

# Cluster University Srinagar

## ENTRANCE TEST SYLLABUS FOR ADMISSION TO 5-YEAR INTEGRATED, 3-YEAR HONOR'S & PROFESSIONAL PROGRAMMES SESSION 2019

### SYLLABUS CLASS XI

Code : 229

### PHYSICS

25% of the maximum marks is allotted to numerical problems.

**Maximum Marks: 100**

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**Theory: 70 Marks**

**Time: 3 hours**  
**Practical: 30 Marks**

#### **Unit - I : Mathematical Tools**

**Marks 04**

Functions, limits of function, simple ideas of differentiation integration, differentiation of  $x^n$ ,  $e^{ax}$ ,  $\sin x$  by ab-initio method, integration of  $x^n$ ,  $1/x$ ,  $e^{ax}$ ,  $\sin x$  and  $\cos x$ . Simple Idea of definite integral.

#### **Unit - II : Physical world and measurement**

**Marks 5**

Physics - Scope and excitement, physics in relation to science, society and technology. Need for measurement, units of measurement, system of units, SI Units, fundamental and derived units, length, mass and time measurement. Accuracy and precision of measuring instruments; errors in measurement, significant figures.

Dimensions of physical quantities, dimensional analysis, its applications.

#### **Unit III : Kinematics**

**Marks 7**

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 graph, position time graphs, relations for uniformly accelerated motion. (graphical treatment and calculus approach).

Scalar and vector quantities, position and displacement vectors, general vector and notation, equality of vectors, multiplication of vectors by a real number, addition and subtraction of vectors, Relative velocity.

Unit vector, Resolution of a vector in a plane rectangular components, Scalar and vector product of two vectors with properties, Motion in a plane, cases of uniform velocity and uniform acceleration. Projectile motion.

## SYLLABUS CLASS XI

### Unit-IV : Laws of Motion

Marks 7

Concept of force and 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.

Friction, static and kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion, centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road).

### Unit-V : Work, Energy and Power

Marks 6

Concept of scalar product of vectors, Work done by a constant force and a variable force, Kinetic Energy, Work energy theorem, Power.

Motion of potential energy, potential energy of spring, conservative forces, conservation of mechanical energy (K. E. and P. E's), non conservative forces, elastic and inelastic collision in one and two dimensions.

### Unit-VI : Motion of system of particles and Rigid body.

Marks 6

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 circular ring, disc, rod and sphere.

Concept of vector product of vectors: Moment of a force, torque, angular momentum, conservation of angular momentum with some examples.

Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, Comparison of linear and rotational motions, moment of inertia, radius of gyration.

Values of moment of inertia for simple geometrical objects (no derivation), statement of parallel and perpendicular axes theorem and their applications.

### Unit VII: Gravitation

Marks 6

Kepler's laws of planetary motion, The universal law of gravitation. Acceleration due to gravity and its variation with altitude, depth and shape, Gravitational potential, gravitational

## SYLLABUS CLASS XI

potential energy, escape velocity, orbital velocity of a satellite, geo-stationary satellite.  
Inertial and gravitational mass.

### Unit VIII: Properties of Bulk matter

7 Marks

Elastic behaviour, stress-strain relationship, Hooke's law, young's modulus, bulk modulus, shear modulus of rigidity.

Pressure due to fluid column, Pascal's law and its applications (hydraulic lift and hydraulic brakes). Effect of gravity on fluid pressure.

Viscosity, stoke's law, terminal velocity, streamline and turbulent flow, Critical velocity, Reynold number, Bernoulli's theorem and its applications.

Surface energy and surface tension, angle of contact, applications of surface tension, ideas to drops, bubbles and capillary rise, action of detergents.

Heat, temperature, thermal expansion, specific heat, calorimetry, change of state-latent heat. Heat transfer-conduction, convection and radiation, thermal conductivity, Newton's law of cooling.

### Unit IX : Thermodynamics

6 Marks

Thermal equilibrium and definition of temperature (Zeroth law of thermodynamics). Heat, work and internal energy, First law of thermodynamics. Second law of thermodynamics, reversible and irreversible processes. Heat engines and refrigerators (concept only).

### Unit X : Behavior of perfect gas and Kinetic theory

6 Marks

Equation of state of perfect gas, work done on compressing a gas.

Kinetic theory of gases-assumptions, concept of pressure, expression for pressure exerted by a gas, Kinetic energy and temperature, rms speed of gas molecules, degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases, concept of mean free path, Avogadro's number.

### Unit XI : Oscillation and waves

10 Marks

Periodic motion- period, frequency, displacement as a function of time. Periodic functions, simple harmonic motion (S.H.M) and its equation, phase, oscillation of a spring-restoring



## SYLLABUS CLASS XI

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 (qualitative ideas only), resonance.

