

**Government of Andhra Pradesh**  
**Department of School Education**  
**State Council of Educational Research & Training**  
**Category of Post: PGT**  
**Paper II – PHYSICS Syllabus**

**Part – I**

**General Knowledge and Current Affairs (Marks: 10)**

**Part – II**

**Perspectives in Education (Marks: 10)**

**1. History of Education :**

- The Education in Ancient India - Pre-Vedic and Post-Vedic period, Medieval Education.
- Education in Pre Independent era - Woods Despatch (1854), Hunter Commission (1882), Hartog Committee (1929), Sargent Committee (1944).
- Education in Post Independent era - Mudaliar Commission (1952-53), Kothari Commission (1964-66), Ishwarbhai Patel committee (1977), NPE-1986, POA-1992

**2. Teacher Empowerment:**

- Need, interventions for empowerment, Professional code of conduct for teachers, Teacher motivation, Professional development of Teachers and Teacher organizations, National / State Level Organizations for Teacher Education, Maintenance of Records and Registers in Schools.

**3. Educational Concerns in Contemporary India:**

- Democracy and Education, Equality, Equity, Quality in Education, Equality of Educational opportunities.
- Economics of Education, Education as Human Capital, Education and Human Resource Development, Literacy - Saakshar Bharat Mission.
- Population Education, Gender - Equality, Equity and Empowerment of Women, Urbanization and migration, Life skills.
- Adolescence Education
- Value Education – Morel Value and Professional Eathics in Education.
- Health and Physical Education
- Inclusive Education - Classroom Management in Inclusive Education
- Role of Education in view of Liberalization, Privatization and Globalization
- Programmes and Projects – APPEP, DPEP, Sarva Siksha Abhiyan, National Programme for Education of Girls at Elementary Level (NPEGEL), Rashtriya Madhyamika Siksha Abhiyan(RMSA), Rashtriya Aveshekar Abhiyan (RAA), KGBVs, Model Schools.
- Incentives and special provisions – Mid Day Meals, Free Books, Scholarship, Awards, Welfare Hostels, Transportation.
- Current Trends in Education – Badi pelusthondi, Badi ki Vasta, Mavuru – Mana Badi, Vidyanjali, Swacha Patasala, Inspire, Kalavutsav.

**4. Acts / Rights:**

- Right of Children to Free and Compulsory Education Act - 2009
- Right to Information Act - 2005
- Child Rights
- Human Rights.

5. **National Curriculum** - Framework, 2005: Perspective, Guiding Principles, Learning and Knowledge, Teaching Learning Process, Assessment, Systemic Reforms.

### **Part - III**

#### **Educational Psychology (Marks: 10)**

##### **1. Development of Child**

- Development, Growth & Maturation — Concept & Nature
- Principles of development and their education implication
- Factors influencing Development — Biological, Psychological, Sociological, emotional.
- Dimensions of Development and their interrelationships — Physical & Motor, Cognitive, Emotional, Social, Moral, Language relating to Infancy, early Childhood, late Child hood, adolescence.
- Understanding Development — Piaget, Kohlberg, Chomsky, Carl Rogers, Erikson
- Individual differences — Intra & Inter Individual differences in the areas of Attitudes, Aptitude, Interest, Habits, Intelligence and their Assessment.
- Development of Personality — Concept, Factors effecting development of personality, self concept.
- Adjustment, Behavioural problems, Mental Health, Defense mechanism.
- Methods and Approaches of Child Development — Introspection, Observation, Interview, Case study, Experimental, Cross sectional and Longitudinal
- Developmental tasks and Hazards

##### **2. Understanding Learning**

- Concept, Nature of Learning — input — process — outcome
- Factors of Learning — Personal and Environmental
- Approaches to Learning and their applicability—Behaviorism (Skinner, Pavlov, Thorndike) Constructivism (Piaget, Vygotsky), Gestalt(Kohler, Koffka) and Observational (Bandura)
- Dimensions of Learning — Cognitive, Affective and Performance.
- Motivation and Sustenance —its role in learning.
- Memory & Forgetting
- Transfer of Learning

