**FEDERAL PUBLIC SERVICE COMMISSION**
**COMPETITIVE EXAMINATION - 2017**
**FOR RECRUITMENT TO POSTS IN BS-17**
**UNDER THE FEDERAL GOVERNMENT**

## PHYSICS, PAPER-I

| TIME ALLOWED: THREE HOURS | PART-I (MCQS) | MAXIMUM MARKS = 20 |
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| PART-I(MCQS):  MAXIMUM 30 MINUTES | PART-II | MAXIMUM MARKS = 80 |

**NOTE: (i)** Part-II is to be attempted on the separate **Answer Book.**
   **(ii)** Attempt **ONLY FOUR** questions from **PART-II. ALL** questions carry **EQUAL** marks.
   **(iii)** All the parts (if any) of each Question must be attempted at one place instead of at different places.
   **(iv)** Candidate must write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
   **(v)** No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
   **(vi)** Extra attempt of any question or any part of the attempted question will not be considered.
   **(vii)** **Use of Calculator is allowed.**

# PART-II

**Q. No. 2.** **(a)** What is the cross product of two vectors? Why the cross product is called pseudo vector? **(5)**

   **(b)** What is divergence of vector field? What is its physical significance? **(5)**

   **(c)** What is line integral? Under what condition it is used to calculate the work done. **(5)**

   **(d)** Consider three vectors: **(5) (20)**
   $$\vec{A} = -3\hat{i} + 3\hat{j} + 2\hat{k} \quad \vec{B} = -2\hat{i} - 4\hat{j} + 2\hat{k} \quad and \quad \vec{C} = 2\hat{i} + 3\hat{j} + 1\hat{k}$$
   **(i)** Find $\vec{A} \cdot (\vec{B} X \vec{C})$     **(ii)** Find $\vec{A} X (\vec{B} X \vec{C})$

**Q. No. 3.** **(a)** What do you mean by circular motion? What is centrifugal force? Explain your answer by taking an example from daily life. **(5)**

   **(b)** What is projectile motion? Why a cricket player lowers his hand while catching a ball? **(7)**

   **(c)** What do you mean by work done by the system and work done on the system? Explain by taking an example of each. **(5)**

   **(d)** A batsman hits a cricket ball at an angle with respect to the horizontal. The ball would strike the ground at 60m from the batsman if it is not stopped. But a fielder at a distance 55 m catches the ball at a height of 1.5 m. Calculate the angle of projection and the velocity of projection. **(3) (20)**

**Q. No. 4.** **(a)** What do you mean by phase and group velocity? Derive a relation between a group and phase velocity. **(7)**

   **(b)** What is superposition of waves? Show that the standing waves are produced by the superposition of two waves of equal amplitudes moving in opposite direction. **(7)**

   **(c)** A medium is disturbed by an oscillation described by, **(3)**
   *Y = 3.0cm sin(πx/10cm) cos (50πt)*
   Determine the amplitude, frequency, wavelength, speed and direction of the component waves whose superposition produces this result.

   **(d)** If light of λ = 660nm has wave train 20λ, what is its coherence length and coherence time? **(3) (20)**

**Q. No. 5.** **(a)** What is unique about light from a laser source, and why should you never look directly into a laser beam? Explain briefly. **(5)**

   **(b)** What is plasma? What do you mean by plasma frequency? Briefly discuss. **(5)**

   **(c)** How the blue laser is useful in storing large amount of data on a CD as compared to red laser? **(5)**

   **(d)** For the He-Ne laser at 2m and 4m distances from the laser, the output beam spot diameters are 2 mm and 3 mm. Calculate the angle of divergence. **(5) (20)**

# PHYSICS, PAPER-I

**Q. No. 6.**
   **(a)** What is viscosity? Discuss effect of temperature on the viscosity of liquids and gases. **(6)**

   **(b)** Differentiate between streamline and turbulent flow and establish equation of continuity. **(4)**

   **(c)** Explain why the level of mercury is down in capillary when placed in container of mercury, while it is up in the capillary in case of water? **(6)**

   **(d)** A garden hose has an inside diameter of 2 cm and water flows through it is at 3 m/s. **(4)** **(20)**
      **(i)** What nozzle diameter is required for the water to emerge at 10 m/s?
      **(ii)** At what rate does the water leave the nozzle?

**Q. No. 7.**
   **(a)** What do you understand by classical statistical mechanics and quantum statistical mechanics? **(6)**

   **(b)** Differentiate between Fermi-Dirac, Bose-Einstein and Maxwell-Boltzman's statistics. **(6)**

   **(c)** What is equipartition of energy? Explain. **(5)**

   **(d)** A $0.5m^3$ vessal is filled with air at atmospheric pressure. The air is churned by a paddel wheel attached to a shaft 0.1m in diameter, rotating at a speed of 1800 rpm. A force of 5.0N acts on the rim of the shaft. What would be the pressure in the vessel after 10 sec of operation **(3)** **(20)**

**Q. No. 8.** Write notes on any **FOUR** of the following: **(5 each)** **(20)**
   **(a)** Polarization of light and its application in determining specific rotation of a liquid.
   **(b)** Wave equation on a string.
   **(c)** Normal and anomalous dispersion of light.
   **(d)** Kinetic theory of gases.
   **(e)** Scalar Triple product.

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