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SECOND SEMESTER

Roll No. 0719
B.Tech. (ALL)

MID SEMESTER EXAMINATION

MARCH-2012

AP-113 APPLIED PHYSICS-II

Time: 1 Hour 30 Minutes

Max. Marks: 20

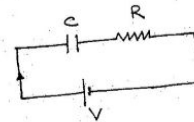
Note: Answer ALL questions.
Assume suitable missing data if any.

- 1[a] An electron has a de Broglie wavelength of 2.00×10^{-12} m. Find its kinetic energy and the phase and group velocities of its de Broglie waves. Rest mass of the electron is $0.511 \frac{\text{MeV}}{c^2}$. 2
- 1[b] X-rays of wavelength 10.0 pm are scattered from a target (i) find the wavelength of the x-rays scattered through 45° (ii) find the maximum wavelength present in the scattered x-rays (iii) find the maximum kinetic energy of the recoil electrons. 2
- 1[c] An electron and a positron are moving side by side in the +ve direction at 0.500 c when they annihilate each other. Two photons are produced that move along the x-axis. What is the energy of each photon? 2
- 2[a] Show that the operations \hat{x} and \hat{p}_x do not commute. Get the commutator $[\hat{x}, \hat{p}_x]$ and explain its physical significance. 1
- 1[b] Which of the following wave functions can not be solutions of Schrodinger's equation for all values of x? Why not?
(i) $\psi = A \tan x$ (ii) $\psi = Ae^{x^2}$. 1
- 1[c] Write the energy eigen values and energy eigen function for a particle trapped in an infinite potential box of width L. Draw the first three energy eigen function for (i) infinite potential box of width L and (ii) finite potential box of width L. Compare the two. 3
- 3[a] Define poynting vector and explain its significance. The electric field vector for an electromagnetic field traveling in vacuum is given by
$$\vec{E} = E_0 \cos(kz - \omega t) \hat{i}$$

Calculate the poynting vector for the wave and show that its magnitude is equal to the energy density of the wave time the velocity of light. 3

- 1[b] Write down and derive the wave equation for propagation of electric field \vec{E} and magnetic field \vec{B} in free space. 2

- 1[a] Describe physical significance of the displacement current considering the example of current flow through a capacitor. 2
- 1[b] A 50 pF parallel plate capacitor is getting charged at such a rate that its voltage is increasing at 300V/s. 2



The plates are circular with a radius of 10 cm. Calculate displacement current density and displacement current. 2

Handwritten note: $\Delta \phi = 0$