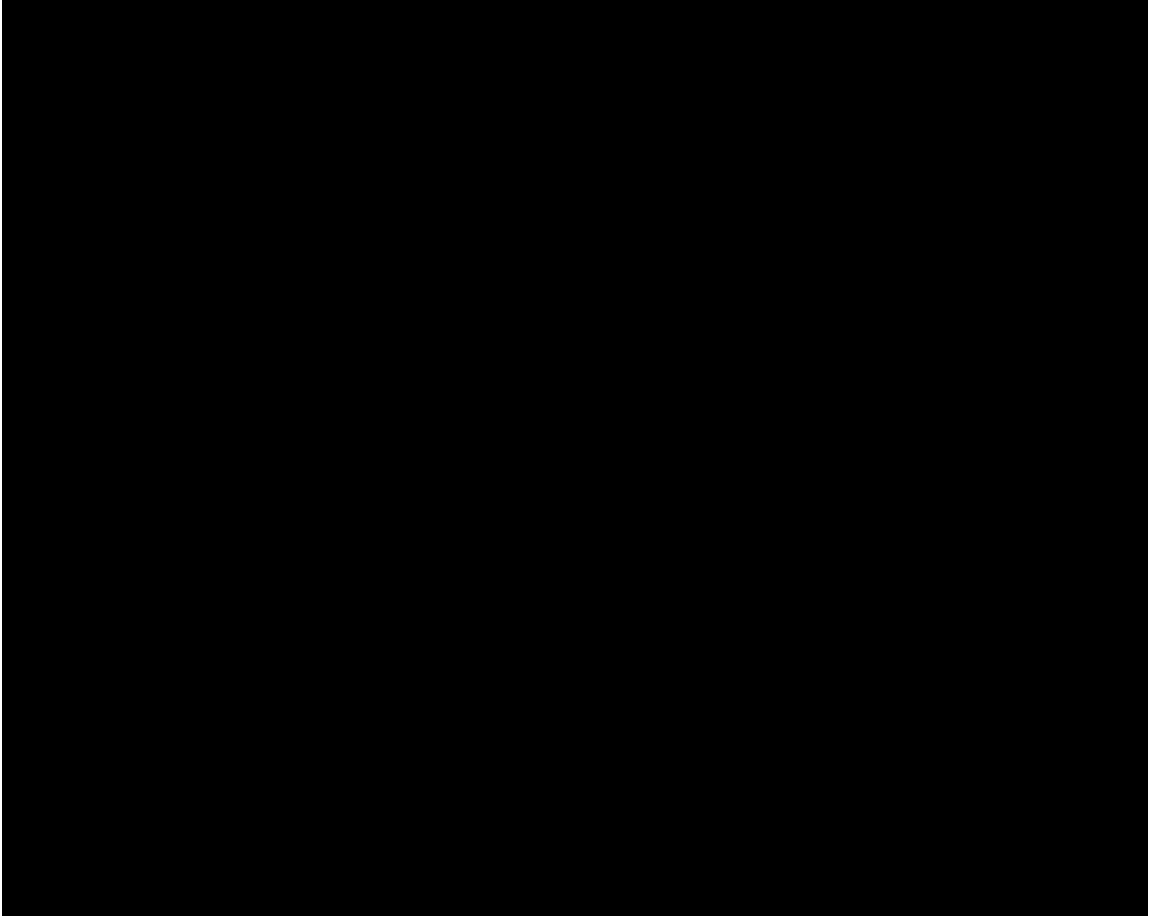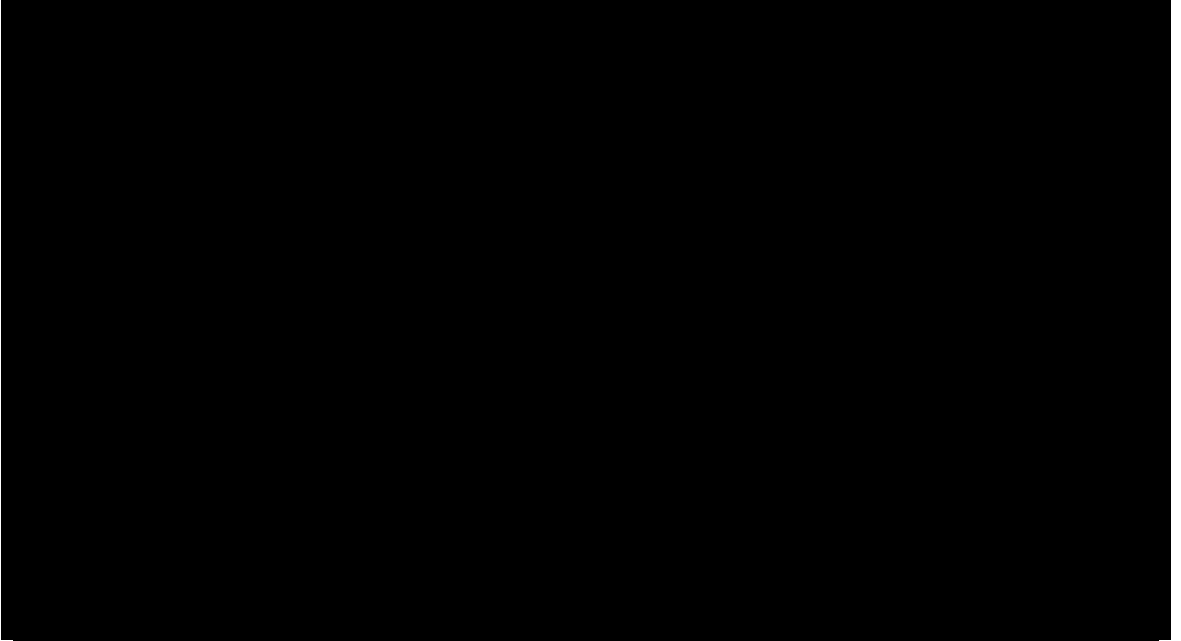
For more information and queries about JEE(Advanced) please contact jeeadv@admin.iitd.ac.in

