अखिल भारतीय छात्रवृत्ति प्रवेश परीक्षा

ALL INDIA SCHOLARSHIP ENTRANCE EXAMINATION

AISEE-2023

User's Manual & Syllabus

Scholarship for Engineering and Medical Aspirant

यदि आप सूरज की तरह चमकना चाहते हैं, तो पहले सूरज की तरह जलना सीखे।

If you want to shine like a sun, first burn like a sun.

A. P. J. Abdul Kalam

Important:

Candidates are required to go through the User Manual carefully and acquaint themselves

1. Candidates can apply for AISEE- 2023 only **"Online"**.
2. User Manual can be downloaded from the website www.aisee.co.in
3. Online submission of Application Form may be made by accessing Official website www.aisee.co.in

   Instructions for Online submission of Application Form are available in the User Manual and on the website www.aisee.co.in
4. Candidates must follow the instructions strictly as given in the User Manual and on website. Candidates not complying with the instructions shall be summarily disqualified.
5. Candidate must save or note down Registration / Enrolment / Application No in safe Place Carefully for further processing.
6. Candidate Can pay Application fee through "**Online Mode**" only (i.e. Debit Card /

   Credit card / Net banking)

   Application fee once paid will not be refunded (full or partial) under any circumstances.

   If your payment debited from your account and not show confirmation page, then please mail or call us as soon as possible and wait for 24-48 hours some time it may take time to update your payment.
7. AISEE-2023 may be held in single stage and would be an objective test.
8. Examination Centre, and Language of Question Paper be chosen carefully as changes are not allowed after submission of online application.
9. Examination Centre and Date of Examination may be change due to huge no of application.
10. For Latest updates, Candidate must remain in touch with the website www.aisee.co.in and regularly check their e-mail till completion of scholarship process
11. The candidates must have their own personal and valid email id. They are also advised to have their own mobile number. The candidates are advised to retain the same mobile number and email-id in use which they have furnished in the application form because the important information may be given to the candidates through SMS or e-mail.

For any query please mail us: info@aisee.co.in or call us 022- 49434300.

Please don't send any documents to AISEE, Save Paper and stay eco-friendly.

Instructions for Applying Online

Before filling up the application form the candidate should have a scanned image of his/her photograph, signature and thumb impression (left hand thumb for boys and girls). These scanned images are to be uploaded during the submission of application s form. The photograph should be colour or b/w (but clear contrast) it as shown below. It should be without cap or goggles. Spectacles are allowed. Polaroid photos are not acceptable. Candidates with unclear photograph are liable to be rejected.

How to Register?

Register yourself on visiting website www.aisee.co.in

If you have already applied, then enter your Application No and email id which is already sent through Email after completion of first step registration and click Login button.

Applicant must check his/her Email (Inbox, Junk mail & Spam) after registration.

Candidate should complete all the steps before closing date of application. Incomplete Registration / application will be rejected automatically without any intimation.

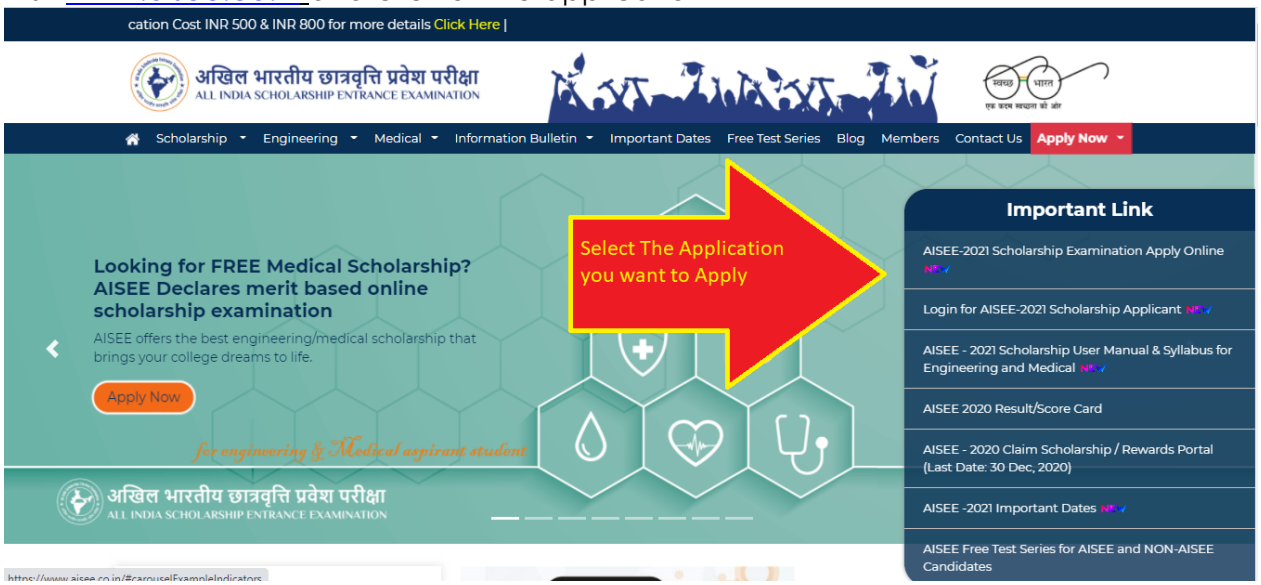
Four Steps to be followed for registration:

1. Step 01 Fill Basic information
2. Step 02 Fill Examination Centre Preference etc
3. Step 03 Pay Application Fee through Online Mode (via Debit Card / Credit Card / Net banking/UPI)
4. Step 04 Fill Qualification details etc
5. Step 04 Upload your photographs, Signature

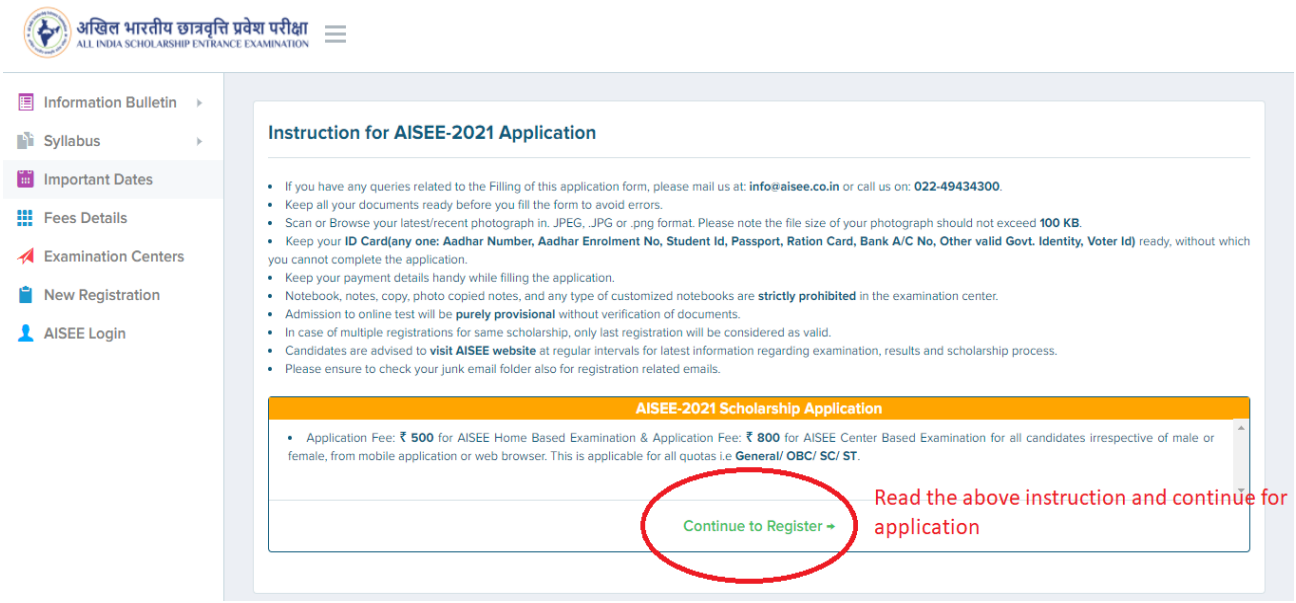
*For payment processing AISEE automatically redirect url to Payment Gateway.

