

Syllabus for BITSAT-2023

Part I: Physics

1. Units & Measurement

- 1.1 Units (Different systems of units, SI units, fundamental and derived units)
- 1.2 Dimensional Analysis
- 1.3 Precision and significant figures
- 1.4 Fundamental measurements in Physics (Vernier calipers, screw gauge, Physical balance etc)

2. Kinematics

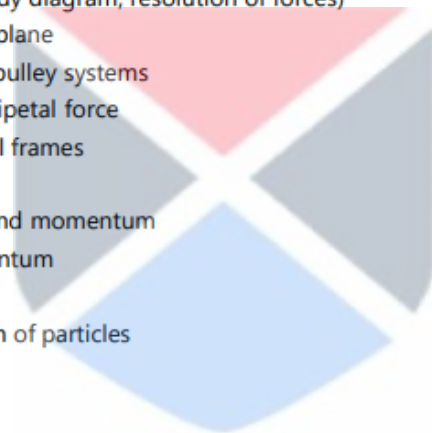
- 2.1 Properties of vectors
- 2.2 Position, velocity, and acceleration vectors
- 2.3 Motion with constant acceleration
- 2.4 Projectile motion
- 2.5 Uniform circular motion
- 2.6 Relative motion

3. Newton's Laws of Motion

- 3.1 Newton's laws (free body diagram, resolution of forces)
- 3.2 Motion on an inclined plane
- 3.3 Motion of blocks with pulley systems
- 3.4 Circular motion – centripetal force
- 3.5 Inertial and non-inertial frames

4. Impulse and Momentum

- 4.1 Definition of impulse and momentum
- 4.2 Conservation of momentum
- 4.3 Collisions
- 4.4 Momentum of a system of particles
- 4.5 Center of mass



5. **Work and Energy**

- 5.1 Work done by a force
- 5.2 Kinetic energy and work-energy theorem
- 5.3 Power
- 5.4 Conservative forces and potential energy
- 5.5 Conservation of mechanical energy

6. **Rotational Motion**

- 6.1 Description of rotation (angular displacement, angular velocity and angular acceleration)
- 6.2 Rotational motion with constant angular acceleration
- 6.3 Moment of inertia, Parallel and perpendicular axes theorems, rotational kinetic energy
- 6.4 Torque and angular momentum
- 6.5 Conservation of angular momentum
- 6.6 Rolling motion

7. **Gravitation**

- 7.1 Newton's law of gravitation
- 7.2 Gravitational potential energy, Escape velocity
- 7.3 Motion of planets – Kepler's laws, satellite motion



8. Mechanics of Solids and Fluids

- 8.1 Elasticity
- 8.2 Pressure, density and Archimedes' principle
- 8.3 Viscosity and Surface Tension
- 8.4 Bernoulli's theorem

9. Oscillations

- 9.1 Kinematics of simple harmonic motion
- 9.2 Spring mass system, simple and compound pendulum
- 9.3 Forced & damped oscillations, resonance

10. Waves

- 10.1 Progressive sinusoidal waves
- 10.2 Standing waves in strings and pipes
- 10.3 Superposition of waves, beats
- 10.4 Doppler Effect

11. Heat and Thermodynamics

- 11.1 Kinetic theory of gases
- 11.2 Thermal equilibrium and temperature
- 11.3 Specific heat, Heat Transfer - Conduction, convection and radiation, thermal conductivity, Newton's law of cooling Work, heat and first law of thermodynamics
- 11.4 2nd law of thermodynamics, Carnot engine – Efficiency and Coefficient of performance

12. Electrostatics

- 12.1 Coulomb's law
- 12.2 Electric field (discrete and continuous charge distributions)
- 12.3 Electrostatic potential and Electrostatic potential energy
- 12.4 Gauss' law and its applications
- 12.5 Electric dipole
- 12.6 Capacitance and dielectrics (parallel plate capacitor, capacitors in series and parallel)

13. Current Electricity

- 13.1 Ohm's law, Joule heating
- 13.2 D.C circuits – Resistors and cells in series and parallel, Kirchoff's laws, potentiometer and Wheatstone bridge
- 13.3 Electrical Resistance (Resistivity, origin and temperature dependence of resistivity).

14. Magnetic Effect of Current

- 14.1 Biot-Savart's law and its applications
- 14.2 Ampere's law and its applications
- 14.3 Lorentz force, force on current carrying conductors in a magnetic field
- 14.4 Magnetic moment of a current loop, torque on a current loop, Galvanometer and its conversion to voltmeter and ammeter

15. Electromagnetic Induction

- 15.1 Faraday's law, Lenz's law, eddy currents
- 15.2 Self and mutual inductance
- 15.3 Transformers and generators
- 15.4 Alternating current (peak and rms value)
- 15.5 AC circuits, LCR circuits

16. Optics

- 16.1 Laws of reflection and refraction
- 16.2 Lenses and mirrors
- 16.3 Optical instruments – telescope and microscope
- 16.4 Interference – Huygen's principle, Young's double slit experiment
- 16.5 Interference in thin films
- 16.6 Diffraction due to a single slit
- 16.7 Electromagnetic waves and their characteristics (only qualitative ideas), Electromagnetic spectrum
- 16.8 Polarization – states of polarization, Malus' law, Brewster's law

17. Modern Physics

- 17.1 Dual nature of light and matter – Photoelectric effect, De Broglie wavelength
- 17.2 Atomic models – Rutherford's experiment, Bohr's atomic model
- 17.3 Hydrogen atom spectrum
- 17.4 Radioactivity
- 17.5 Nuclear reactions: Fission and fusion, binding energy

18. Electronic Devices

- 18.1 Energy bands in solids (qualitative ideas only), conductors, insulators and semiconductors;
- 18.2 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.
- 18.3 Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator
- 18.4 Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.