PHYSICS

Crash Course JEE (MAIN)/AIEEE – Mathematics
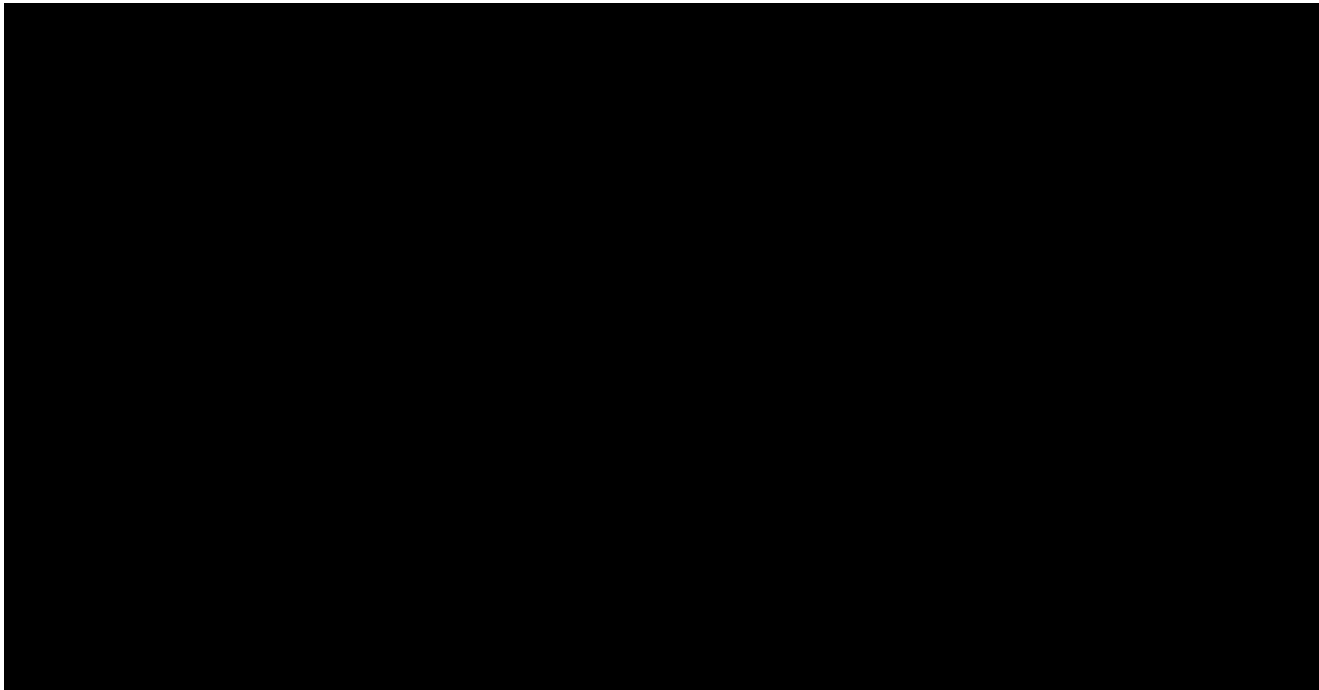