##### **3. Pedagogical Concerns**

- Teaching and its relationship with learning and learner.
- Learners in Contexts: Situating learner in the socio-political and cultural context
- Children from diverse contexts—Children With Special Needs (CWSN), Inclusive Education.
- Understanding of pedagogic methods — Enquiry based learning, Project based learning, Survey, Observation and Activity based learning, Cooperative and collaborative learning.
- Individual and Group learning: Issues and concerns with respect to organizing learning in class room like Study habits, Self learning and Learning to learn skills.
- Organizing learning in heterogeneous class room groups — Socio-economic background, Abilities and Interest.

- Paradigms of organizing Learning-Teacher centric, Subject centric and Learner centric.
- Theory of instruction – Bruner
- Teaching as Planned activity — Elements of Planning
- Phases of Teaching — Pre active, Interactive and Post active
- General and Subject related skills, competencies required in teaching and attributes of good facilitator.
- Learning resources — Self, Home, School, Community, Technology.
- Class room Management: Role of student, teacher, Leadership style of teacher, Creation of non threatening learning environment, Managing behaviour problems, Guidance & Counselling, Punishment and its legal implications, Rights of a child, Time Management.
- Distinction between Assessment for Learning & Assessment of Learning, School based Assessment, Continuous & Comprehensive Evaluation : Perspective & Practice.
- Understanding teaching & learning in the context of NCF, 2005 & Right to Education Act, 2009.

### **Content (marks: 50)**

**I. Mechanics:** Vector Analysis: Scalar and Vector fields, Vector integration- Stokes, Gauss, and Green Theorems. Mechanics of Particles: Laws of motion, Motion of variable mass system, conservation of energy and momentum. Collisions in two and three dimension, Mechanics of Rigid Bodies: Rigid body- rotational kinematics relations, equation of motion for a rotating body, angular momentum and inertial tensor, Euler's equations, Mechanics of continuous media: Central Forces, Conservative nature of central forces, Equation of motion under a central force, Gravitational field, motion under inverse square law, derivation of Kepler's laws. Special Theory of Relativity: Galilean relativity, absolute frames, Michelson-Morley experiment, postulates of special theory of relativity, Lorentz transformation.

**II. Waves and oscillations:** Fundamentals of Vibrations: Simple harmonic motions, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies, Lissajou's figures. Damped and force Oscillations: Damped harmonic oscillator, amplitude resonance, velocity resonance. Complex vibrations: Fourier theorem Coupled Oscillators, Vibrating strings: Transverse wave propagation along a stretched string, energy transport, transverse impedance. Ultrasonics: determination of wave length of ultrasonic waves, applications.

**III. Thermodynamics:** Kinetic theory of gases: Maxwell's law of distribution of molecular speeds, Toothed Wheel Experiment, Transport Phenomena –Viscosity of gases – thermal conductivity – diffusion of gases. Reversible and irreversible processes – Carnot's engine, Carnot's theorem – Second law of thermodynamics, Kelvin's and Clausius statements – Thermodynamic scale of temperature – Entropy, Change of Entropy, entropy (T-S) diagram. Thermodynamic potentials and Maxwell's equations: Derivation of Maxwell's thermodynamic relations –Clausius-Clayperon's equation – Derivation for ratio of specific heats –Derivation for difference of two specific heats for perfect gas. Joule Kelvin effect– expression for Joule Kelvin coefficient for perfect and Vanderwaal's gas; Low temperature Physics: Joule Kelvin effect – liquefaction of gas using porous plug experiment. Liquefaction of helium, Adiabatic demagnetization – Low temperatures – principle of Refrigeration, Refrigerator and Air conditioning

machines, Effects of Chloro and Fluro Carbons on Ozone layer; Black body-Ferry's black body – Wein's law, Rayleigh-Jean's law – Quantum theory of radiation - Planck's law – Measurement of radiation – Types of pyrometers – Solar constant, Temperature of sun. Statistical Mechanics: Ensembles, Phase space, Maxwell-Boltzmann's distribution law, Molecular energies in an ideal gas, Bose-Einstein Distribution law, Fermi-Dirac Distribution law, Black Body Radiation, Rayleigh-Jean's formula, Planck's radiation law, Weins Displacement, Stefan's Boltzmann's law from Planck's formula.

