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

Roll Number

PHYSICS, PAPER-I

TIME ALLOWED: THREE HOURS	**PART-I (MCQS) MAXIMUM MARKS = 20**
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)**

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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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PHYSICS, PAPER-II

TIME ALLOWED: THREE HOURS	**PART-I (MCQS) MAXIMUM MARKS = 20**
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 dipole moment? Obtain the expression for the potential and field due to an electric dipole.	**(10)**	
	(b)	Calculate the potential at a point on the axis of circular plastic disk of radius R, one surface of which carries a uniform charge density σ.	**(8)**	
	(c)	Why do we use unit "electron volts"?	**(2)**	**(20)**
Q. No. 3.	**(a)**	State and explain the Biot Savart law.	**(4)**	
	(b)	State and prove Ampere's law. Apply it to calculate the magnetic field due to a solenoid.	**(10)**	
	(c)	A long straight wire carries a current of 20 Amperes. An electron at 2.0 cm from the wire is travelling at a speed of 10^7 m/sec. What force acts on the electron if its motion is directed (1) towards the wire, (2) parallel to the wire and (3) at right angles to the direction given in (1) and (2).	**(6)**	**(20)**
Q. No. 4.	**(a)**	Write the Maxwell's equations and explain the significance of each equation.	**(6)**	
	(b)	Deduce the Maxwell equations for free space and also prove that electromagnetic waves are transverse.	**(12)**	
	(c)	What is index of refraction?	**(2)**	**(20)**
Q. No. 5.	**(a)**	Describe the Stern Gerlach experiment that provided experimental evidence of the space quantization of atomic magnetic moments.	**(10)**	
	(b)	What is the physical significance of the three quantum numbers n, 1, and m in the labelling of the hydrogenic wave functions?	**(6)**	
	(c)	What do you understand by strange particles?	**(4)**	**(20)**
Q. No. 6.	**(a)**	What is liquid drop model of nucleus and write down its essential features?	**(8)**	
	(b)	What are magic numbers? How can they be generated on the basis of shell model?	**(8)**	
	(c)	What is nuclear fusion?	**(4)**	**(20)**
Q. No. 7.	**(a)**	Differentiate the Metals, Semiconductors and Insulators on the basis of Energy Band Theory.	**(6)**	
	(b)	What is a rectifier? How we can use diode as a rectifier? Explain half-wave rectification in detail with diagrams.	**(14)**	**(20)**

Q. No. 8. Writer short notes on any TWO of the following: **(10 each)** **(20)**
(a) Schrodinger equation
(b) Linear accelerator
(c) Cyclotron

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