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SECOND SEMESTER

B. TECH. (ALL)

END SEMESTER EXAMINATION MAY--2011

AP-113 APPLIED PHYSICS-II

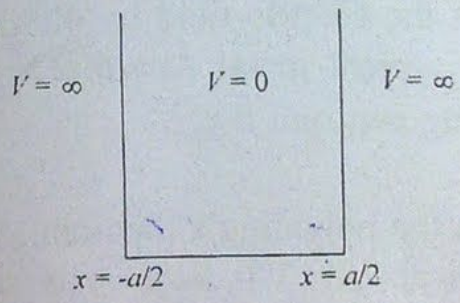
Time: 3:00 Hours *Max. Marks : 70*

Note : Answer any *SEVEN* questions.
Assume suitable missing data, if any.

1[a] What do you mean by Compton effect? Show that Compton shift is given by $\Delta\lambda = \frac{h}{m_0 c}(1-\cos\phi)$, where the symbols have their usual meaning. 5

[b] Analysis of a bubble chamber photograph reveals the creation of an electron-positron pair as photon passes through matter. The electron and positron tracks have opposite curvature in the uniform magnetic field B of 0.20 Weber/m^2, their radii each having 2.5×10^{-2}m. What was the energy and wavelength of the pair producing photon? 5

2[a] A quantum mechanical particle is trapped in infinite potential well as shown in figure. Find the normalized wave function of the particle. 5



[b] The component of velocity of an electron are measured as (4±0.18), (0.34±0.12) and (1.41±0.08) in 10^5 m/s. Calculate the minimum volume within which the electron is located. 5

3[a] What is liquid drop model? Derive the empirical formula for BE/A by this model. Also find the simple formula for the line of stability using this model. 5

[b] Explain α-decay and Q-value in nuclear reaction. Show that the Kinetic energy of emitted α particle (KE_α) and the disintegration energy (Q) given by $KE_\alpha \approx \left(\frac{A-4}{A}\right)Q$. 5

4[a] consider a relation $^{14}N(\alpha,p)^{17}O$(i.e. $^{14}N + \alpha \rightarrow {}^{17}O + {}^{1}H$) and calculate the Q-value of the reaction if the masses of ^{14}N, α, ^{14}N, α, ^{17}O and ^{1}H are 14.003074, 4.002604, 16.99914 and 1.007834 amu respectively. Comment on the Q-value of the reaction. 5

[b] Explain Shell model and find the spin of the following nuclei in the ground state $_2He^5$, $_8O^{17}$ and $_{19}K^{41}$. 5

5 Differentiate between all the three Maxwell-Boltzmann, Fermi-Dirac & Bose Einstein statistics. Consider a gas of only two particles; call them A and B. Assume that each particle can be in one of the possible quantum state S = 1,2,3. Calculate the possible states of the whole gas under these three different statistics. 10

6 Derive expression for Bose Einstein statistics and hence obtain the plank distribution law for photon gas. 10

7 Write the Maxwell equation in dielectric and conductive medium. Show that the skin depth in a poor conductor and good conductor are $\frac{2}{\sigma}\sqrt{\frac{\varepsilon}{\mu}}$ and $\frac{\lambda}{2\pi}$, respectively. Also show that in a good conductor the magnetic field lags the electric field by 45°. Find the skin depth (in nonometers) for a typical metal ($\sigma \approx 10^7 (\Omega m)^{-1}$) in the visible range ($\omega \approx 10^{15}/s$), assuming $\varepsilon \approx \varepsilon_0$ and $\mu \approx \mu_0$. 10

8 Derive and explain the polynting's theorem. The intensity of sunlight hitting the earth is about 1300 W/m^2. If sunlight strikes a perfect absorber, what pressure does it exert? How about a perfect reflector? What fraction of atmospheric pressure does this amount to? 10

9 Write short note on any four of the following: 2.5x4

[a] Nuclear Reactor. [b] Displacement current

[c] Nuclear fusion [d] De-Broglie wavelength

[e] Negative kinetic energy in quantum mechanical harmonic oscillator.