**IV. Optics:** The Matrix methods in paraxial optics: Matrix method, effect of translation, effect of refraction, imaging by a spherical refracting surface. Imaging by a co-axial optical system, Unit planes, Nodal planes, A system of two thin lenses. Aberrations and its types Interference: Principle of superposition, coherence, Interference of light Interference by division of wave front: Interference by division of amplitude, Diffraction: Fresnel and Fraunhofer diffraction, Resolving Power of grating, Polarization: Brewster's law, Malu's law, Babinet's compensator. Laser, Fibre Optics and Holography: Laser, Laser principle, Types of Lasers and its Applications. Fibre Optics: Optical fibres, Types of optical fibres, Principles of fibre communication and advantages of fibre communication. Holography: Basic Principle of Holography – Gabor hologram and its limitations, Holography applications.

**V. Electricity:** Electrostatics: Gauss law, uniformly charged sphere, charged cylindrical conductor and an infinite conducting sheet of charge. Deduction of Coulomb's law from Gauss law, Mechanical force on a charged conductor Electric potential –Potential due to a charged spherical conductor, electric field strength from the electric dipole and an infinite line of charge, Potential of a uniformly charged circular disc. Dielectrics: An atomic view of dielectrics, potential energy of a dipole in an electric field. Polarization and charge density, Gauss's law for dielectric medium– Relation between D,E, and P. Dielectric constant, susceptibility and relation between them. Capacitance: Capacitance of concentric spheres and cylindrical condenser, capacitance of parallel plate condenser with and without dielectric. Electric energy stored in a charged condenser – force between plates of condenser, measurement of dielectric constant and potential difference.

**VI. Magnetism And Electro Magnetism:** Magnetism: Magnetic properties of para, dia and ferromagnetic materials. Langevin's theory of paramagnetism, Weiss' theory of ferromagnetism –Concepts of magnetic domains, anti ferromagnetism and ferrimagnetism ferrites and their applications, Magneto statics: Moving charge in electric and magnetic field: Hall effect, cyclotron, synchrocyclotron and synchrotron – force on a current carrying conductor placed in a magnetic field, force and torque on a current loop, Biot–Savart's law Electromagnetic induction: Faraday's law –Lenz's law – expression for induced emf – time varying magnetic fields – Betatron –Ballistic galvanometer – self and mutual inductance, coefficient of coupling, energy stored in magnetic field – transformer ,Varying and alternating currents: Growth and decay of currents in LR, CR and LCR circuits – Critical damping. Alternating current relation between current and voltage in pure R, C and L vector diagrams – Power in ac circuits, LCR series and parallel resonant circuit –Q-factor, Maxwell's equations and electromagnetic waves.

**VII. Electronics:** Basic Electronics: Energy bands in solids, Intrinsic and extrinsic semiconductors, p-n junction diode, half wave and full wave rectifiers, filters, ripple factor, Zener diode and its application, p-n-p and n-p-n transistors, current components in transistors, CB,CE and CC configurations, transistor as an amplifier – Positive and negative feedback, Barkhausen criterion, RC coupled amplifier and phase shift oscillator. Digital Principles: Binary and Hexa decimal number system and their conversion, Logic gates: OR, AND, NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive – OR gate, De Morgan's Laws, Half and Full adders, Parallel adder circuits.