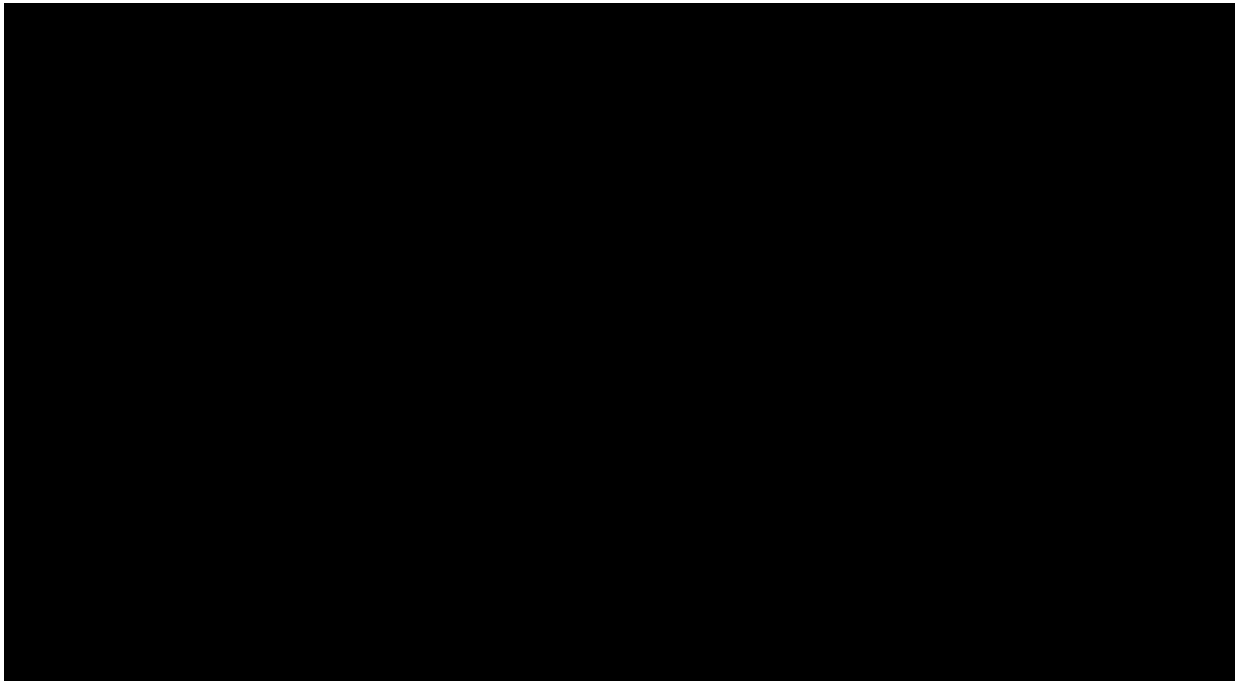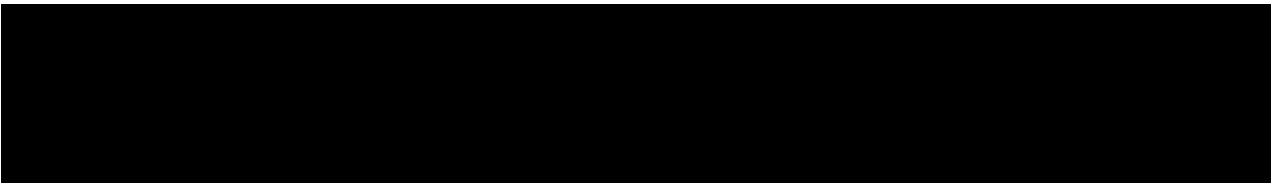