PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION
FOR RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE, ETC -2022
CASE NO. 2C2023

SUBJECT: PHYSICS (PAPER-I)

TIME ALLOWED: THREE HOURS   MAXIMUM MARKS: 100

NOTE:
i.   All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

NOTE: **Attempt any FIVE Questions in All. Attempt in Urdu or English.**

Q. No.1   a) What are spherical polar coordinates? Define these coordinates. How these are related with Cartesian coordinates (x, y, z)? Explain direction cosines of a vector.
(4+4+4=12 Marks)

b) Explain vector triple product? Show that

$$\vec{A} \times (\vec{B} \times \vec{C}) = (\vec{A} \cdot \vec{C})\vec{B} - (\vec{A} \cdot \vec{B})\vec{C}$$

(8 Marks)

Q. No.2   (a) Derive the Stokes' theorem from the fundamental theorem of calculus and the definition of line and surface integrals. Discuss the assumptions and conditions under which Stokes' theorem holds, and give counterexamples to illustrate when the theorem fails.

(b) How is the curl related to the rotation and divergence of a vector field? What are some common properties and identities of the curl.   (10+10=20 Marks)

Q. No.3   a) Define pressure of a fluid. Derive an expression for the pressure gradient between a point inside a fluid and a point at the surface. Determine variation in pressure in the atmosphere.   **(14 Marks)**

b) A bowler swings a ball while bowling to a cricketer. Explain this swing using Bernoulli's equation.   **(6 Marks)**

Q. No.4   a) What are stationary waves? How these waves are formed? Describe their characteristics and mathematical treatment.

b) Calculate formula for power and intensity in wave motion.
(10+10=20 Marks)

Q. No.5   (a) Explain the phenomenon of interference of waves. What is the difference between constructive and destructive interference? Give an example of each and discuss their applications.

(b) Explain the working principle of a spectrometer. How does it measure the spectral distribution of light?   (10+10=20 Marks)

Q. No.6   (a) What is coherence and why is it important in the study of wave phenomena? Explain the difference between spatial coherence and temporal coherence.

(b) What is the resolving power of a diffraction grating? Derive the equation for the resolving power of a diffraction grating and explain the factors affecting it.   (10+10=20 Marks)

Q. No.7   (a) What is the difference between reversible and irreversible processes in thermodynamics? How do reversible processes relate to entropy and energy conservation?   **(10 Marks)**

(b) What is enthalpy and how is it related to internal energy and work?   **(5 Marks)**

(c) What is Brownian motion and how does it occur?   **(5 Marks)**

Q. No.8   a) What is an ideal gas? Calculate pressure of an ideal gas on the basis of kinetic theory of gases. Prove that pressure exerted by ideal gas molecules is directly proportional to the average translational kinetic energy of gas molecules.

b) Considering thermodynamic potentials discuss Maxwell's relations.
(12+8=20 Marks)