



FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT, 2015

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) 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) State and prove Gauss's law of electrostatics. Derive its differential form. (12)
(b) Use Gauss's law to calculate the electric field due to a line charge. (05)
(c) A point charge of $1.8 \mu\text{C}$ is at the centre of a cubical Gaussian surface (03)
 55 cm on edge. What is the net electric flux through this surface? Use (20)
 $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2/\text{N} \cdot \text{m}^2$.
- Q. No. 3.** (a) Analyze the RLC-series circuit using j-operator method and discuss its (14)
frequency response. Discuss the importance of this circuit.
(b) Find the impedance of a circuit consisting of a $1.5 \text{ k}\Omega$ resistor, (04)
 $5.0 \mu\text{F}$ capacitor and 50 mH inductor in series at a frequency of 10 kHz .
(c) What are the advantages of A.C. mains supply? (02) (20)
- Q. No. 4.** (a) Describe the forward and reverse biased characteristics of a PN junction. (06)
(b) Explain the working of a bridge rectifier using a neat and labelled circuit (12)
diagram.
(c) Why semiconductor devices are preferred over the vacuum tubes? (02) (20)
- Q. No. 5.** (a) What is meant by Compton Effect? Derive an expression for Compton (16)
shift in wavelength.
(b) A beam of X-rays is scattered by a carbon target. At 45° from the beam (4)
direction the scattered X-rays have a wavelength of 2.2 pm . What is the
wavelength of the X-rays in the direct beam?
(Given that $h = 6.626 \times 10^{-34} \text{ J} \cdot \text{s}$, $m_e = 9.109 \times 10^{-31} \text{ kg}$ and $c = 2.998 \times 10^8 \text{ m/s}$) (20)
- Q. No. 6.** (a) Derive expressions for half-life and mean life of a radioactive substance. (15)
(b) The activity of a certain radionuclide decreases to 15 percent of the (03)
original value in 10 days. Find its half-life.
(c) Give any two industrial or medical uses of radioisotopes. (02) (20)
- Q. No. 7.** (a) Differentiate between nuclear fission and fusion. (03)
(b) Draw a labelled diagram of a nuclear reactor and explain the functions of (13)
various parts.
(c) Calculate the energy released in the following fission reaction induced by (04)
slow neutrons.

$${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow [{}_{92}^{236}\text{U}]^* \rightarrow {}_{54}^{140}\text{Xe} + {}_{38}^{94}\text{Sr} + 2 {}_0^1\text{n}$$
Express your answer in MeV
[Given that $m({}_{92}^{235}\text{U}) = 235.043923 \text{ a.m.u.}$, $m({}_{54}^{140}\text{Xe}) = 139.921640 \text{ a.m.u.}$
 $m({}_{38}^{94}\text{Sr}) = 93.915360 \text{ a.m.u.}$, $m({}_0^1\text{n}) = 1.008665 \text{ a.m.u.}$
and $1 \text{ a.m.u.} = 931.5 \text{ MeV}/c^2$] (20)
- Q. No. 8.** Write notes on any **TWO** of the following: (10 each) (20)
(a) Modulation and demodulation (b) Common emitter single stage amplifier
(c) Bainbridge mass spectrometer
