

MANARAT STEM FEST

2027

PHYSICS OLYMPIAD SYLLABUS

CLASS 7-8

1. Measurements & Mathematical Foundations

- Units and Measurements: Understanding SI units, fundamental vs. derived quantities, and scientific notation (powers of 10).
- Measuring Instruments: Mastering the use of Slide Calipers, Screw Gauges, and Vernier scales, including calculating error and uncertainty.
- Math for Physics: Using basic trigonometry (sine and cosine rules) and vector representation (displacement, velocity, and force diagrams).

2. Mechanics & Motion

- Kinematics: Studying types of motion (uniform vs. non-uniform), displacement, and speed/velocity calculations.
 - Motion Graphs: Interpreting and drawing position-time and velocity-time graphs.
 - Newton's Laws of Motion: Understanding inertia, $F=ma$, action-reaction pairs, and the law of conservation of momentum.
 - Forces: Analyzing balanced and unbalanced forces, friction (static and kinetic), and circular motion/centripetal force.
- Work, Power, and Energy: Calculating work done, kinetic and potential energy, and the principle of conservation of energy.

3. Matter, Fluids & Thermal Physics

- States of Matter: Understanding the molecular structure of solids, liquids, and gases, and intermolecular forces.
- Fluids: Mastering concepts of density, pressure in liquids, Pascal's Law, and Archimedes' Principle (buoyancy and floating).
- Heat & Thermodynamics: Distinguishing between heat and temperature, different temperature scales (Celsius, Fahrenheit, Kelvin), and methods of heat transfer (conduction, convection, radiation).
- Gas Laws: Introduction to Boyle's Law, Charles' Law, and Gay-Lussac's Law.

CLASS 7-8

4. Waves, Sound & Light

- Waves and Sound: Understanding wave characteristics (amplitude, frequency, wavelength), sound propagation, echoes, and the audible range.
- Light: Mastering the laws of reflection and refraction, formation of shadows, plane mirrors, and primary/secondary colors.
- Lenses and Rays: Studying thin lenses and the dispersion of light into the electromagnetic spectrum.

5. Electricity & Magnetism

- Electricity: Understanding electric potential, current flow, Coulomb's Law, and simple circuits (series vs. parallel).
- Electrical Safety: Knowing how to use fuses, circuit breakers, and earth wires safely.
- Magnetism: Studying magnetic field lines, properties of magnets, and electromagnetism applications like the electric bell.

4. Modern Physics & Space

- Atomic Structure: Basic introduction to atoms, nuclei, and the structure of substances.
- Astronomy: Studying the Earth-Moon-Sun relationship, rotation, revolution, and the solar

CLASS 9-10

1. Core Physics Principles

- **Motion, Forces, and Energy:** Includes the study of kinematics, dynamics, and the different forms of energy.
- **Thermal Physics:** Covers heat transfer, temperature scales, and the kinetic molecular model of matter.
- **Waves:** Understanding the general properties of waves, sound propagation, and light behavior.

Electricity and Magnetism: Studying static electricity, current circuits, electromagnetic induction, and magnetic fields.

- **Nuclear Physics:** Exploring atomic structure, radioactivity, and nuclear reactions.
- **Space Physics:** Examining the Earth, the Solar System, stars, and the wider universe.

2. Mathematical & Advanced Topics

- **Functions & Graphs:** Utilizing linear, quadratic, logarithmic, and exponential functions to model physical phenomena.
- **Trigonometry:** Applying trigonometric identities to wave motion and force vectors.
- **Coordinate Geometry:** Using circle geometry and two-dimensional vectors to calculate trajectories and circular motion.
- **Calculus:** Basic differentiation and integration to analyze rates of change in motion and energy.
- **Circular Measure:** Calculating arc lengths and sector areas in rotating systems.
- **Physical Quantities and Units:** Understanding SI units, fundamental vs. derived quantities, and scientific notation.
- **Kinematics:** The study of motion, including displacement, velocity, acceleration, and projectile motion.
- **Dynamics:** Analyzing movement using Newton's laws and the principle of conservation of momentum.

CLASS 11-12

- **Physical Quantities and Units:** Understanding SI units, fundamental vs. derived quantities, and scientific notation.
- **Kinematics:** The study of motion, including displacement, velocity, acceleration, and projectile motion.
- **Dynamics:** Analyzing movement using Newton's laws and the principle of conservation of momentum.
- **Forces, Density, and Pressure:** Studying balanced/unbalanced forces, moments, and fluid mechanics.
- **Work, Energy, and Power:** Calculating work done, kinetic/potential energy, and the efficiency of power systems.
- **Deformation of Solids:** Understanding stress, strain, and Young's Modulus.
- **Waves & Superposition:** Mastering wave behavior, interference, diffraction, and stationary waves.
- **Electricity:** Studying electric current, potential difference, and D.C. circuits (Ohm's Law and Kirchhoff's Laws).
- **Particle Physics:** Introduction to the standard model, quarks, and fundamental particles.
- **Circular Motion & Oscillations:** Studying motion in a circle and Simple Harmonic Motion (SHM).
- **Fields (Gravitational & Electric):** Understanding field strength, potential, and the laws governing gravitational and electric forces.
- **Thermal Physics:** Exploring temperature scales, the behavior of ideal gases, and the laws of thermodynamics.
- **Capacitance & Magnetic Fields:** Mastery of capacitors, magnetic flux density, and electromagnetic induction.
- **Alternating Currents:** Analyzing A.C. circuits and the function of transformers.
- **Quantum & Nuclear Physics:** Studying the photoelectric effect, line spectra, and radioactive decay.
- **Medical Physics:** Understanding medical imaging technologies like X-rays, Ultrasound, and PET scans.