Screenshot and Instruction Regarding Fields:

Visit www.aisee.co.in and click online application



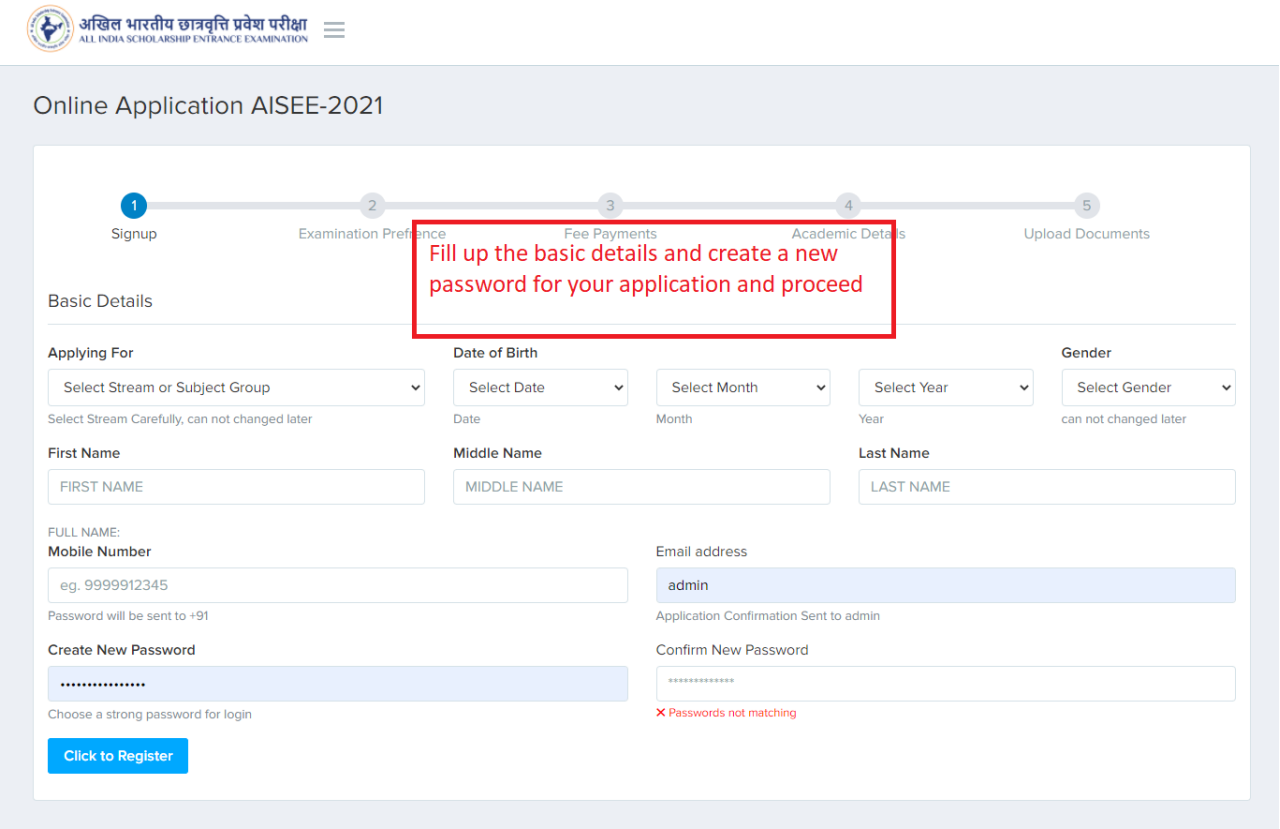
Read Instruction Carefully and Click for Registration:



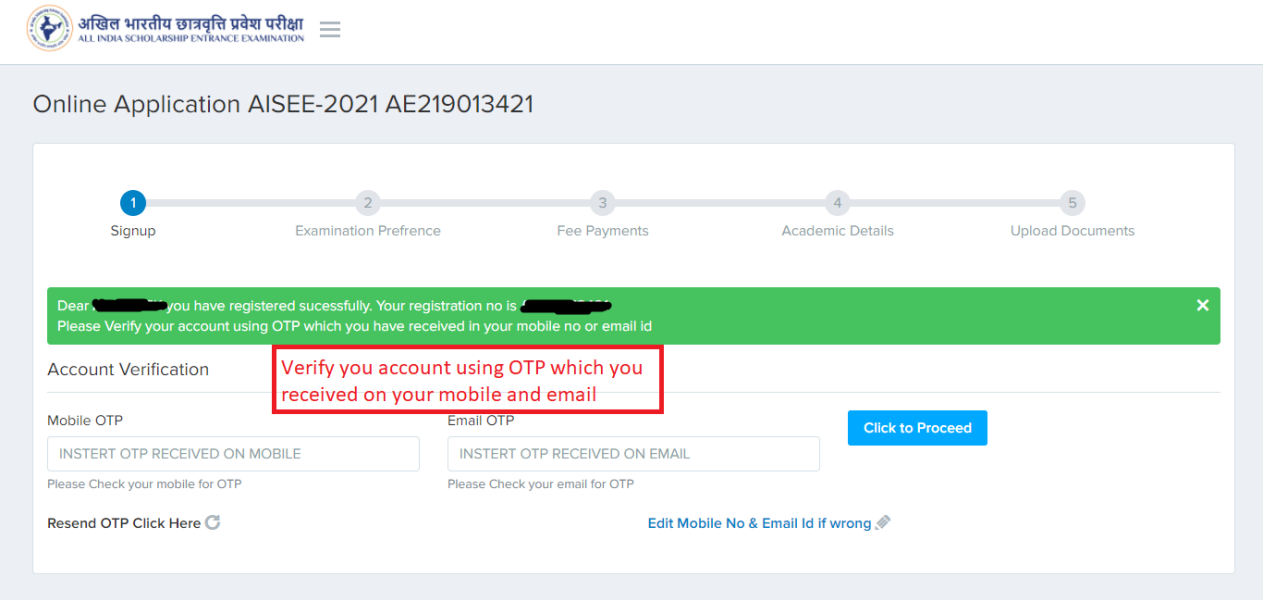
Complete First step registration and check your email id for your registration no.