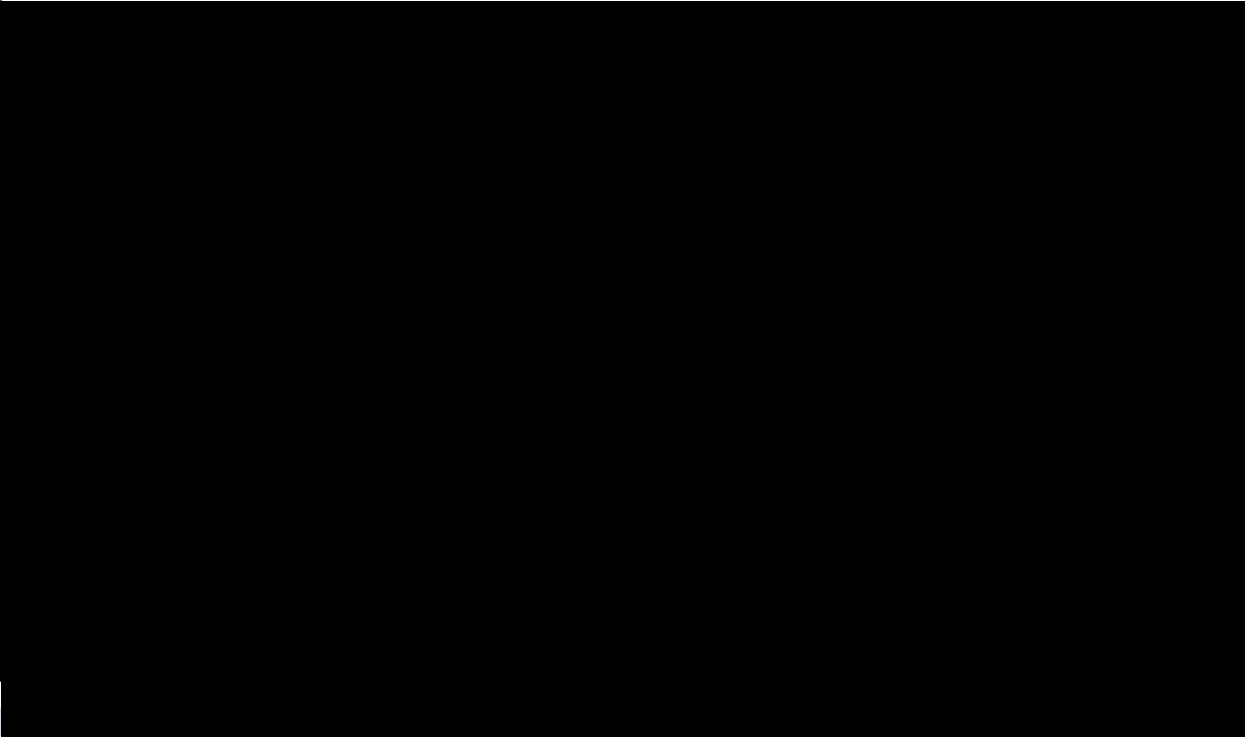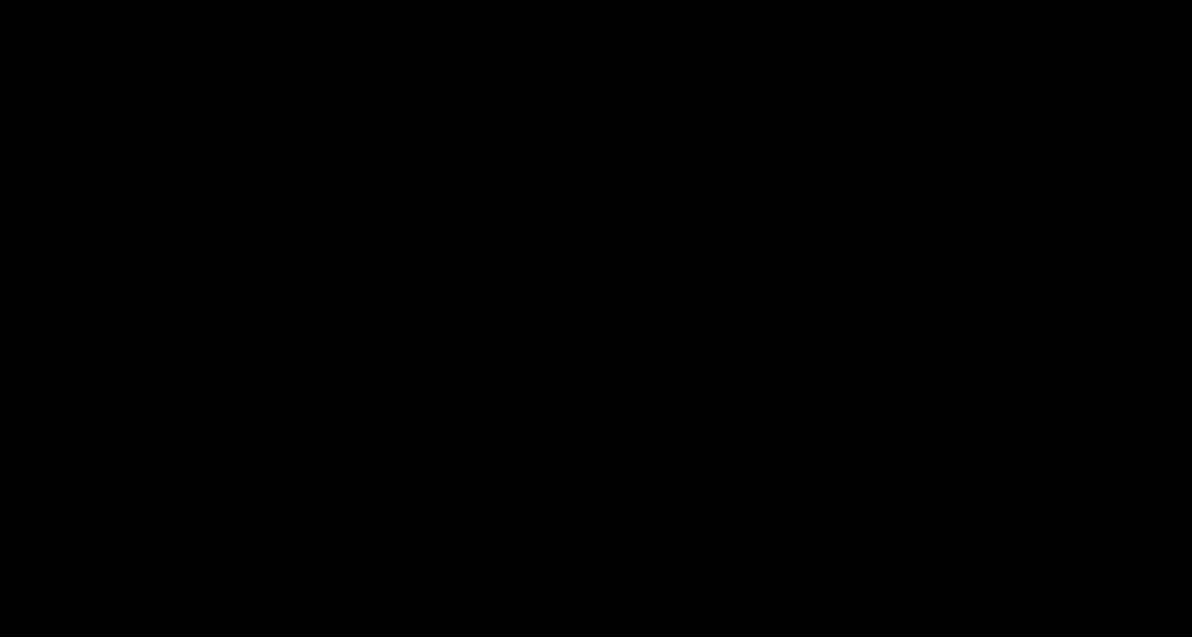
MATHEMATICS