Wave motion - Longitudinal and transverse waves, speed of wave motion, Displacement relation for a progressive wave, Principle of super position of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics. Beats, Doppler effect.

## PRACTICALS

NOTE :- Every student is required to perform minimum of 10 experiments and 8 activities.

### EXPERIMENTS :

1. Use of vernier calipers.
  - i) To measure diameter of a small spherical/ cylindrical body.
  - ii) To measure internal diameter and depth of a given beaker/ calorimeter and hence find its volume.
2. Use of screw gauge.
  - i. To measure diameter of given wire.
  - ii. to measure thickness of a given sheet.
  - iii. to measure volume of an irregular lamina.
3. To determine radius of curvature of a given spherical surface by a spherometer.
4. To find the weight of a given body using parallelogram law of vectors.
5. Using a simple pendulum plot L-T graph hence find acceleration due to gravity (g).
6. To study the relation between force of limiting friction and normal relation force find coefficient of friction between a block and a horizontal pull of the earth and study in relationship with the angle of inclination by plotting a graph between force and  $\sin \theta$ .

# PHYSICS

Maximum Marks: 100

Theory: Marks 70

Time: 3 hour

Practicals: Marks 30

I. Electrostatics	08 marks
II. Current Electricity	07 marks
III. Magnetic effects of current and magnetism	08 marks
IV. Electro-magnetic induction and alternating currents	08 marks
V. Electro-magnetic waves	03 marks
VI. Optics	14 marks
VII. Dual nature of matter and radiation	04 marks
VIII. Atoms and Nuclei	06 marks
IX. Electronic devices	07 marks
X. Communication system	05 marks

## Unit I : Electrostatics

Electric charges; conservation of charge, coulomb's law – force between two point charges, forces between multiple charges, superposition principle and continuous charge distribution.

Electric field, electric field due to point charge, electric field lines, and electric dipole. electric field due to dipole, Torque on a dipole in uniform electric field.

Electric flux, statement of Gauss's theorem and its application 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 point charge, a dipole and system of charges; equipotential surfaces, electric potential energy of a system of two point charges and of electric dipole in an electrostatic field.

Conductor and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, 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-II : Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current. Ohm's law, electric resistance. V-I. Characteristics, (linear, non-linear), electrical energy and power, electric resistivity and conductivity, carbon resistors, colour code for carbon 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. Elementary idea of secondary cells. Kirchoff's laws and their applications. Wheat stone bridge, meter bridge.

Potentiometer-principle and its application to measure potential difference and for comparing e.m.f. of two cells; measurement of internal resistance of a cell.

### **Unit-III : 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 infinite long straight wire, straight and toroidal solenoids.

Force on a moving charge in a 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. 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 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 strength, permanent magnets.

### **Unit IV : Electro-magnetic Induction and Alternating Currents**

Electromagnetic induction, Faraday's laws, induced e.m.f. 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 (qualitative treatment only) & LCR circuits series, Resonance, power in A.C. circuits, wattless current, AC Generator and transformer.

### **Unit-V : Electro-magnetic Waves**

Need for displacement current, Electro-magnetic waves and their characteristics (qualitative ideas only), transverse nature of electromagnetic waves.

Electromagnetic spectrum (radio-waves, micro-waves, infra-red, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

### **Unit VI : Optics**

Ray 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 lenses formula, lens-makers formula, Newton's relation: displacement method to find position of images (conjugate points), Magnification, power of 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. Elementary idea of Raman effect.

Optical instruments - Human eye, image formation and accommodation, correction of eye defects (myopia, hypermetropia, presbyopia and astigmatism) using lenses. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

Wave optics-wave front and Huygen's principle, reflection and refraction of plane wave at



a plane surface using wavefronts. Proofs of laws of reflection and refraction using Huygen's Principle, Interference, Young's double slit 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. Polarization, plane polarized light, Brewster's law, uses of plane polarized light and polaroids.

#### **Unit VII : Dual Nature of Matter and Radiation**

Dual nature of 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 (experimental details should be omitted; only conclusion should be explained).

#### **Unit VIII : Atomic Nuclei**

Alpha-particle scattering experiment, Rutherford's model of atom, Bohr's Model of atom; energy levels, Hydrogen spectrum. Continuous and characteristics of X-rays. 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/nucleon and its variation with mass no., nuclear fission and nuclear fusion.

#### **Unit IX : 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, photo diode, solar cell and Zener diode; Zener diode as a voltage regulator, Junction transistors and its action; characteristics of a transistor, transistor as an amplifier (common emitter configuration and oscillator (common emitter). Logic gates (OR, AND, NOT), concept of NAND and NOR gates, Transistor as a switch.

#### **Unit X : Communication System**

Elements of communication system (block diagram only), Band width of signals (speech, T.V 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.