Fields Name	Instructions
Applying for	Choose the stream you wish to apply for: Medical/Engineering
Candidate Full Name	Fill in your full Name as in your Standard 10th Certificate
Email address	Please fill correct email ID so that you can receive registration no after first step of registration
Mobile Number	Please fill correct mobile number
Gender	Select Male / Female

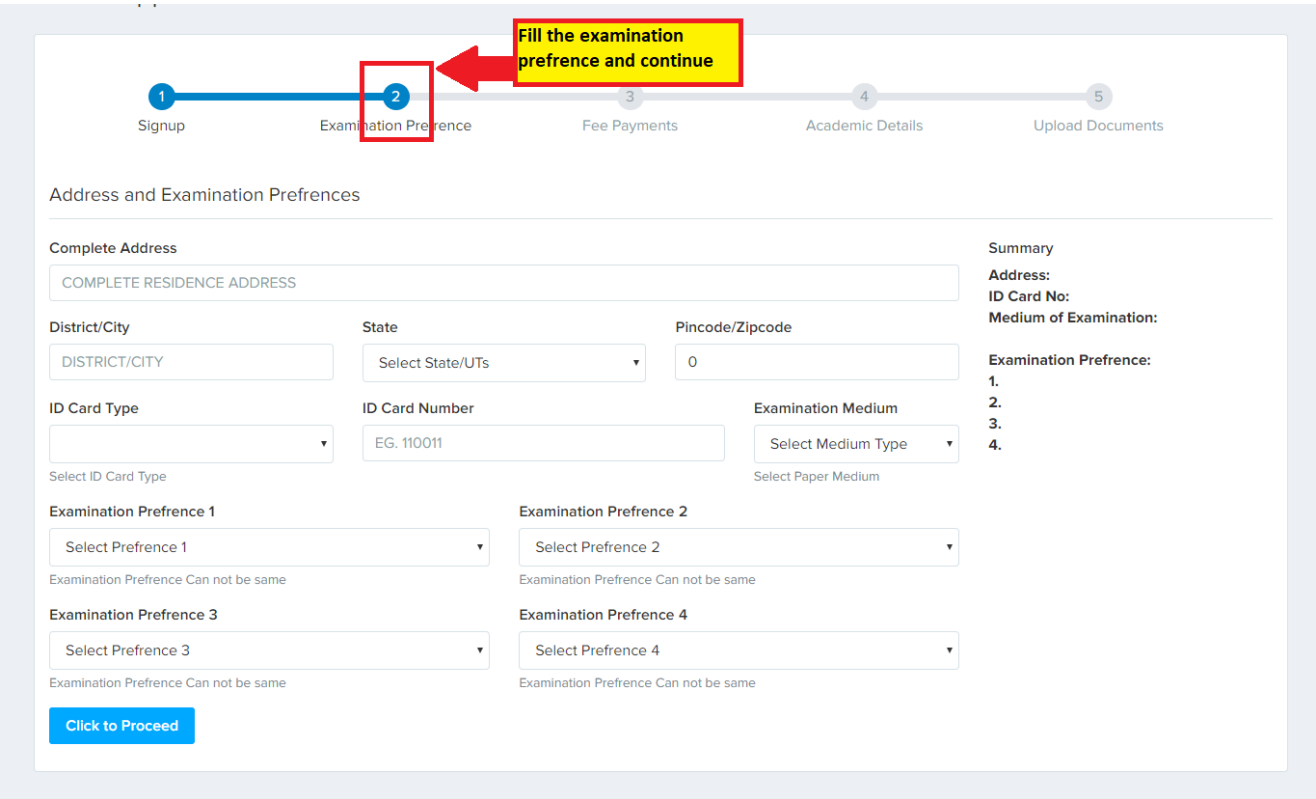
Basic information



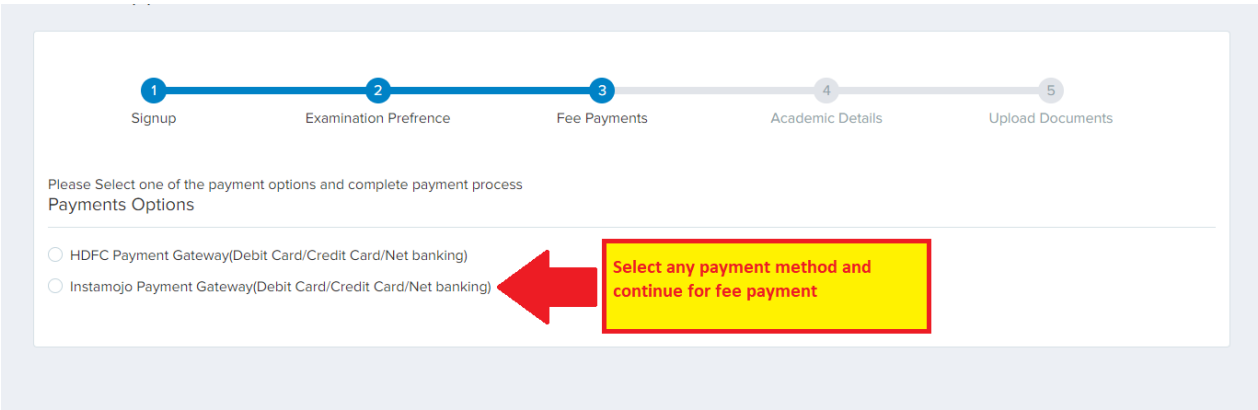
Password verification process:



2nd step: Examination centre preference according to your choice.



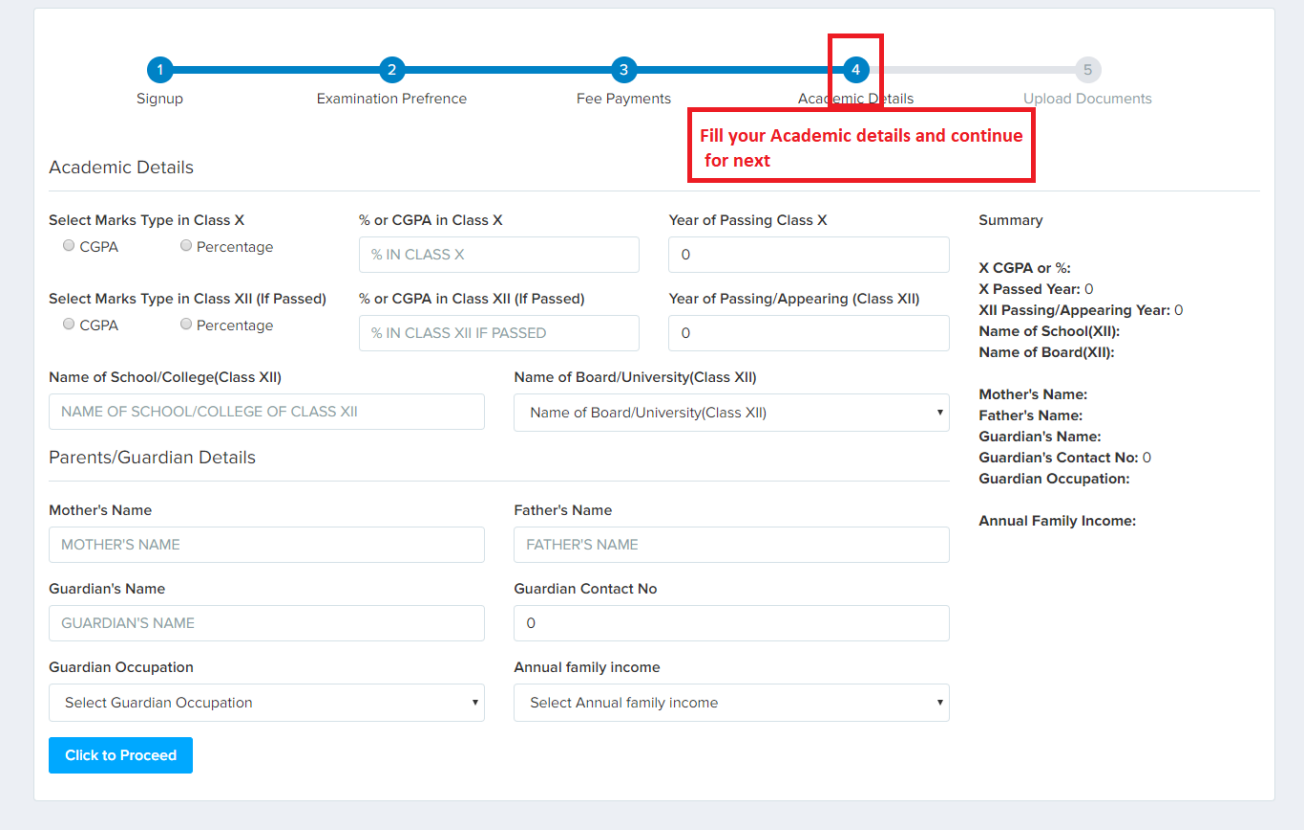
3rd step: Pay Application Fee via Credit / Debit / ATM Card or Net banking with Payment Gateways



