

- 5.4 Ex-servicemen of Punjab Domicile shall be allowed to deduct the period of his service in the Armed Forces of Union from his actual age and if the resultant age does not exceed the maximum age limit prescribed for direct appointment to such a vacancy in the Service Rules concerned by more than three years, he shall be deemed to satisfy the condition regarding age limit.
- 5.5 The upper age limit is also relaxed up to 42 years for widows, divorcees and certain other categories of women.
- 5.6 The upper age limit is also relaxed up to 47 years for "Persons with Disability" of Punjab.

**Note:** Provisions mentioned in Punjab Civil Services (General and Common Conditions of Service) Rules, 1994 amended from time to time may be considered

## 6. PATTERN AND SCHEME OF COMPETITIVE EXAMINATION FOR SELECTION

### 6.1 PROCEDURE FOR SELECTION

The procedure for selection of candidates for the post of Lecturer Physics (Group-A) (Subordinate Institutions) in the Department of Technical Education and Industrial Training, Government of Punjab will be as per the following details:-

| Subject Matter                  | No. of Questions | Total Marks |
|---------------------------------|------------------|-------------|
| Written Competitive Examination | 120              | 480         |
| Interview                       | -                | 60          |
| <b>Total Marks</b>              | -                | <b>540</b>  |

The written competitive examination for the post will be scheduled soon.

### 6.2 PATTERN OF THE WRITTEN COMPETITIVE EXAMINATION

The pattern for written competitive examination comprising of 120 questions (@ 4 marks for each question) is as follows:

| Sr.No.       | Topic   | No. of Questions | Marks (Each Question carries 4 marks) | Type of Questions                |
|--------------|---|------------------|---------------------------------------|----------------------------------|
| 1.           | Questions from the Subject (Part-A of Syllabus)   | 100              | 400                                   | MCQs (Multiple Choice Questions) |
| 2.           | Questions from General Knowledge & Current Affairs, General Mental Ability, Logical Reasoning & Quantitative Aptitude. (Part-B of Syllabus) | 20               | 80                                    |                                  |
| <b>Total</b> |   | <b>120</b>       | <b>480</b>                            |                                  |

**The important points to note:**

- i. The Question Paper will be in English language only.**
- ii. Each question carries 4(four) marks and, for each correct answer candidate will get 4 (four) marks.**
- iii. There will be Negative Marking (One Mark for each question) in the written examination for questions wrongly answered i.e. for each in correct answer, 1(One) mark will be deducted from the total score.**

General Information regarding 09 posts of Lecturer Physics (Group-A) (Subordinate Institutions) in the Department of Technical Education and Industrial Training, Government of Punjab in the year of 2022

## ANNEXURE (VIII)

### PART-A

#### **1 Mathematical Physics**

Dimensional analysis; Vector algebra and vector calculus; Linear algebra, matrices, Cayley Hamilton theorem, eigenvalue problems; Linear differential equations; special functions (Hermite, Bessel, Laguerre and Legendre); Fourier series, Fourier and Laplace transforms; Elements of complex analysis: Laurent series-poles, residues and evaluation of integrals; Elementary ideas about tensors; Introductory group theory, SU(2), O(3); Elements of computational techniques: roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, solution of first order differential equations using Runge-Kutta method; Finite difference methods; Elementary probability theory, random variables, binomial, poisson and normal distributions.

#### **2 Classical Mechanics**

Newton's laws; Phase space dynamics, stability analysis; Central-force motion; Two-body collisions, scattering in laboratory and centre-of-mass frames; Rigid body dynamics, moment of inertia tensor, non-inertial frames and pseudoforces; Variational principle, Lagrangian and Hamiltonian formalisms and equations of motion; Poisson brackets and canonical transformations; Symmetry, invariance and conservation laws, cyclic coordinates; Periodic motion, small oscillations and normal modes; Special theory of relativity, Lorentz transformations, relativistic kinematics and mass-energy equivalence.

#### **3 Electromagnetic Theory**

Electrostatics: Gauss' Law and its applications; Laplace and Poisson equations, boundary value problems; Magnetostatics: Biot-Savart law, Ampere's theorem, electromagnetic induction; Maxwell's equations in free space and linear isotropic media; boundary conditions on fields at interfaces; Scalar and vector potentials; Gauge invariance; Electromagnetic waves in free space, dielectrics, and conductors; Reflection and refraction, polarization, Fresnel's Law, interference, coherence, and diffraction; Dispersion relations in plasma; Lorentz invariance of Maxwell's equations; Transmission lines and wave guides; Dynamics of charged particles in static and uniform electromagnetic fields; Radiation from moving charges, dipoles and retarded potentials.

