SYLLABUS FOR SUBSIDIARY PHYSICS (SPH)

Paper - I : Theory (100 marks)

Unit 1 : **Units and Dimensions and Vector :** Scalar and vector fields, Axial and polar vectors, Dot and cross products; Pseudo vector, Scalar triple product, Vector trip product, Gradient, Divergence and Curl, Stokes' theorem and Gauss' divergence theorem.

Unit 2 : **Mechanics of a particle :** Newton's laws of motion, Conservation of linear momentum, Conservative force field, conservation of total energy; Rotational motion, angular velocity and angular acceleration, Torque, Conservation of angular momentum; Rocket motion, Dynamics of rigid bodies, Moment of Inertia; Theorems of parallel and perpendicular axes, Calculation of M. I. for simple symmetrical systems.

Unit 3 : **Gravitation :** Kepler's laws of planetary motion . Newton's law of gravitation, Gravitational potential and intensity for point mass, spherical shell, solid sphere; Variation of 'g', Escape velocity, Geostationary orbit.

Elasticity : Hooke's law, Elastic constants and inter relations; Torsion of a cylinder, Elastic potential energy. Bending of a beam- Cantilever, light beam loaded at the middle.

Unit 4 : **Surface Tension :** Surface tension and surface energy, Explanation from atomic viewpoint, angle of contact, excess pressure over curved surface; Rise and fall of a liquid in capillary tubes, Jurin's law, Variation of surface tension with temperature.

Viscosity : Streamline motion, Reynold's number, Poiseuille's equation, Stockes' law, Bemoulli's theorem.

Unit 5 : **Kinetic theory of gases :** Pressure of perfect gas, Hydrogen gas thermometer, R. M. S, mean and most probable velocities, Maxwell's distribution of velocities (Statement and explanation), Degrees of freedom, Equipartion of energy, Specific heats.

Real gases : Andrews' experiment and results, Van der waal's equation, Critical constants, Law of corresponding states.

Unit 6 : **Thermodynamics :** Thermodynamic system, Thermodynamic equilibrium, State variables, Zeroth law, concept of temperature and 1st law of thermodynamics; Isothermal and adiabatic changes, Indicator diagram; 2nd law of thermodynamics, Carnot's cycle, inefficiency, reversible and irreversible processes; Absolute scale of temperature, Carnot's theorem, Clausius theorem; Entropy, its physical interpretation, J-T cooling.

Unit 7 : **Radiation :** Kirchoff's law, Black body radiation, Planck's law (statement), Stefan's law, Solar constant, Temperature of the Sun, Pyrometer.

Conduction : Rectilinear propagation of heat, Fourier's equation (in one dimension), Ingenhausz's experiment, Conductivity of bad conductors.

Unit 8 : **Vibration, Waves and Acoustics :** Simple harmonic motion, Superposition of S. H. M, Damped S. H. M, Forced vibration and resonance, Equation of plane progressive waves; Superposition of waves, Velocity of longitudinal waves in material medium, Velocity of transverse waves in stretched string, Doppler effect.

Unit 9 : **Geometrical optics :** Fermat's principle, Refraction at spherical surfaces, Lens equation, Combination of thin lenses, Seidal aberrations (qualitative), their remedy. Dispresive power, Chromatic aberration, its remedy.

Unit 10 : **Ramsden and Huygen's** eye-pieces; Telescopes and Microscopes.

Paper - II : Theory (100 marks)

Unit 1 : **Huygen's wave theory,** Explanation of reflection and refraction.

Interference : Intensity distribution in Young's experiment, Biprism, Newton's ring.

Unit 2 : **Diffraction :** Fresnel type-Rectilinear propagation of light and zone plate. Fraunhofer type Single slit, Plane Transmission grating.

Unit 3 : **Polarization :** Polarization by reflection, refraction and double refraction, Nicol prism and polaroid, Production and detection of polarized light, Optical activity.

Unit 4 : **Electrostatics :** Coulomb's law, Gauss' law- simple applications, electrostatic pressure, dipole; Dielectric polarization, Electric displacement, Capacitors.