Please Fill Qualification & Examination Preference:

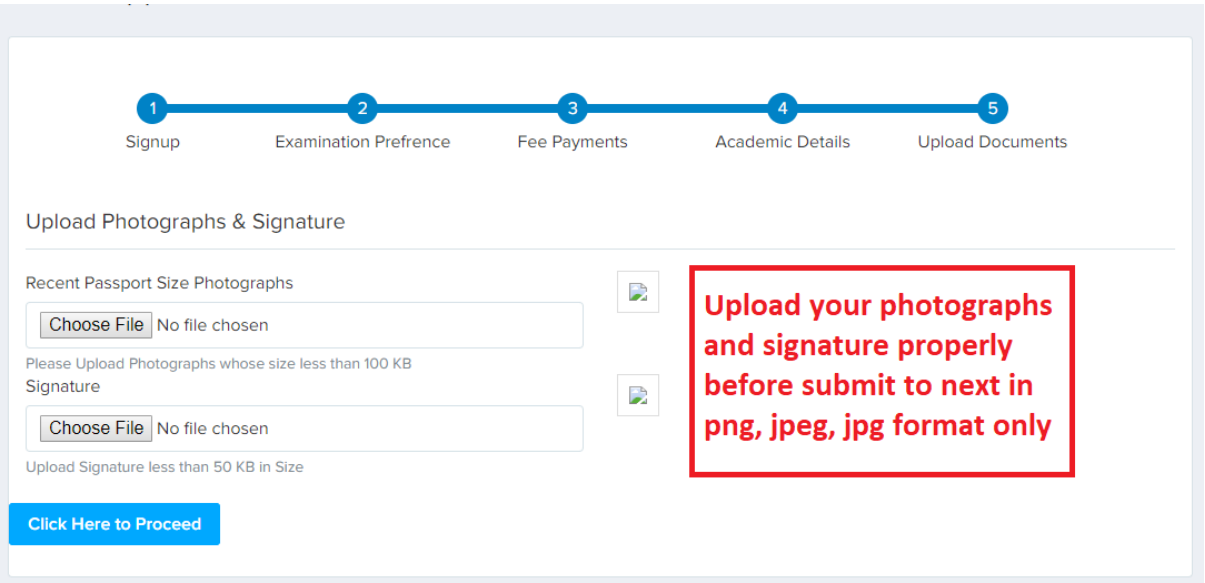
Fields Name	Instructions
Id Card No	Please Fill your ID Card No Carefully
Mother's Name	Full Mother's Name as in X Certificate
Father's Name	Full Father's Name as in X Certificate
Date of Birth	As mentioned in X Certificate
Nationality	Indian Candidate or Foreign
Address	Complete Mailing address where we communicate till the
	scholarship process
District / City	District / City for address
State / UT	State / UT for address
Pin code / Zip code	Put you correct pin code for better communication
From Where Applying Application	Name of City / Town / village from you fill this form
Form	
Choose Medium	Choose Medium of Examination like Hindi or English
First Preference Examination Centre	Choose Examination city 1st Preference you wish
Second Preference Exam Centre	Choose Examination city 2nd Preference you wish
Tenth class %	How much % you have got in your 10th Board Examination
Year of Passing Class X	Which you have passed class X
% of Class XII	How much % you got if passed else leave blank
Year of Passing / Appearing XII	In which year you passed this exam or appearing for exam
Name of School/ College	Name of School of Class XII
Name of Board (XII)	Name of Board from you passed or appearing for 12th
Appearing in Examination	Name of Competition Examination for which you apply or
	plan to Apply like: NEET, JEE MAIN etc
Guardian Name	Name of Your Guardian
Guardian Contact No	Mobile Number of Your Guardian
Guardian Occupation	Occupation of Guardian like farmer, Doctor, Engineer etc.
Annual family Income	Annual Family income like 100000, 2000000 etc (in lakh)
Facebook ID	Your Facebook Id for free alert or updates regarding
	scholarship (optional)
Whatsapp	Your Whatsapp no. where we add to AISEE and you are
	getting real time update about examination and scholarship

4th step: Academic details



5th step: Upload Photograph and Signature

Please Upload photographs in .jpeg, .jpg, .png format only and not exceed 100kb
Please Upload Signature in . .jpeg, .jpg, .png format only and not exceed 50kb



Confirmation Page:

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ALL INDIA SCHOLARSHIP ENTRANCE EXAMINATION

Hi,
AE

- Dashboard
- Basic Information
- Examination Prefrences
- Fee Payments
- Academic Details
- Upload Documents
- Download AISEE-2021 Confirmation Page
- Logout

Click to Download Confirmation Page

Download this Confirmation Page for your reference

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ALL INDIA SCHOLARSHIP ENTRANCE EXAMINATION

CONFIRMATION PAGE - AISEE 2021

	Registration number : **AE21!**	Appliaction Status: **Completed**

Candidate profile		
Candidate Name : ı	**Date of Birth :** 2007-02-01	All India Scholarship Entrance Examination / अखिल भारतीय छात्रवृत्ति प्रवेश परीक्षा
Gender: Male	**Language in which Question paper is desired:** English	
Application Type: AISEE-2021	**Stream Type:** Engineering	
Father's Name: D	**Mother's Name:**D	
Email ID: a live.com	**Phone Number:** 9	

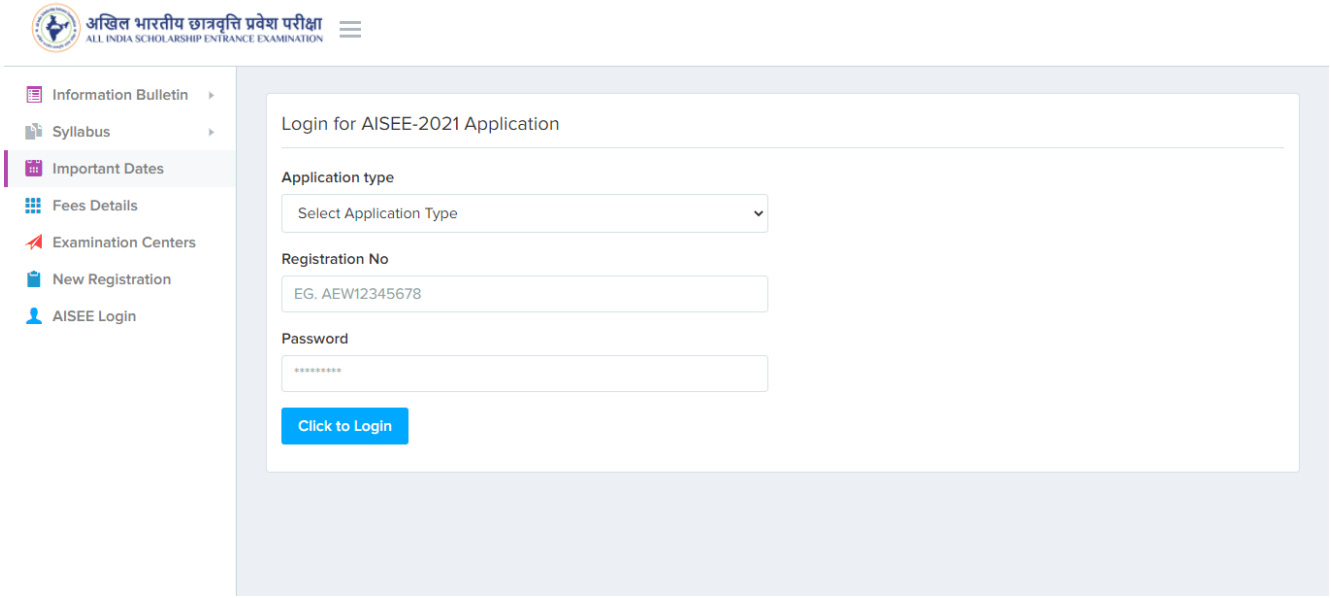
Exam Preference (Examination Mode: Center Based Examination)	
Preference 1 : Cuttack	**Preference 2 :** Chennai
Preference 3 : Chandigarh	**Preference 4 :** Bhubaneshwar
Address: #7 Avenue road, Bangalore, Karnataka, 560098	
Academic Details:	
Class X CGPA or % : 89 %	**Class XII CGPA or % :** 9.8 CGPA
Class X Passed Year : 2018	**Class XII School name:**KENDRIYA VIDYALA
Class XII Passing Year :2020	**Class XII Board name :**Central Board of Secondary Education (CBSE)
Valid Photo Identity (To be present in original at the Examination Center along with Admit Card)	
ID Proof : Aadhar Number	**Aadhar Number :** BK12345678