#### **4 Quantum Mechanics**

Wave-particle duality; Wave functions in coordinate and momentum representations; Commutators and Heisenberg's uncertainty principle; Matrix representation; Dirac's bra and ket notation; Schroedinger equation (time-dependent and time-independent); Eigenvalue problems such as particle-in-a-box, harmonic oscillator, etc; Tunneling through a barriers; Motion in a central potential; Orbital angular momentum, Angular momentum algebra, spin; Addition of angular momenta; Hydrogen atom, spin-orbit coupling, fine structure; Time-independent perturbation theory and applications; Variational method; WKB approximation; Time dependent perturbation theory and Fermi's Golden Rule; Selection rules; Semi-classical theory of radiation; Elementary theory of scattering, phase shifts, partial waves, Born approximation, Identical particles, Pauli's exclusion principle, spin-statistics connection; Relativistic quantum mechanics: Klein Gordon and Dirac equations.

## **5 Thermodynamics and Statistical Physics**

Laws of thermodynamics and their consequences; Thermodynamic potentials, Maxwell relations; Chemical potential, phase equilibria; Phase space, micro- and macrostates; Microcanonical, canonical and grand-canonical ensembles and partition functions; Free Energy and connection with thermodynamic quantities; First- and second-order phase transitions; Classical and quantum statistics, ideal Fermi and Bose gases; Principle of detailed balance; Blackbody radiation and Planck's distribution law; Bose-Einstein condensation; Random walk and Brownian motion; Introduction to nonequilibrium processes; Diffusion equation.

## **6 Electronics**

Semiconductors device physics, including diodes, junctions, transistors, field effect devices, homo and heterojunction devices, device structure, device characteristics, frequency dependence and applications; Optoelectronic devices, including solar cells, photodetectors, and LEDs; High-frequency devices, including generators and detectors; Operational amplifiers and their applications; Digital techniques and applications (registers, counters, comparators and similar circuits); A/D and D/A converters; Microprocessor and microcontroller basics.

## **7 Atomic and Molecular Physics**

Quantum states of an electron in an atom; Electron spin; Stern-Gerlach experiment; Spectrum of Hydrogen, helium and alkali atoms; Relativistic corrections for energy levels of hydrogen; Hyperfine structure and isotopic shift; width of spectral lines; LS & JJ coupling, Zeeman, Paschen Back & Stark effect; X-ray spectroscopy; Electron spin resonance, Nuclear magnetic resonance, chemical shift, Rotational, vibrational, electronic, and Raman spectra of diatomic molecules; Frank-Condon principle and selection rules; Spontaneous and stimulated emission, Einstein A & B coefficients; Lasers, optical pumping, population inversion, rate equation: Modes of resonators and coherence length.

## **8 Condensed Matter Physics**

Bravais lattices; Reciprocal lattice, diffraction and the structure factor, Bonding of solids, Elastic properties, phonons, lattice specific heat; Free electron theory and electronic specific heat; Response and relaxation phenomena; Drude model of electrical and thermal conductivity: Hall effect and thermoelectric power; Diamagnetism, paramagnetism, and ferromagnetism; Electron motion in a periodic potential, band theory of metals, insulators and semiconductors, Superconductivity, type I and type II superconductors, Josephson junctions; Defects and dislocations; Ordered phases of matter, translational and orientational order, kinds of liquid crystalline order; Conducting polymers; Quasicrystals.

## **9. Nuclear and Particle Physics**

Basic nuclear properties: size, shape, charge distribution, spin and parity, Binding energy, semi-empirical mass formula; Liquid drop model; Fission and fusion; Nature of the nuclear force, form of nucleon-nucleon potential; Charge-independence and charge-symmetry of nuclear forces; Isospin, Deuteron problem; Evidence of shell structure, single-particle shell model, its validity and limitations, Rotational spectra, Elementary ideas of alpha, beta and gamma decays and their selection rules; Nuclear reactions, reaction mechanisms, compound nuclei and direct reactions; Classification of fundamental forces; Elementary particles (quarks, baryons, mesons, leptons); Spin and parity assignments, isospin, strangeness; Gell-Mann-Nishijima formula; C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction, Relativistic kinematics.

**PART-B**

**General Knowledge, Logical Reasoning & Mental Ability**

**(a) General Knowledge & Current affairs**

General Knowledge and Current affairs of National and International importance including:

- (i) Economic issues.
- (ii) Polity issues.
- (iii) Environment issues.
- (iv) Geography.
- (v) Science and Technology.
- (vi) Any other current issues.
- (vii) (a) History of India with special reference to Indian freedom struggle movement.  
(b) History of Punjab- 14th century onwards.

**(b) Logical Reasoning, Mental Ability & Quantitative Aptitude.**

- (i) Logical reasoning, analytical and mental ability.
- (ii) Basic numerical skills, numbers, magnitudes, percentage, numerical relation appreciation.
- (iii) Data analysis, Graphic presentation charts, tables, spreadsheets.