Steady Current : Kirchoff's laws, Wheatstone Bridge; Thevenin and Norton Theorems; Thermoelectricity.

Unit 5 : **Magnetic effect of current :** Lorentz force, force on current carrying wire in a magnetic field, Biot-Savart law, Magnetic field (B) due to a straight current, circular current, solenoid. Ampere's circuital law. Suspended coil Galvanometer.

Magnetic material : Relation between B and H field, Hysterisis.

Unit 6 : **Electromagnetic Induction :** Self and mutual inductances.

Varying currents : Charging and discharging of L-R and C-R circuits.

Unit 7 : **Alternating currents :** L-R, C-R and L-C-R circuits.

Unit 8 : **Electronics :** P-N junction diodes, rectifiers, filters, Zener diode as voltage regulator; Transistors, Load line, α, β and their interrelation. Digital circuits-Binary and decimal numbers, their conversion, Binary addition and subtraction.

Logic gates : OR, AND, NOT gates; De Morgan's theorem; NOR and NAND as universal gates.

Unit 9 : **Quantum theory of radiation,** Photoelectric effect.

Special theory of relativity : Lorentz transformation, Length contraction, Time dilatation, velocity addition, mass variation, mass energy relation; De Broglie waves, Time independent S. E, particle in one dimensional infinite potential well, Probability interpretation of wave function.

Unit 10 : **Atomic physics :** Bohr's theory, vector atom model, Pauli's exclusion principle, Periodic table.

X-rays: Production, X-ray spectra, Bragg's law, Mosley's law.

Nuclear physics : Radio activity, radioactive equilibrium, Binding energy and stability, Nuclear reactions and Q value; α, β, γ spectra; fission and fusion.

Reference : (Papers 1 & 2)

1. পদার্থের ধর্ম — ডি. পি. রায়চৌধুরী।
2. তাপগতিবিদ্যা — অশোক ঘোষ।
3. গ্যাসের আণবিক তত্ত্ব — পি. কে. চৌধুরী।
4. ভৌত আলোকবিজ্ঞান — বি. এস. বসাক।
5. পরমাণু ও কেন্দ্রগঠক পরিচয় (Vols 1 & 2) — এস. এন. ঘোষাল।
6. স্নাতক পদার্থবিজ্ঞান — চিত্তরঞ্জন দাসগুপ্ত।
7. স্নাতক পদার্থবিদ্যা — মহাদেব দাসখান।

Paper - III : Practical (100 marks)

Unit 1. Tortional Pendulum and determination of rigidity modulus of the material of a wire.

Unit 2. Melde's experiment— propagation of wave in a stretched string.

Unit 3. Flow of water in a capillary tube and determination of viscosity of water.

Unit 4. Determination of focal length of a convex and a concave lense : displacement and combination methods.

Unit 5. Determination of thermal conductivity of a bad conductor of heat by Lee's disc method.

Unit 6. Verification of Thevenin, Norton and reciprocal theorems.

Unit 7. Graduation of a thermistor and determination of the band gap of the material of the thermistor using a mercury thermometer.

Unit 8. Drawing of the input and output characteristic curves for common base or common emitor transistor circuits.

Unit 9. Drawing of the characteristic curves of a Zenerdiode and its use in the construction of voltage regulator.

Unit 10. Determination of the relation between the optical rotation and concentration of a sugar solution by a polarimeter.

Unit 11. Drawing of $\delta-\lambda$ and $\delta-1/\lambda^2$ curves using a prism spectrometer and hence the determination of the wavelength of an optical line.

Unit 12. Drawing of $\sin\theta-\lambda$ curves by a diffraction grating and determination of wavelength.

Unit 13. Determination of the temperature coefficient of the material of a wire by metre bridge.

Unit 14. (a) Verification of OR and AND truth tables by constructing the gates using semiconductor dicodes.

(b) Verification of NOT, AND and OR truth tables by constructing the gates using NAND and NOR IC chips.