UNDERTAKING/DECLARATION:
I hereby declare that the infomation furnished by me in the Registration/Application Form is correct and nothing has been concealed.In case any information furnished by me is found to be false/incorrect/untrue than i shall be liable to civil/criminal prosecution and my claim to admission/appointment/registraion/service in the Institute may be cancelled/terminated.

Signature of Candidate : अखिल भारतीय छात्रवृत्ति प्रवेश परीक्षा

Download Confirmation Page

For Login or Check you application Status Click on AISEE Form login and using registration no. and password and check any status.



Eligibility Criteria:

Any 12th passed out or appearing candidate from a recognize board whose appearing year is 2023 or passed year is 2018 onwards and appearing in any Medical & Engineering Entrance Exam (like JEE, NEET etc.) are eligible.

Application Fee:

Application Fee (Home Based Exam*): ₹ 1200.00 for all Quota (General/ OBC/ SC/ ST)
~~Application Fee (Center Based Exam): ₹ 1500.00 for all Quota (General/ OBC/ SC/ ST)~~
***Due to COVID, AISEE only conduct the Home-Based Examination for AISEE-2023.**

*For Home Based Examination Candidate have to arrange desktop or laptop for their examination on the date of examination scheduled

Important Dates:

Online Application: 1st Dec 2022

Last Date of Application: 22nd Jan 2023

Admit Card / Slot Booking: Mid of May 2023

Examination: June 2023(For Exact Date check the website)

Examination center: Due to COVID, AISEE only conduct the Home Based Examination for AISEE-2023.

Agra, Ahmedabad, Ajmer, Allahabad, Ambala, Amritsar, Bengaluru, Bhagalpur, Bhilai, Bhopal, Bhubaneshwar, Bilaspur, Bokaro, Chandigarh, Chennai, Coimbatore, Cuttack, Darjeeling, Dehradun, DELHI/NCR, Dhanbad, Durgapur, Gandhinagar, Gaya, Guwahati, Gwalior, Hyderabad, Indore, Jabalpur, Jaipur, Kanpur, Kochi, Kolkata , Kota, Kurukshetra, Lucknow, Ludhiana, Madurai, Mangalore, Mumbai, Muzzafarpur, Mysore, Nagpur, Nasik, Patna, Pune, Raipur, RANCHI, Rourkela, Shimla, Sikar, Solan, Thiruvananthpuram, Udaipur, Varanasi, Vijaywada, Vishakhapatnam.
*Examination Center may be change

Structure of Online Test:

Duration of Examination: 90 Minutes
Question type: Objective (Multiple Choice Question/Integer Type/Paragraph Type/ Match the following)

Subject	Physics	Chemistry	Mathematics / Biology	General Science & Logical Thinking	**Total Questions**
Questions	25	25	25	15	**90**

Marking Scheme: 4 marks will be awarded for every correct response; for incorrect response 1 mark will be deducted. No marks will be given for unattempt questions.

You are allowed to use your text book during examination period because AISEE-2023 is open book examination.

Syllabus

General Science & Logical Thinking

General Science:
Science - ToThePoint
Branches of Science
Scientific Instruments
Common Names of Chemical Compounds
Vitamins and Minerals
Ores and Alloys
Important Facts About Human Body
Common Drugs and their uses
Scientific Laws and Theories
Types of Diseases
Atomic Numbers, Symbols of Elements
Diseases and Affected Body Parts
S.I. Units of Measurement
First in Space Diseases in Plants
Scientific Names of Common Plants and Animals
Breeds of Cattle in India
Names of Animals and their Young Ones

Logical Thinking:
Series Completion
Analogy
Classification
Coding-Decoding
Blood Relations
Puzzle Test
Direction Sense Test
Alphabet Test and Logical
Inserting the Missing Character

PHYSICS

Unit 1: Physical World and Measurement

Physics: Scope and excitement; nature of physical laws; Physics, technology and society. *Need for measurement*: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures. 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 and position-time graphs, relations for uniformly accelerated motion.

Elementary concepts of differentiation and integration for describing motion. *Scalar and vector quantities*: Position and displacement vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity.

Unit vectors. Resolution of a vector in a plane – rectangular components. Scalar and Vector products of Vectors. Motion in a plane. Cases of uniform velocity and uniform acceleration – projectile motion. Uniform circular motion.

Unit 3: Laws of Motion

Intuitive concept of force. Inertia, Newton's first law of motion; momentum and 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, lubrication. *Dynamics of uniform circular motion*: Centripetal force, examples of circular motion.

Unit 4: Work, Energy and Power

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces; conservation of mechanical energy; non-conservative forces; motion in a vertical circle, elastic and inelastic collisions in one and two dimensions.

Unit 5: Motion of System of Particles and Rigid Body

Centre of mass of a two-particle system, momentum conservation and centre of mass motion. Centre of mass of a rigid body; centre of mass of uniform rod. Moment of a force, torque, angular momentum, conservation of angular momentum with some examples. Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration. Values of M.I. for simple geometrical objects. Statement of parallel and perpendicular axes theorems and their applications.

Unit 6: Gravitation

Kepler's laws of planetary motion. The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy; gravitational potential. Escape velocity, orbital velocity of a satellite. Geostationary satellites.

Unit 7: Properties of Bulk Matter

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity, Poisson's ratio; elastic energy. Pressure due to a fluid column; Pascal's law and its applications. Effect of gravity on fluid pressure. Viscosity, Stokes' law, terminal velocity, Reynold's number, streamline and turbulent flow. Criticalvelocity, Bernoulli's theorem and its applications. Surface energy and surface tension, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise. Heat, temperature, thermal expansion; thermal expansion of solids, liquids, and gases. Anomalous expansion. Specific heat capacity: Cp, Cv – calorimetry; change of state – latent heat. Heat transfer – conduction and thermal conductivity, convection and radiation. Qualitative ideas of Black Body Radiation, Wein's displacement law, and Green House effect. Newton's law of cooling and Stefan's law.

Unit 8: Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of Thermodynamics). Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic processes. *Second law of thermodynamics*: Reversible and irreversible processes. Heat engines and refrigerators.

Unit 9: Behaviour of Perfect Gas and Kinetic Theory

Equation of state of a perfect gas, work done on 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 and application to specific heat capacities of gases; concept of 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 (SHM) and its equation; phase; oscillations of a spring – restoring force and force constant; energy in SHM – 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 wave motion. 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.

Unit 11: Electrostatics

Electric charges and their conservation. Coulomb's law – force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electric field, 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, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside). Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipoles in an electrostatic field. Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, 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, Van de Graaff generator.

