PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE, ETC -2021

CASE NO. 3C2022

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.

Attempt any FIVE questions in All. Attempt in Urdu or English.

Q.No.1 (a) Differentiate between gradient and divergence of a vector by giving two examples of each. **(5+5=10 Marks)**

(b) If A, B and C are vectors then show that

$$\mathbf{A.(B\times C) = B.(C\times A) = C.(A\times B)}$$ **(10 Marks)**

Q.No.2 (a) Differentiate between Conservative and Nonconservative Forces. **(4 Marks)**

(b) Write down Newtonian laws of motion. **(6 Marks)**

(c) Prove that the line integral of a vector field **A vector** around any closed curve is equal to the surface integral of the curl of **A vector** taken over any surface **S** of which the curve is a bounding edge. Mathematically **(10 Marks)**

$$\oint_C \vec{A} \cdot \overrightarrow{dl} = \iint_S (\vec{\nabla} \times \vec{A}) \cdot \overrightarrow{dS}$$

Q.No.3 (a) Differentiate between elasticity and viscosity with the help of examples. **(4 Marks)**

(b) Prove that **(8 Marks)**

$$P+\frac{1}{2}\rho v^2+\rho gh = \text{constant}$$

(c) Write down a note on Gyroscope. **(8 Marks)**

Q.No.4 (a) Write down the Postulate of special theory of relativity. Write down the Lorentz transformation equation. **(6+4=10 Marks)**

(b) State and explain the three Kepler's laws of planetary motion. **(10 Marks)**

Q.No.5 (a) Differentiate between longitudinal and transverse waves. Also discuss standing waves and travelling waves. **(6+6=12 Marks)**

(b) Define Simple Harmonic Motion. Derive equation of motion of Simple Harmonic Oscillator and write its solution. **(8 Marks)**

Q.No.6 State and explain the laws of thermodynamics in detail. **(20 Marks)**

Q.No.7 What is LASER? Describe its construction, working and applications. **(20 Marks)**

Q.No.8 **Write down note on the followings:** **(7+7+6=20 Marks)**

(i) Maxwell's equations in thermodynamics

(ii) Newton's Ring

(iii) Maxwell-Boltzmann Statistics

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CASE NO. 3C2022

SUBJECT: PHYSICS (PAPER-II)

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 Five Questions in All, Selecting ONE from Section-I and TWO Each from Section-II and Section-III. Calculator is allowed (Not programmable). Attempt in Urdu or English.**

SECTION-I

Q. No. 1: **a)** Prove that the negative of the rate of change of the potential with position in any direction is the component of electric field in that direction.

b) Explain the motion of charged particle in (i) uniform and (ii) non- uniform magnetic field.

(10+10=20 Marks)

Q. No. 2: **a)** Using Maxwell's equations show that the velocity of electromagnetic waves in free space is given by $1/\sqrt{\mu_o \varepsilon_o}$.

b) Derive an expression for torque acting on a current carrying loop placed in a uniform magnetic field.

(10+10=20 Marks)

SECTION-II

Q. No. 3: **a)** Simplify the Boolean expression.

(i) $\overline{AB + AC} + \bar{A}\,\bar{B}C$ (ii) $X(Y + \bar{W}Z) + WXZ$

b) Explain the operation of a JK master slave flip-flop. How will you convert a D flip-flop into JK flip-flop?

(10+10 =20 Marks)

Q. No. 4: **a)** Draw the circuit of full wave (center tapped transformer) rectifier with π-filter and find the expression for ripple factor and V_{dc} in it.

b) Determine the ripple factor for full wave rectifier with π-filter at 50 Hz frequency having $C_1 = C_2 = 50\ \mu F$, $L = 5$ H, $I_{dc} = 300$ mA and $V_{dc} = 30$ V. What should V_{rms} be?

(12+8=20 Marks)

Q. No. 5: **a)** What is de-Broglie hypothesis? Describe the experimental evidence in support of de-Broglie hypothesis.

b) Describe how Heisenberg Uncertainty principle works in a single slit diffraction.

(12+8=20 Marks)

SECTION-III

Q. No. 6: **a)** Define fission chain reaction. Discuss the difficulties involved in sustaining a fission chain reaction. What are their possible solutions?

b) Write down the conservation laws in nuclear reactions.

(12+8=20 Marks)

Q. No. 7: **a)** Write down the main assumptions of shell model of the nucleus. How does this model predict the existence of magic numbers and other nuclear properties? Also discuss its achievements and limitations.

b) The radius R of a nucleus changes with mass number A like $R \propto A^{1/3}$. How could one justify this behavior of the nuclear radius R?

(14+6=20 Marks)

Q. No. 8: **a)** Explain Bohr Theory of hydrogen atom and derive an expression for the energies of its stationary states.

b) Describe the four quantum numbers for hydrogen atom in detail. What are these quantum numbers associated with?

(10+10=20 Marks)