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SUBJECT CODE NO: - Y-2017
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-V)
Examination March / April - 2023
Physics Paper-XV (Classical & Quantum Mechanics)

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B 1) All questions are compulsory.
2) Question first and second 20 marks and question third 10 marks.

Given Data:

$K = 1.38 \times 10^{-23}\ J/K\ ; h = 6.63 \times 10^{-34}\ J.S$

$me = 9.1\ \times 10^{-31}\ Kg\ ; c = 3 \times 10^{8}\ m/s$

$1\ ev = 1.6\ \times 10^{-19}\ J\ ;\ \mu_0 = 4\pi\ \times 10^{-7}\ wb/Amp$

Q1 a) State and prove D' Alembert principle. 10

b) Obtain an expression of Plank's radiation law. Deduce Rayleigh's law from Plank's law. 10

OR

a) State and explain Heisenberg's Uncertainty Principle 10

b) Discuss the problem of particle in one dimensional box and prove that energy of particle is quantized 10

Q2 a) Explain the principle of virtual work. 05

b) Write a note on holonomic and non holonomic constraints 05

c) Calculate the wave length associated with a thermal electron of energy 2.5ev. 05

d) Explain the electron can not exist inside the nucleus. 05

OR

a) Show that linear momentum of photon in term of wave vector $\vec{k}$, $P = H\left|\vec{K}\right|$ 05

b) Calculate threshold frequency for tungsten surface whose work function is 4.5 ev. 05

c) Write a note on expectation values. 05

d) Calculate the first energy level of an electron in a box of $1°A$ wide 05

Q3 Multiple choice questions. 10

1) The constraints involved when a particle is restricted to move along a curve of surface are _____
   a) Holonomic
   b) Non holonomic
   c) Both a and b
   d) None of these

2) At woods machine is an example of _____ system.
   a) Linear
   b) Angular
   c) Conservative
   d) None of these

3) The spectrum of black body radiation is _____
   a) Line
   b) Band
   c) Continuous
   d) Absorption

4) Which of the following phenomenon supports the quantum nature of light _____
   a) Interference
   b) Diffraction
   c) Polarisation
   d) Compton effect

5) De-Broglies wavelength is _____
   a) $\lambda = {}^{h}/_{mv}$
   b) $h/\sqrt{2mkT}$
   c) $\lambda = h/\sqrt{2mE}$
   d) All of these

6) Devission and Germar experiment is related to _____
   a) Interference
   b) Polarization
   c) Diffraction
   d) All of these

7) Operator from the time dependent Schrodinger equation is _____
   a) $H\psi = 1$
   b) $H\psi = A$
   c) HA = AH
   d) $H\psi = E\psi$

8) The wave function must be _____
   a) Single valued
   b) Continuous
   c) Finite
   d) All of these

9) Which relation is correct _____
   a) $V = n\lambda$
   b) $K = {}^{2\pi}/_{\lambda}$
   c) $Vg = \frac{dw}{dk}$
   d) $All\ of\ these$

10) Probability density is _____
   a) $P = |\psi|^2$
   b) $P = \psi$
   c) $P = {}^{\psi}/_{2}$
   d) $P = 5\psi$