Unit 12: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm's law, electrical resistance, *V-I* characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity. Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance. Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel. Kirchhoff 's laws and simple applications. Wheatstone bridge, Metre Bridge. Potentiometer – principle and applications to measure potential difference, and for comparing emf of two cells; measurement of internal resistance of a cell.

Unit 13: Magnetic Effects of Current and Magnetism

Concept of magnetic field, Oersted's experiment. Biot - Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids. 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 a 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. Magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements.

Para-, dia- and ferro - magnetic substances, with examples. Electromagnets and factors affecting their strengths. 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; LC oscillations, LCR series circuit, resonance; power in AC circuits, wattles current. AC generator and transformer.

Unit 15: Electromagnetic Waves

Need for displacement current. Electromagnetic waves and their characteristics. Transverse nature of electromagnetic waves. Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

Unit 16: Optics

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror. Refraction and dispersion of light through a prism. Scattering of light – blue colour of the sky and reddish appearance of the sun at sunrise and sunset. *Optical instruments*: Human eye, image formation and accommodation, correction of eye defects (myopia and hypermetropia) using lenses. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers. *Wave optics*: Wave front and Huygens' principle, reflection and refraction of plane wave at a plane surface using wavefronts. Proof of laws of reflection and refraction using Huygens' principle. Interference, Young's double hole experiment and expression for fringe width, coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Resolving power of microscopes and astronomical telescopes. Polarisation, plane polarised light; Brewster's law, uses of plane polarised light and Polaroids.

Unit 17: Dual Nature of Matter and Radiation

Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation – particle nature of light. Matter waves – wave nature of particles, de Broglie relation. Davisson-Germer 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

Energy bands in solids, conductors, insulators and 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

Elements of a communication system, bandwidth of signals (speech, TV and digital data); bandwidth of transmission medium. Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation. Need for modulation. Production and detection of an amplitude-modulated wave.

CHEMISTRY

Unit 1: Some Basic Concepts of Chemistry

General Introduction: Importance and scope of chemistry. Historical approach to particulate nature of matter, laws of chemical combination, *Dalton's atomic theory*: concept of elements, atoms and molecules. Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry.

Unit 2: Structure of Atom

Discovery of electron, proton and neutron; atomic number, isotopes and isobars. Thompson's model and its limitations, Rutherford's model and its limitations, Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of *s*, *p* and *d* orbitals, rules for filling electrons in orbitals - Aufbau principle, Pauli exclusion principle and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.

Unit 3: Classification of Elements and Periodicity in Properties

Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements –atomic radii, ionic radii, inert gas radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence. Nomenclature of elements with atomic number greater than 100.

Unit 4: Chemical Bonding and Molecular Structure

Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization involving *s*, *p* and *d* orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules.
Hydrogen bond.

Unit 5: States of Matter: Gases and Liquids

Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws in elucidating the concept of the molecule, Boyle's law, Charle's law, Gay Lussac's law, Avogadro's law, ideal behaviour, empirical derivation of gas equation, Avogadro number, ideal gas equation. Kinetic energy and molecular speeds (elementary idea), deviation from ideal behaviour, liquefaction of gases, critical temperature. Liquid State – Vapour pressure, viscosity and surface tension

Unit 6: Thermodynamics

Concepts of system, types of systems, surroundings, work, heat, energy, extensive and intensive properties, state functions. First law of thermodynamics – internal energy and enthalpy, heat capacity and specific heat, Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution. Introduction of entropy as a state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium. Third law of thermodynamics –Brief introduction.

Unit 7: Equilibrium

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium – Le Chatelier's principle; ionic equilibrium – ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of polybasic acids, acid strength, concept of pH., Hydrolysis of salts (elementary idea), , buffer solutions, Henderson equation, solubility product, common ion effect

Unit 8 : Redox Reactions

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers , applications of redox reactions.

Unit 9: Hydrogen

Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen; hydrides – ionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide-preparation, reactions, use and structure; hydrogen as a fuel.

Unit 10: *s*- Block Elements (Alkali and Alkaline earth metals)

Group 1 and Group 2 elements: General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses. Preparation and Properties of Some Important Compounds**:**
Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogencarbonate, biological importance of sodium and potassium. CaO, CaCO3, and industrial use of lime and limestone, biological importance of Mg and Ca.

Unit 11: Some *p*-Block Elements

General Introduction to *p*-Block Elements : *Group 13 elements***:** General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boronphysical and chemical properties, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalies. *Group 14 elements***:** General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon - catenation, allotropic forms, physical and chemical properties; uses of some important compounds: oxides. Important compounds of silicon and a few uses : silicon tetrachloride, silicones, silicates and zeolites, their uses.

Unit 12: Organic Chemistry – Some Basic Principles and Techniques

General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions.

Unit 13: Hydrocarbons

Classification of Hydrocarbons. Aliphatic Hydrocarbons: *Alkanes* – Nomenclature, isomerism, conformations, physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis. *Alkenes* – Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition. *Alkynes* – Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of - hydrogen, halogens, hydrogen halides and water. *Aromatic hydrocarbons* – Introduction, IUPAC nomenclature; Benzene: resonance, aromaticity ; chemical properties: mechanism of electrophilic substitution – nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

Unit 14: Environmental Chemistry

Environmental pollution – Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain, ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming – pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

Unit 15: Solid State

Classification of solids based on different binding forces :molecular, ionic covalent and metallic solids, amorphous and crystalline solids(elementary idea),unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids ,number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties, Band theory of metals ,conductors, semiconductors and insulators and *n* and *p* type semiconductors .

Unit 16 : Solutions

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in

liquids, solid solutions, colligative properties – relative lowering of vapour pressure, Raoult's law , elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Vant Hoff factor.

Unit 17: Electrochemistry

Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea), dry cell – electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.

Unit 18: Chemical Kinetics

Rate of a reaction (average and instantaneous), factors affecting rates of reaction: concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment).Activation energy, Arrhenious equation.

Unit 19: Surface Chemistry

Adsorption – physisorption and chemisorption; factors affecting adsorption of gases on solids; catalysis :homogenous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions – types of emulsions.

Unit 20: General Principles and Processes of Isolation of Elements

Principles and methods of extraction – concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.

Unit 21: *p*-Block Elements

*Group 15 elements***:** General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen – preparation, properties and uses; compounds of nitrogen: preparation and properties of ammonia and nitric acid, oxides of nitrogen; Phosphorous-allotropic forms; compounds of phosphorous: preparation and properties of phosphine ,halides (PCl3, PCl5) and oxoacids . *Group 16 elements* **:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen: preparation, properties and uses; classification of oxides; ozone. Sulphur – allotropic forms; compounds of sulphur: preparation, properties and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, oxoacids of sulphur . *Group 17 elements* **:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens . *Group 18 elements***:** General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

Unit 22: *d* and *f* Block Elements

General introduction ,electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals – metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of K2Cr2O7 and KMnO4. *Lanthanoids* – electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences. *Actinoids* – Electronic configuration, oxidation states and comparison with lanthenoids .

Unit 23: Coordination Compounds

Coordination compounds : Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding, Werner's theory VBT,CFT; isomerism (structural and stereo)importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems).

Unit 24: Haloalkanes and Haloarenes

Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of

substitution reactions. Optical rotation. *Haloarenes:* Nature of C-X bond, substitution reactions. Uses and environmental effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

Unit 25: Alcohols, Phenols and Ethers

A*lcohols***:** Nomenclature, methods of preparation, physical and chemical properties; identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, with special reference to methanol and ethanol. *Phenols* **:** Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophillic substitution reactions, uses of phenols. *Ethers* **:** Nomenclature, methods of preparation, physical and chemical properties, uses.

