PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION
FOR RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE -2020

SUBJECT: PHYSICS (PAPER-I)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE:
i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

Attempt FIVE Questions in All. Attempt in Urdu or English.

Q. No. 1 **(a)** How can we multiply two vector quantities? Discuss in detail, the vector product, giving at least two examples. **(10 Marks)**

(b) Define and explain the line integral and surface integral of a vector. **(10 Marks)**

Q. No. 2 **(a)** Define and derive a relation for the rotational kinetic energy of a rigid body. How will you find the rotational kinetic energy of a hoop and a solid sphere? **(12 Marks)**

(b) Prove that the square of time period of a planet bears a direct relation with the cube of the mean distance between Sun and the planet. **(08 Marks)**

Q. No. 3 **(a)** Define and briefly discuss two postulates of Special theory of relativity. **(08 Marks)**

(b) Discuss the consequences of Lorentz transformation for relativity of length and time. **(12 Marks)**

Q. No. 4 Derive Bernoulli's equation and briefly explain its physical significance. Using this equation, establish a relation between speed and pressure of a fluid passing through a pipe of variable diameters. **(20 Marks)**

Q. No. 5 What is a damped harmonic oscillator? Write the equation of motion of such an oscillator and derive its solution which could help to find the displacement of damped harmonic oscillator. **(20 Marks)**

Q. No. 6 **(a)** Discuss Young's double slit experiment in detail. How can we find the fringe width and angular spacing using this experiment? **(15 Marks)**

(b) Sketch a ray diagram for Michelson Interferometer. **(05 Marks)**

Q. No. 7 **(a)** What is an ideal gas? Discuss the work done on an ideal gas during thermal isolation. **(10 Marks)**

(b) Discuss adiabatic expansion and adiabatic compression processes. **(10 Marks)**

Q. No. 8 **Write short note on the following:-** **(4 x 5 = 20 Marks)**

(i) Equivalence of Mass and Energy
(ii) Lissajous Figures
(iii) Entropy
(iv) Brownian Motion

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COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE -2020

SUBJECT: PHYSICS (PAPER-II)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE:

i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

Attempt Five Questions in All, Selecting ONE from Section-I and TWO each from Section-II and Section-III, Calculator is allowed (Not programmable). Attempt in Urdu or English.

SECTION-I

Q No.1: a) Distinguish between photoelectric effect and Compton effect. Also show that the Compton shift depends only on the scattering angle and not on the initial wavelength.

b) The threshold frequency for photoelectric emission in copper is $1.1 \times 10^{15} sec^{-1}$. Find the maximum energy of the photoelectrons (in joules and electron volts) when light of frequency $1.5 \times 10^{15} sec^{-1}$ is directed on a copper surface. **(12+8=20 Marks)**

Q No.2: a) State Uncertainty principle. Describe its different forms.

b) Derive time dependent Schrodinger wave equation in one dimension.

(12+8=20 Marks)

SECTION-II

Q No.3: a) What is rectification? How diodes act as rectifier? Explain half and full wave rectifications in detail, support your answer by drawing circuits.

b) Define NOR gate. Describe its symbol, Boolean expression, truth table and circuit diagram. **(14+6=20 Marks)**

Q No.4: a) What is transistor phase shift oscillator? Explain its circuit and operation in detail.

b) What is common-emitter configuration of a transistor? Explain in detail.

(12+8=20 Marks)

Q No.5: a) State radioactive decay law.

b) Define half life of a radioactive element and determine an expression for the half life relating to decay constant.

c) Radioactive isotope of mercury ^{197}Hg decays into ^{197}gold Au with a decay constant of $0.018 h^{-1}$. (a) Calculate its life. (b) What fraction of this original amount will remain after three half lives. **(4+8+8=20 Marks)**

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SECTION-III

Q No.6: a) What is mass spectrograph? Describe its principle, construction and working.

b) In a mass spectrometer, a singly charged positive ion($q=1.602 \times 10^{-20}$ emu) is accelerated through a potential difference of 1000 volts. It then travels through a uniform magnetic field for which H = 1000 gauss, and is deflected into a circular path18.2 cm in radius. What is (a) the speed of the ion? (b) The mass of the ion, in grams and atomic mass units? (c) The mass number of the ion?

(12+8=20 Marks)

Q No.7: a) Prove that $\nabla . B = 0$

b) Write down the integral and differential form of Maxwell equations in the absence of magnetic or polarizable media.

c) Differentiate between natural radioactivity and artificial radioactivity.

(6+8+6=20 Marks)

Q No.8: a) Define Ampere's law. Derive the differential form of the Ampere's law.

b) State and prove Poynting theorem.

(10+10=20 Marks)