

Nov- Dec
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Total No. of Questions : 6]

[Total No. of Printed Pages : 4

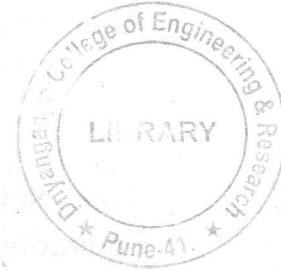
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F. E. Examination - 2011

APPLIED SCIENCE - II

(PHYSICS)

(2008 Pattern)



Time : 2 Hours]

[Max. Marks : 50

Instructions :

- (1) All questions are compulsory.
- (2) Black figures to the right indicate full marks.
- (3) Neat diagrams must be drawn wherever necessary.
- (4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (5) Assume suitable data, if necessary.

Q.1) (A) Classify the following characteristics of DeBroglie Waves into **true** and **false** : [06]

- (a) DeBroglie Waves are probability waves.
- (b) The wavelength of DeBroglie Waves is inversely proportional to the momentum of the particle.
- (c) The Group Velocity of the DeBroglie Waves is given
$$v_g = v_{\text{particle}}$$
- (d) DeBroglie Waves are significant for subatomic particles.
- (e) DeBroglie Waves associated with bounded particles are quantized.
- (f) DeBroglie Waves are associated only with moving material particles.

(B) Calculate the Wavelength of a Photon and an Electron both having an energy 1.0 eV.

(Given : Planck's Constant $h = 6.63 \times 10^{-34}$ J-s

Mass of Electron = 9.1×10^{-31} kg.)

[04]

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P.T.O.

- (C) Obtain the wavefunction for a particle moving in a rigid box. Also obtain the expression for its quantized energy. Highlight the step at which quantization begins to occur. [6+1=07]

OR

- Q.2) (A) State Schrödinger's Time Independent and Time Dependent Equations and state any one difference between them. What are the basic requirements for solution of the Schrödinger's Equation to be acceptable? [3+4=07]

- (B) Identify and mark which of the following statements of the Heisenberg's Uncertainty Principle are incorrect. In front of the incorrect statement write the corrected statements :

$$\Delta x \Delta P_y \geq h$$

$$\Delta \theta \Delta P_x \geq h$$

$$\Delta x \Delta E \geq h$$

$$\Delta x \Delta P_x \leq h$$

$$\Delta x \Delta t \geq h$$

[05]

- (C) Assuming Atomic Nucleus to be a rigid box (infinite potential well), calculate the ground state energy of an electron if it existed inside the nucleus. (Given Planck's Constant = 6.63×10^{-34} J-s, Mass of the Electron = 9.1×10^{-31} kg. and size of the nucleus $\sim 10^{-15}$ m. Using this result, argue that electron cannot exist inside the nucleus. Given, maximum binding energy per nucleon = 8.8 MeV) [05]

- Q.3) (A) Define following concepts : (Any Three) [3x2=06]

(a) Spontaneous Emission

(b) Stimulated Emission

(c) Metastable State

(d) Population Inversion

(e) LASING

