

# Syllabus for Uchcha Madhyamic Paper II STET 2023

## UNIT I Subject -----Physics 100 Marks

### Unit-1

#### Mechanics :-

- Error Theory
- Units and dimensions, SI Units, Kinematics of Particle (projectiles and circular motion).
- Dynamics of Particles: forces in nature, Friction, Gravitation, Contact forces
- Work and energy, Momentum and Energy conservation laws, collision in one and two dimensions, Gravitational potential, Satellite, escape speed, variation of  $g$  on Earth.
- Centre of mass, moment of force, angular momentum, moment of inertia
- Analytical Mechanics: Generalised co-ordinates and velocities, Hamilton's Principle, Lagrangian and the Euler- Lagrange equation, Hamilton's equations of motion.
- High speed mechanics: Postulates of Special Theory of Relativity, Lorentz Transformations, Variation of mass with velocity, Mass-energy Equivalence.

### Unit -2

#### General Properties of Bulk matter :-

- Elasticity: Stress, strain, Hooke's law, Moduli of elasticity, Poisson's ratio, stress in anisotropic bodies
- Viscosity: Types of fluid flow, Ideal flow and Bernoulli's Theorem, viscosity, Stokes law, Poiseuille Equation
- Surface Tension: Surface Energy, Contact angle, capillarity, Effect of temperature and contaminations

### Unit -3

#### Heat & Thermodynamics :-

- Kinetic Theory of Gases, Distribution of Velocities, Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and Experimental Verification, Mean free Path, Van der Waal's Equation of State for Real Gases.
- Zeroth and First Law of Thermodynamics: Zeroth Law of Thermodynamics & Concept of Temperature, First Law of Thermodynamics and its differential form, Internal Energy, Application of First Law: General Relation between  $C_p$  and  $C_v$ , Work Done during Isothermal and Adiabatic Processes.

- Second Law of Thermodynamics: Reversible and Irreversible process with examples, Carnot's Cycle, Carnot engine & efficiency, Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin – Planck and Clausius Statements and their Equivalence, Carnot's Theorem.
- Entropy: Concept of Entropy, Clausius Theorem, Clausius Inequality, Second Law of Thermodynamics in term of Entropy.

## Unit -4

### Oscillations and Waves :-

- Periodic motion, oscillation, SHM Damped oscillation, forced oscillation, Resonance.
- Wave Motion: Plane and Spherical Waves, Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves, Wave Equation, Phase and Group Velocities, Changes with respect of Position and Time.
- Wave Speed in air, Laplace's correction to Newton's formula Oscillation of air column and resonance tube, Beats, Acoustic Doppler Effect, Acoustics of Buildings.

## Unit -5

### Electrostatics and Magnetostatics

- Electric Field and Electric Potential: Electric field, electric field lines, electric flux Gauss' Law with applications. Conservative nature of Electrostatic Field, Electrostatic Potential, Laplace's and Poisson equations.
- Dielectric Properties of Matter: Polarization, Displacement Vector D, Relations between E, P and D
- Magnetic Field: Magnetic force between current elements and definition of Magnetic Field B, Biot-Savert's Law and its simple applications.
- Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M. H-H curve and hysteresis, Ferromagnetism.

## Unit -6

### Electromagnetic Theory:-

- Electromagnetic Induction: Faraday's Law, Lenz's Law, Self Inductance and Mutual Inductance, Introduction to Maxwell's Equations : Displacement Current, Boundary Conditions at Interface between Different Media, Wave Equation, Electromagnetic Energy Density and its Physical concept.

- EM Wave in Bounded Media: Brewster's law, Total internal reflection.
- Optical Fibres: Numerical Aperture, Step and Graded Indices (Definitions Only), Single and Multiple Mode Fibres.

## **Unit -7**

### **Electric circuit:-**

- Charging and discharging of capacitor in RC circuit, Growth and decay of current in inductor in LR circuit, AC circuit: Kirchhoff's Law for AC circuits, impedance, Reactance, Capacitance, circuits with AC source and L, C and R. LCR-series circuit, resonance, band width, Q-factor, Parallel LCR circuit as rejecter circuit.

