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

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) How does a vector quantity differ from a scalar quantity? **(06)**

(b) A small airplane leaves an airport on an overcast day and is later sighted 215 km away in a direction making an angle of 22^o east of north. How far east and north is the airplane from the airport when sighted? **(08)**

(c) Explain the conservation of linear momentum and angular momentum. **(06)** **(20)**

Q. No. 3. (a) Describe Michelson-Morley experiment and show how negative results obtained from this experiment were interpreted? **(10)**

(b) What is time dilation in special relativity? Obtain an expression for time dilation regarding time interval between two events measured from two different inertial frames. **(10)** **(20)**

Q. No. 4. (a) What is length contraction in special theory of relativity? **(04)**

(b) What are isothermal and adiabatic changes? Explain with volume pressure diagram. **(08)**

(c) Define the term Coherence. Drive an Expression for the Coherence length of a wave train that has a frequency bandwidth $\Delta\nu$. **(08)** **(20)**

Q. No. 5. (a) Explain the formation of Newton's rings and show that the radii of m^{th} dark ring is proportional to the under root of wavelength. **(10)**

(b) What is diffraction grating? Define grating element. Explain how a plane transmission grating is used to determine the wavelength of light. **(10)** **(20)**

Q. No. 6. (a) What is a LASER? Explain with neat diagram the process of absorption of light, spontaneous emission and stimulated emission of light. **(08)**

(b) Explain with the help of energy level diagram how stimulated emission results from electron impact of He-Ne Gas LASER? **(06)**

(c) Explain how the viscosity of a given liquid is determined using Stokes's method experimentally? **(06)** **(20)**

Q. No. 7. (a) Distinguish between the resolving power and the magnifying power of a Telescope. **(08)**

(b) Discuss the applications of First Law of Thermodynamics. **(06)**

(c) Describe the Galileo's principles of relativity. **(06)** **(20)**

Q. No. 8. Briefly discuss any **FOUR** of the following terms: **(05 each)** **(20)**

(a) Standing waves (b) Doppler's effect

(c) Electromagnetic waves (d) Surface tension

(e) Components of vectors

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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 $1.8\ \mu C$ is at the centre of a cubical Gaussian surface $55\ cm$ on edge. What is the net electric flux through this surface? Use $\varepsilon_o = 8.854 \times 10^{-12} C^2/N.m^2$. **(03)** **(20)**

Q. No. 3. (a) Analyze the RLC-series circuit using j-operator method and discuss its frequency response. Discuss the importance of this circuit. **(14)**
(b) Find the impedance of a circuit consisting of a $1.5\ k\Omega$ resistor, $5.0\ \mu F$ capacitor and $50\ mH$ inductor in series at a frequency of $10\ kHz$. **(04)**
(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 diagram. **(12)**
(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 shift in wavelength. **(16)**
(b) A beam of X-rays is scattered by a carbon target. At 45^o from the beam direction the scattered X-rays have a wavelength of $2.2\ pm$. What is the wavelength of the X-rays in the direct beam? **(4)**
(Given that $h = 6.626 \times 10^{-34} J.s, m_o = 9.109 \times 10^{-31} kg$ and $c = 2.998 \times 10^8 m/s$) **(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 original value in 10 days. Find its half-life. **(03)**
(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 various parts. **(13)**
(c) Calculate the energy released in the following fission reaction induced by slow neutrons. **(04)**

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow [^{236}_{92}U]^* \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + 2\ {}^{1}_{0}n$$

Express your answer in MeV

[Given that $m(^{235}_{92}U) = 235.043923$ a.m.u. , $m(^{140}_{54}Xe) = 139.921640$ a.m.u.
$m(^{94}_{38}Sr) = 93.915360$ a.m.u. , $m(^{1}_{0}n) = 1.008665$ a.m.u.
and 1 a.m.u. $= 931.5\ MeV/c^2$] **(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

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