AIEEE 2012 – AN INDEPTH ANALYSIS

AIEEE (All India Engineering Entrance Examination) conducted by CBSE (Central Board of Secondary Education)is considered as the second toughest engineering entrance exam, next to IIT-JEE. AIEEE-2012 paper pencil based exam concluded on April 29, 2012. Over 10 lakh students took the offline test at more than 4500 exam centres across India. The first paper for admission to engineering colleges in India took place between 9:30 am to 12:30 pm.

The paper comprised of multiple choice based questions on Physics, Mathematics and Chemistry subjects.

This is the first time when AIEEE has introduced online mode of exam along with the offline test. The online test will commence from **Monday, May 7, 2012** to **Saturday, May 26, 2012** and the dates are**7th May, 12th May, 19th May and 26th May, 2012.**

The offline test was reported to be an easy exam overall; Chemistry was easiest paper while Mathematics and Physics were reported to be an average paper. However, students taking the exam in Tier-II cities had to face power failures and poor infrastructure. The paper was not lengthy and questions were simple and direct.

AIEEE was divided into 2 parts- Paper 1 and Paper 2

Paper 1 had 3 sections namely; Physics, Chemistry and Mathematics. Each section comprised of objective type questions with 4 choices. Paper 1 has a negative marking system where 0.25 marks will deducted for each wrong answer.

Paper 2 had 3 sections namely; Drawing, Mathematics and Aptitude. Aptitude section comprised of drawing based questions while mathematics and drawing section had objective type questions.

➡ Physics and Chemistry - 150 multiple choice based questions with equal weightage to Physics and Chemistry - Total marks 450
➡ Mathemtics - 75 objective type questions - Total marks 225
➡ Aptitude Test Part I - objective type questions - Total marks 150
➡ Aptitude Test Part II - questions to test drawing aptitude - Total marks 75

However, AIEEE 2012 offline test was marked by few mistakes as well. The B.Tech section of the paper comprised few errors. In code C, Chemistry section, more than 1 answer was given for question number 11 and 24. In code C, Math section, question number 36 had no answers. Moreover, in question number 51 of Math, data was insufficient to solve the problem.