## **Unit -8**

### **Optics :-**

- Fermat Principle, reflection law and mirrors, refraction laws, refractive index, critical angle, Total Internal Reflection, Slab, Prism, refraction at spherical interface, lens, lens maker's formula, magnification, power of lens doublet,
- Dispersion, scattering, Light waves: Huygens Principle.
- Interference: Young's double slit experiment interference in Thin Film, parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes), Fringes of equal thickness (Fizeau Fringes), Newton's Ring, Measurement of wavelength and refractive index.
- Difference between interference and diffraction.
- Polarization and its laws.

## **Unit -9**

### **Modern Physics:-**

- Planck's Quantum hypothesis, Blackbody radiation, Photoelectric effect, Compton's scattering, De-Broglie's wavelength, Davission-Germer experiment, Wave description of particles by wave packets, Heisenberg Uncertainty Principle.
- Many electron atom: Bohr's Atomic model, Bohr's Sommerfeld atomic model, Fine structure of hydrogen lines, Total Angular Momentum, Vector Atom Model, Quantum numbers associated with the atom, Spin Quantization, Spin orbit coupling in atom: L-S and J-J couplings.
- Particle Accelerators: Cyclotron, Measurement of Charge and the ratio (e/m).

- Size and structure of atomic nucleus, Nature of Nuclear force, NZ curve, Binding energy Stability of the nucleus, Radioactivity, Mean life and half-life, Alpha decay, Beta decay, Gamma ray emission, Origin and types of X-ray spectra, Fission and fusion, Nuclear reactor.
- Lasers: Spontaneous and Stimulated emission, Optical Pumping and Population Inversion.
- Basic Quantum mechanics: Wave function of a free particle, Time dependent Schrodinger equation, Properties of wave function, Interpretation of Wave Function, Normalization, Eigenvalues and Eigenfunctions, Particle in a box, Simple harmonic oscillator-energy levels and energy eigenfunctions.
- Quantum Numbers of Hydrogen like atoms, Zeeman Effect.

## Unit -10

### Electronics and communication:-

- P and N type semiconductors, Energy band gap, conductivity and mobility, PN junction Diode, Forward and Reverse Biased Diode, Zener diode and Voltage Regulation.
- Transistor, I-V characteristics, Current gains in transistor, transistor and amplifier, Barkhausen's Criterion, Oscillator (basic).
- Digital circuit: analog and digital circuit, Decimal and Binary Numbers, Logic Gates, Universal Logic Gates, De Morgan's Theorems, Boolean Laws.
- Block diagram and communication system Bandwidth of signal, Propagation of EM waves in the atmosphere, Sky and space wave propagation, Need for modulation, Amplitude Modulation.

### Syllabus for Art of Teaching and Other Skills STET 2023

<b>Unit II Art of Teaching, Other skills</b>	<b>Marks 50</b>
<b>(A) Art of Teaching</b>	<b>Marks 30</b>
<b>(B) Other skills</b>	<b>Marks 20</b>

#### A. Art of Teaching

1. Teaching & Learning:- Meaning, Process & Characteristics.
2. Teaching Objectives and Instructional objectives: Meaning & Types, Blooms Taxonomy.
3. Teaching Methods: - Types and its Characteristics, Merit, and demerits of Methods.
4. Lesson Plan: - Types and Format & Various Model.
5. Microteaching & Instructional analysis.
6. Effective ecosystem of Classroom.
7. Textbook and library
8. Qualities of Teacher.
9. Evaluation & Assessment for learning.

10. Curriculum.
11. Factors affecting teaching and learning.
12. Teaching Aids and Hands on learning.

**B. Other skills**

1. General Knowledge,
- 2.Environmental Science
3. Mathematical aptitude,
- 4.logical Reasoning

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