Unit 26: Aldehydes, Ketones and Carboxylic Acids

*Aldehydes and Ketones***:** Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.*Carboxylic Acids***:** Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

Unit 27: Organic Compounds Containing Nitrogen

*Amines***:** Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines. *Cyanides and Isocyanides* – will be mentioned at relevant places in context. *Diazonium salts***:** Preparation, chemical reactions and importance in synthetic organic chemistry.

Unit 28: Biomolecules

Carbohydrates – Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D-L configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance. *Proteins* **-** Elementary idea of a **-** amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure, denaturation of proteins; enzymes. ***Hormones*** **–Elementary idea (excluding structure).**

Vitamins – Classification and functions. *Nucleic Acids***:** DNA and RNA

Unit 29: Polymers

Classification – Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polythene, nylon, polyesters, bakelite, rubber. Biodegradable and non-biodegradable polymers.

Unit 30: Chemistry in Everyday Life

1. Chemicals in medicines – analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
2. Chemicals in food – preservatives, artificial sweetening agents, **elementary idea of antioxidants.**
3. Cleansing agents – soaps and detergents, cleansing action.

BIOLOGY

Unit 1. Diversity in Living World

What is living?; Biodiversity; Need for classification; Three domain of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy– Museums, Zoos, Herbaria, Botanical gardens. Five kingdom classification; Salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids.
Salient features and classification of plants into major groups- Algae, Bryophytes, Pteridophytes, Gymnosperm and Angiosperm (three to five salient and distinguishing features and at least two examples of each category); Angiosperms- classification up to class, characteristic features and examples.
Salient features and classification of animals- non chordate up to phyla level and chordate up to classes level (three to five salient features and at least two examples).

Unit 2. Structural Organisation in Animals and Plants

Morphology and modifications; Tissues; Anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence- cymose and racemose, flower, fruit and seed (To be dealt along with the relevant practical of the Practical Syllabus). Animal tissues; Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach).

Unit 3. Cell Structure and Function

Cell theory and cell as the basic unit of life; Structure of prokaryotic and eukaryotic cell; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles– structure and function; Endomembrane system- endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, microbodies; Cytoskeleton, cilia, flagella, centrioles (ultra structure and function); Nucleus–nuclear membrane, chromatin, nucleolus. Chemical constituents of living cells: Biomolecules– structure and function of proteins, carbodydrates,lipid, nucleic acids; Enzymes–types, properties, enzyme action. Cell division : Cell cycle, mitosis, meiosis and their significance.

Unit 4. Plant Physiology

Transport in plants: Movement of water, gases and nutrients; Cell to cell transport– Diffusion, facilitated diffusion, active transport; Plant – water relations– Imbibition, water potential, osmosis, plasmolysis; Long distance transport of water– Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; Transpiration– Opening and closing of stomata; Uptake and translocation of mineral nutrients– Transport of food, phloem transport, Mass flow hypothesis; Diffusion of gases (brief mention).Mineral nutrition: Essential minerals, macro and micronutrients and their role; Deficiency symptoms;Mineral toxicity; Elementary idea of Hydroponics as a method to study mineral nutrition; Nitrogen metabolism – Nitrogen cycle, biological nitrogen fixation. Photosynthesis: Photosynthesis as a means of Autotrophic nutrition; Where does photosynthesis take place; How many pigments are involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and non cyclic photophosphorylation; Chemiosmotic hypothesis; Photorespiration; C3 and C4 pathways; Factors affecting photosynthesis. Respiration: Exchange of gases; Cellular respiration – glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations – Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient. Plant growth and development: Seed germination; Phases of plant growth and plant growth rate; Conditions of growth; Differentiation, dedifferentiation and redifferentiation; Sequence of developmental process in a plant cell; Growth regulators–auxin, gibberellin, cytokinin, ethylene, ABA; Seed dormancy; Vernalisation; Photoperiodism.

Unit 5. Human Physiology

Digestion and absorption: Alimentary canal and digestive glands; Role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; Calorific value of proteins, carbohydrates and fats (for box item not to be evaluated);

Egestion; Nutritional and digestive disorders– PEM, indigestion, constipation, vomiting, jaundice, diarrhea. Breathing and Respiration: Respiratory organs in animals; Respiratory system in humans; Mechanism of breathing and its regulation in humans– Exchange of gases, transport of gases and regulation of respiration, Respiratory volumes; Disorders related to respiration-Asthma, Emphysema, Occupational respiratory disorders. Body fluids and circulation: Composition of blood, blood groups, coagulation of blood; Composition of lymph and its function; Human circulatory system– Structure of human heart and blood vessels; Cardiac cycle, cardiac output, ECG; Double circulation; Regulation of cardiac activity; Disorders of circulatory system-Hypertension, Coronary artery disease, Angina pectoris, Heart failure. Excretory products and their elimination: Modes of excretion – Ammonotelism, ureotelism, uricotelism; Human excretory system–structure and fuction; Urine formation, Osmoregulation; Regulation of kidney function– Renin-angiotensin, Atrial Natriuretic Factor, ADH and Diabetes insipidus; Role of other organs in excretion; Disorders-Uraemia, Renal failure, Renal calculi, Nephritis; Dialysis and artificial kidney.Locomotion and Movement: Types of movement – ciliary, flagellar, muscular; Skeletal muscle – contractile proteins and muscle contraction; Skeletal system and its functions (To be dealt with the relevant practical of Practical syllabus); Joints; Disorders of muscular and skeletal system- Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis, Gout. Neural control and coordination: Neuron and nerves; Nervous system in humans– central nervous system, peripheral nervous system and visceral nervous system; Generation and conduction of nerve impulse; Reflex action; Sensory perception; Sense organs; Elementary structure and function of eye and ear. Chemical coordination and regulation: Endocrine glands and hormones; Human endocrine system-
Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action (Elementary Idea); Role of hormones as messengers and regulators, Hypo-and hyperactivity and related disorders (Common disorders e.g. Dwarfism, Acromegaly, Cretinism, goiter, exopthalmic goiter, diabetes, Addison's disease). Imp: Diseases related to all the human physiology systems to be taught in brief.

Unit 6. Reproduction

Reproduction in organisms: Reproduction, a characteristic feature of all organisms for continuation of species; Modes of reproduction – Asexual and sexual; Asexual reproduction; Modes- Binary fission, sporulation, budding, gemmule, fragmentation; vegetative propagation in plants. Sexual reproduction in flowering plants: Flower structure; Development of male and female gametophytes; Pollination–types, agencies and examples; Outbreedings devices; Pollen-Pistil interaction; Double fertilization; Post fertilization events– Development of endosperm and embryo, Development of seed and formation of fruit; Special modes– apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation.
Human Reproduction: Male and female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis- spermatogenesis & oogenesis; Menstrual cycle; Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation (Elementary idea); Parturition (Elementary idea); Lactation (Elementary idea). Reproductive health: Need for reproductive health and prevention of sexually transmitted diseases (STD); Birth control- Need and Methods, Contraception and Medical Termination of Pregnancy (MTP); Amniocentesis; Infertility and assisted reproductive technologies – IVF, ZIFT, GIFT (Elementary idea for general awareness).

Unit 7. Genetics and Evolution

Heredity and variation: Mendelian Inheritance; Deviations from Mendelism– Incomplete dominance, Co-dominance, Multiple alleles and Inheritance of blood groups, Pleiotropy; Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosomes and genes; Sex determination–
In humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance- Haemophilia, Colour blindness; Mendelian disorders in humans– Thalassemia; Chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes. Molecular Basis of Inheritance: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; Transcription, genetic code, translation; Gene expression and regulation– Lac Operon; Genome and human genome project; DNA finger printing. Evolution: Origin of life; Biological evolution

and evidences for biological evolution (Paleontological, comparative anatomy, embryology and molecular evidence); Darwin's contribution, Modern Synthetic theory of Evolution; Mechanism of evolution– Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic dirft; Hardy- Weinberg's principle; Adaptive Radiation; Human evolution.