### **VIII. Modern physics:**

**A) Atomic physics and Molecular physics:** Atomic Spectra: Drawbacks of Bohr's atomic model - Sommerfeld's elliptical orbits, Stern & Gerlach experiment Vector atom model, L-S and j-j coupling schemes, Spectra of alkali atoms, Alkaline earth spectra, Zeeman Effect, Paschen-Back Effect and Stark Effect. Molecular Spectroscopy: determination of inter nuclear distance. Vibrational energies and spectrum of diatomic molecule, Raman Effect, Classical theory of Raman Effect.

**B) Quantum Mechanics:** Spectral radiation, Planck's law. Photoelectric effect, Einstein's photoelectric equation, Compton's effect, Matter Waves: de Broglie's hypothesis – wavelength of matter waves and their properties, Davisson and Germer experiment. Double slit experiment. Uncertainty Principle: Heisenberg's uncertainty principle for position and momentum, Energy and time. Schrodinger Wave Equation: Schrodinger time independent and time dependent wave equations, significance and its applications.

**C) Nuclear Physics:** Nuclear Structure: Properties of nucleus, Binding energy of nucleus, nuclear forces, nuclear models, Alpha and Beta Decays: Geiger – Nuttal law, Gammow's theory of alpha decay, Fermi's theory of  $\beta$ -decay. Nuclear Reactions: Nuclear Detectors.

**D) Solid State Physics:** Crystal Structure: Crystalline nature of matter, Crystal lattice, Unit Cell, Elements of symmetry, Crystal systems, Bravais lattices, Miller indices, Simple crystal structures. X-ray Diffraction: Bragg's law, Laue's method and powder method. Nano materials, Superconductivity, superconductors,

### **Teaching Methodology (Marks: 20)**

- 1. The Nature of Science:** Nature and scope of science, Science, ideology and Society, Structure of Science (a) Substantive structure – Empirical knowledge, Theoretical Knowledge – (Facts, Concepts, hypothesis, theory, Principle Law), (b) Syntactic Structure of Science – Scientific inquiry, Processes of Science, Attitudes of inquiry.
- 2. The History and Development of Science:** A brief introduction to oriental and western science, Contribution of the following Scientists in the Development of Science: Aryabhatta, Bhaskara Charya, Aristotle, Copernicus, Newton, Einstein, C.V.Raman, Various organizations working for the development of science in India.
- 3. Aims and Values of teaching Physical Sciences:** Aims of teaching Physical Sciences, Values of teaching Physical Science, Correlation of Physics and with other subjects.

- 4. Objectives of teaching Physical Sciences:** Meaning and importance of objectives, Bloom's Taxonomy of Educational objectives, Specific / Behavioural objectives / (Instructional objectives), Critique on Bloom's Taxonomy.
- 5. Approaches and Methods of teaching Physical Sciences:** Inductive and Deductive Approaches, Micro Teaching, Team Teaching, Lecture Method, Lecture cum Demonstration Method, Historical Method, Heuristic Method, Project Method, Laboratory method, Problem Solving Method, Scientific Method, Multimedia Approach in Teaching Learning process, Programmed Learning, CAI and CAL.
- 6. Planning for effective instruction in Science:** Year Plan, Unit Plan, Lesson Plan, Learning experience, characteristics, classification, source and relevance.
- 7. Teaching Learning Material (TLM):** Characteristics and Importance of TLM, Classification and Types of TLM, Hardware and Software in TLM, TLM Principles to be followed, Edgar Dale's cone of learning experience.
- 8. Science laboratories:** Importance of Practical work in science, Planning of Science laboratories, Procurement, care and maintenance of laboratory equipment, Registers, Management of safety and science kits, Development of improvised Apparatus.
- 9. Physical Science Curriculum:** Principles of Curriculum Construction, Defects in the existing school science curriculum, Qualities of a good Science Text Book.
- 10. Non-formal Science Education:** Science Clubs, Science Fairs – purposes, levels, organization, advantages, Science Library, Role of NGOs and State in popularizing Science.
- 11. Evaluation:** Concept and Process of Evaluation, Tools of Evaluation, Preparation of Scholastic Achievement Test (SAT), Analysis and interpretation of Scores.