Table of subject wise distribution based on the distribution of Class XI and XII syllabus

TYPE	PHYSICS		CHEMISTRY		MATHS	
	Class-XI portion	**Class-XII portion**	**Class-XI portion**	**Class-XII portion**	**Class-XI portion**	**Class- XII portion**
Total no. of questions	13	17	13	17	15	15
Marks	52	68	52	68	60	60
Marks%	**43%**	**57%**	**43%**	**57%**	**50%**	**50%**

Let us go through topic-wise analysis for each section:

PHYSICS TOPIC-WISE ANALYSIS

Unit wise Analysis - Physics
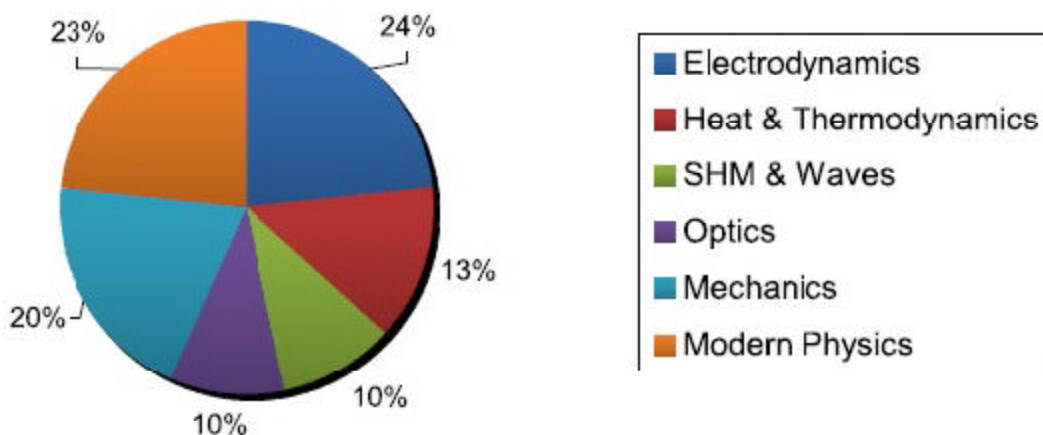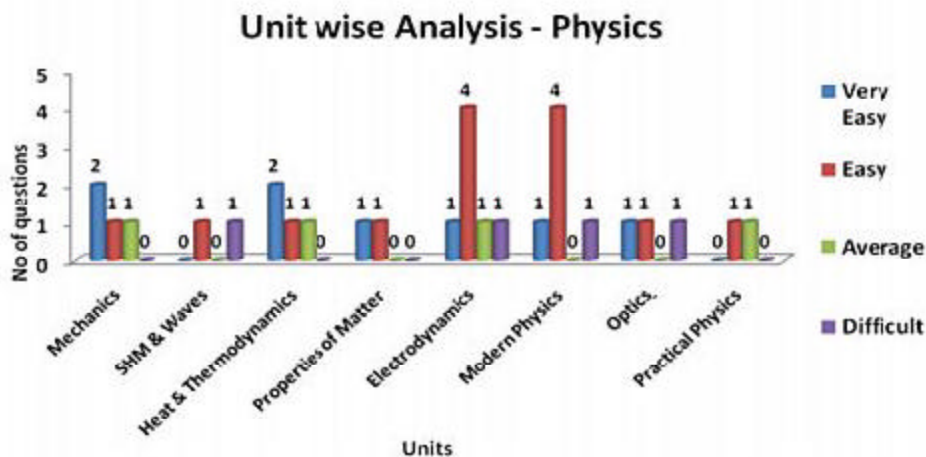
Topics	Marks Distribution
Electrodynamics	28
Electrostatics	8
Current Electricity	4
Capacitance	4
Electro Magnetic Field	8
Electro Magnetic Induction	4

Topics	Marks Distribution
Alternating Current	0
Heat & Thermodynamics	16
Calorimetry & Thermal Expansion	4
KTG	8
Heat Transfer	4

Topics	Marks Distribution
SHM & Waves	12
SHM	8
Sound Waves	4
String Wave	0
Optics	12
Geometrical Optics	8
Wave Optics	4
Mechanics	24
Unit & Dimension	0
Error in Measurement	4
Rectilinear Motion & Vectors	0
Projectile Motion	4
Relative Motion	0
Newton's Laws of Motion	0

Topics	Marks Distribution
Friction	0
Work, Power & Energy	4
Circular Motion	4
Centre of Mass	0
Rigid Body Dynamics	0
Gravitation	4
Fluid Mechanics & Properties of Matter	4
Modern Physics	28
Modern Physics	16
Semiconductors	4
Electromagnetic waves & communication	8
Total	**120**