



FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT, 2014

Roll Number

PHYSICS, PAPER-I

TIME ALLOWED:	(PART-I MCQs) 30 MINUTES	MAXIMUM MARKS: 20
THREE HOURS	(PART-II) 2 HOURS & 30 MINUTES	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) Candidate must write **Q. No.** in the **Answer Book** in accordance with **Q. No.** in the **Q. Paper**.
(iv) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(v) Extra attempt of any question or any part of the attempted question will not be considered.

PART-II

- Q. No. 2.** (a) Define a Scalar field. Obtain an expression for the Gradient of a Scalar field. (11)
Why the Gradient of a Scalar field is vector?
(b) Given $w(x, y, z) = x^2 y z^3$, Find grad w at (1, 2, 1). (5)
(c) For what value of 'a' the vector $A = 2i + aj + k$ and $B = 4i - 2j - 2k$ are perpendicular. (4)
- Q. No. 3.** (a) Distinguish between Linear and Angular momentum. Explain the laws of conservation of Angular momentum. Prove that the angular momentum is constant in the absence of external torque. (13)
(b) The angular momentum of a particle is given as: (7)
 $J = 8t^4 i - 2t^2 j + 12t^3 k$
Find the torque τ at $t = 1$
- Q. No. 4.** (a) Show that the work done by a constant force is equal to the difference of initial and final kinetic energies of the body. (10)
(b) Prove that the total Work done by a conservative force around a closed path is ZERO and is independent of the path. (10)
- Q. No. 5.** (a) Describe Einstein's postulates of special theory of Relativity. (10)
(b) Establish the Mass-Energy relationship. (6)
(c) What is the speed of the air craft whose clock runs one second slow per hour, relative to a clock on the earth [$C = 3 \times 10^8$ m/sec] (4)
- Q. No. 6.** (a) Distinguish between streamline and turbulent motion of a liquid. (3)
(b) What is "Coefficient of Viscosity"? Explain in detail the Stoke's law applicable in determining the coefficient of viscosity of a viscous liquid experimentally. (14)
(c) Why do automanufacturers recommend using different viscosities of Engine oil in cold and hot climate? (3)
- Q. No. 7.** (a) Define Entropy. State second law of thermodynamics in terms of entropy. (13)
(b) Show that the entropy remains constant in a reversible process but increases in an irreversible one. (3)
(c) Distinguish between Isothermal and Adiabatic process. (4)
- Q. No. 8.** (a) Explain the phenomenon of diffraction from a Single Slit and a diffraction grating. Discuss conditions for maxima and minima in both cases. (16)
(b) Differentiate between Fresnel and Fraunhofer's diffraction. (4)



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PHYSICS, PAPER-II

TIME ALLOWED:	(PART-I MCQs) 30 MINUTES	MAXIMUM MARKS: 20
THREE HOURS	(PART-II) 2 HOURS & 30 MINUTES	MAXIMUM MARKS: 80

- NOTE:**(i) **Part-II** is to be attempted on the separate **Answer Book**.
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PART-II

- Q.NO.2.** (a) A nonconducting disk of radius R has a uniform positive surface charge density σ . Find the electric field at a point along the axis of the disk a distance x from its center. Assume that x is positive. (9)
(b) Explain the use of dielectric materials between the conducting plates of the capacitor? (6)
(c) The parallel plates of a 1.0 F capacitor are 1.0 mm apart. What is their area? (5)
- Q.NO.3.** (a) Explain the working mechanism of the moving coil microphone and electric guitar. (3+3)
(b) Explain the working mechanism of the Ground Fault Circuit Interrupter (GFCI) and walk-through metal detector. (3+3)
(c) An observer is 1.8 m from a light source (of dimensions much smaller than 1.8 m) whose power output is 250 W. Calculate the *rms* value of electric field at the position of the observer. Assume that the source irradiates uniformly in all directions. (8)
- Q.NO.4.** (a) Enlist the practical applications of the diode. (5)
(b) Explain volt-ampere characteristics of the diode. (6)
(c) Differentiate between insulator, conductor and semiconductor materials using energy band gap approach. (9)
- Q.NO.5.** (a) State and explain the amplitude modulation in communication systems. (8)
(b) Explain the construction of PNP transistor and give its one practical application in detail. (4+4)
(c) What are the advantages of digital signal over analog signal? (4)
- Q.NO.6.** (a) Explain the Lyman, Balmer and Paschen series of atomic hydrogen. (3+3+3)
(b) State and explain photoelectric effect. (5)
(c) Some major features of photoelectric effect cannot be explained in the terms of classical wave theory of light, discuss in detail. (6)
- Q.NO.7.** (a) Explain Zeeman effect in the context of energy level diagram. (8)
(b) Explain dual nature of light. (4)
(c) State and explain Heisenberg's uncertainty principle. (8)
- Q.NO.8.** (a) Explain the working mechanism of the scintillation counter and bubble chamber in detail. (4+4)
(b) State and explain nuclear fission giving at least three examples. (6)
(c) A small cyclotron of maximum radius $R=0.25$ m accelerates protons in a 1.7 T magnetic field. Calculate (i) the frequency needed for the applied alternating voltage, and (ii) the kinetic energy of the protons when they leave the cyclotron. (6)
