



FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2021
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

Roll Number

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) 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 question will not be considered.
(vii) **Use of Calculator is allowed.**

PART – II

- Q. 2.** (a) Consider an infinitely long cylindrical insulating shell of inner radius a , and outer radius b , and has a uniform volume charge density ρ . If a line of charge density λ is placed along the axis of the shell then determine the electric field intensity at a point r such that (i) $a < r < b$ and (ii) $r > b$. (8)
- (b) Determine the energy density for a capacitor. (6)
- (c) Discuss the Lorentz force. (6) **(20)**
- Q. 3.** (a) Find the magnetic energy density for the magnetic field of the inductor. (10)
- (b) State and explain the Lenz's law. (6)
- (c) Why is the work done by a magnetic field on a charged particle always zero? (4) **(20)**
- Q. 4.** (a) Describe the properties of each of, an electron and the light, that show their dual nature. (8)
- (b) State and explain the de Broglie hypothesis? (6)
- (c) Metals A, B and C have work functions 2.2eV, 3.6eV and 4.8eV. If a light of wavelength 320nm is incident on these, then find (6) **(20)**
- (i) Which metals exhibit photoelectric effect?
- (ii) Maximum kinetic energy of photoelectron in each case?
- Q. 5.** (a) Determine the transmission co-efficient for a particle having energy E (14)
incident on a rectangular barrier, so that $E < V_0$, the barrier is given by
- $$V(x) = \begin{cases} +V_0 & \text{for } -a < x < a \\ 0 & \text{for } |x| > a \end{cases}$$
- (b) For an operator \hat{A} , we know $[\hat{H}, \hat{A}] = 0$, where \hat{H} is the Hamiltonian operator, what can we conclude about the eigen states of \hat{A} and the $\langle \hat{A} \rangle$? (4)
- (c) Give two examples for the operator \hat{A} , given in part (b) above. (2) **(20)**

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- Q. 6.** (a) Describe the electrical conduction in different types of solids in terms of band theory. (8)
- (b) Explain the crystal structure of diamond. (6)
- (c) Find the carrier concentration of electrons in Silicon at a temperature of 25°C. (6) **(20)**
- Q. 7.** (a) What factors contribute to the stability of a nucleus? Draw and explain the plot of neutron number N versus atomic number Z for stable nuclei. (10)
- (b) Explain the use of chain reaction in relation to a nuclear reactor. (6)
- (c) The stable isotope of potassium is ^{39}K , what kind of radioactivity do you expect from ^{40}K ? Give reasons. (4) **(20)**
- Q. 8.** Write notes on any **TWO** of the following: **(10 marks each)** **(20)**
- (a) Poynting Vector
- (b) Fusion in stars
- (c) MOSFET