Unit 8. Biology and Human Welfare

Health and Disease: Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis, Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology–vaccines; Cancer, HIV and AIDs; Adolescence, drug and alcohol abuse. Improvement in food production: Plant breeding, tissue culture, single cell protein, Biofortification; Apiculture and Animal husbandry. Microbes in human welfare: In household food processing, industrial production, sewage treatment, energy generation and as biocontrol agents and biofertilizers.

Unit 9. Biotechnology and Its Applications

Principles and process of Biotechnology: Genetic engineering (Recombinant DNA technology). Application of Biotechnology in health and agriculture: Human insulin and vaccine production, gene therapy; Genetically modified organisms- Bt crops; Transgenic Animals; Biosafety issues– Biopiracy and patents.

Unit 10. Ecology and environment

Organisms and environment: Habitat and niche; Population and ecological adaptations; Population interactions–mutualism, competition, predation, parasitism; Population attributes–growth, birth rate and death rate, age distribution. Ecosystems: Patterns, components; productivity and decomposition; Energy flow; Pyramids of number, biomass, energy; Nutrient cycling (carbon and phosphorous); Ecological succession; Ecological Services– Carbon fixation, pollination, oxygen release. Biodiversity and its conservation: Concept of Biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, National parks and sanctuaries. Environmental issues: Air pollution and its control; Water pollution and its control; Agrochemicals and their effects; Solid waste management; Radioactive waste management; Greenhouse effect and global warming; Ozone depletion; Deforestation; Any three case studies as success stories addressing environmental issues.

MATHEMATICS

UNIT 1: SETS AND FUNCTIONS

1. Sets

Sets and their representations. Empty set. Finite and Infinite sets. Equal sets. Subsets. Subsets of the set of real numbers especially intervals (with notations). Power set. Universal set. Venn diagrams. Union and intersection of sets. Difference of sets. Complement of a set, Properties of Complement sets.

2. Relations and Functions

Ordered pairs, Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the reals with itself (upto $R \times R \times R$).

Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Function as a special kind of relation from one set to another. Pictorial representation of a function, domain, co-domain and range of a function. Real valued function of the real variable, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum and greatest integer functions with their graphs. Sum, difference, product and quotients of functions.

3. Trigonometric Functions

Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin 2x + \cos 2x = 1$, for all x. Signs of trigonometric functions and sketch of their graphs. Expressing $\sin(x+y)$ and $\cos(x+y)$ in terms of $\sin x$, $\sin y$, $\cos x$ and $\cos y$. Deducing the identities like following:

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \times \tan y}, \cot(x \pm y) = \frac{\cot x \cot y \mp 1}{\cot y \pm \cot x}$$

$$\sin x + \sin y = 2\sin\frac{x+y}{2}.\cos\frac{x-y}{2}, \cos x + \cos y = 2\cos\frac{x+y}{2}\cos\frac{x-y}{2}$$

$$\sin x - \sin y = 2\cos\frac{x+y}{2}.\sin\frac{x-y}{2}, \cos x - \cos y = -2\sin\frac{x+y}{2}\sin\frac{x-y}{2}$$

Identities related to $\sin 2x$, $\cos 2x$, $\tan 2x$, $\sin 3x$, $\cos 3x$ and $\tan 3x$.

UNIT 2 : ALGEBRA

1. Principle of Mathematical Induction

Process of the proof by induction, motivating the application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction and simple applications.

2. Complex Numbers and Quadratic Equations

Need for complex numbers, especially 1, to be motivated by inability to solve every quadratic equation. Brief description of algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex number system, Square-root of a Complex number.

3. Linear Inequalities

Linear inequalities, Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables - graphially.

4. Permutations and Combinations

Fundamental principle of counting. Factorial n. Permutations and combinations derivation of formulae and their connections, simple applications.

5. Binomial Theorem

History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, general and middle term in binomial expansion, simple applications.

6. Sequence and Series

Sequence and Series. Arithmetic Progression (A.P.), Arithmetic Mean (A.M.), Geometric Progression (G.P.), general term of a G.P., sum of *n* terms of a G.P. Arithmetic and geometric series, infinite G.P. and its sum, geometric mean (G.M.). Relation between A.M. and G.M.

UNIT 3 : COORDINATE GEOMETRY

1. Straight Lines

Brief recall of 2-D from earlier classes, shifting of origin. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two-point form, intercepts form and normal form. General equation of a line. Equation of family of lines passing through the point of intersection of two lines. Distance of a point from a line.

2. Conic Sections

Sections of a cone: Circles, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

3. Introduction to Three-dimensional Geometry

Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

UNIT 4 : CALCULUS

Limits and Derivatives

Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit. $\lim_{x\to 0}\frac{\log_e(1+x)}{x}, \lim_{x\to 0}\frac{e^x-1}{x}$. Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

UNIT 5: MATHEMATICAL REASONING

Mathematically acceptable statements. Connecting words/phrases - consolidating the understanding of "if and only if (necessary and sufficient) condition", "implies", "and/or", "implied by", "and", "or", "there exists" and their use through variety of examples related to real life and Mathematics. Validating the statements involving the connecting words - difference between contradiction, converse and contrapositive.

UNIT 6 : STATISTICS AND PROBABILITY

1. Statistics

Measure of dispersion; mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances.

2. Probability

Random experiments: outcomes, sample spaces (set representation). Events: Occurrence of events, 'not', 'and' & 'or' events, exhaustive events, mutually exclusive events. Axiomatic (set theoretic) probability,

connections with the theories of earlier classes. Probability of an event, probability of 'not', 'and', & 'or' events.

UNIT 7: RELATIONS AND FUNCTIONS

1. Relations and Functions

Types of relations: Reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

2. Inverse Trigonometric Functions

Definition, range, domain, principal value branches. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

UNIT 8: ALGEBRA

1. Matrices

Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

2. Determinants

Determinant of a square matrix (up to 3 × 3 matrices), properties of determinants, minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

UNIT 9: CALCULUS

1. Continuity and Differentiability (Periods 18)

Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Concepts of exponential, logarithmic functions. Derivatives of log*e x* and *ex*. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations.

2. Applications of Derivatives (Periods 10)

Applications of derivatives: Rate of change, increasing/decreasing functions, tangents and normals, approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

3. Integrals

Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type –

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}},$$

$$\int \frac{(px+q)}{ax^2 + bx + c} dx, \int \frac{(px+q)}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2} dx \text{ and } \int \sqrt{x^2 - a^2}\, dx,$$

$$\int \sqrt{ax^2 + bx + c}\ dx \text{ and } \int (px+q)\sqrt{ax^2 + bx + c}\ dx$$

to be evaluated. Definite integrals as a limit of a sum. Fundamental Theorem of Calculus. Basic properties of definite integrals and evaluation of definite integrals.

4. Applications of the Integrals

Applications in finding the area under simple curves, especially lines, arcs of circles/parabolas/ellipses, area between the two above said curves (the region should be clearly identifiable).

5. Differential Equations

Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type –

UNIT 10: VECTORS AND THREE-DIMENSIONAL GEOMETRY

1. Vectors

Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors, scalar triple product.

2. Three-dimensional Geometry

Direction cosines/ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

Unit V: Linear Programming

Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constrains).

Unit VI: Probability

Multiplications theorem on probability. Conditional probability, independent events, total probability, Baye's theorem. Random variable and its probability distribution, mean and variance of haphazard variable. Repeated independent (Bernoulli) trials and Binomial distribution.

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