CBCS SCHEME

USN | | | | | | | | | | 21PHY12

First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Draw neat sketches wherever necessary.*
3. *Physical constants : Speed of light "C" = 3×10^8 m/s^{-1} ;*
Planck's constant "h" = 6.625×10^{-34} JS ; Boltzmann constant "K" = 1.38×10^{-23} J/K^{-1}
Acceleration due to gravity "g" = 9.8 m/s^{-2} ;
Permittivity of Free space "$\in_o$" = 8.854×10^{-12} F/m^{-1}.

Module-1

1 a. What is Free and Forced Oscillation? Obtain expression for Amplitude and phase of vibration in case of forced vibration. **(09 Marks)**

b. Describe the construction and working of the Reddy shock tube. **(06 Marks)**

c. Calculate the peak amplitude of vibration of a system whose natural frequency is 1000 Hz when it oscillates in a resistive medium of damping / unit mass of 0.008 rad/s under the action of an external periodic force / unit mass of 5N/m with tunable frequency. **(05 Marks)**

OR

2 a. What is Force Constant? Obtain expression for effective Spring constant and Time period for two springs connected in series. **(08 Marks)**

b. Define Simple Harmonic Motion and give two examples. Obtain the differential equation for Simple Harmonic Motion using Hooke's Law. **(08 Marks)**

c. In a Reddy shock tube experiment, the time taken to travel between the two sensors is 195 μs. If the distance between the two sensors is 100mm. Calculate the mach number. Assume speed of sound as 340 m/s. **(04 Marks)**

Module-2

3 a. Discuss the spectral distribution of energy in the black body radiation spectrum and hence explain Wein's Displacement Law. **(06 Marks)**

b. Using the Schrodinger Time Independent wave equation , obtain expression for Energy Eigen values and the Normalized wave function. **(09 Marks)**

c. The position and momentum of an electron with energy 0.5 Ke V is found with a minimum percentage uncertainty in momentum. Find its uncertainty if the measurement of position has a uncertainty of 0.5A°. **(05 Marks)**

OR

4 a. What is Wave function? Arrive at the Time Independent Schrodinger Wave equation. **(08 Marks)**

b. State and explain Heisenberg's Uncertainty principle and hence use it to show that electrons do not exist inside the nucleus. **(08 Marks)**

c. Evaluate the De – Broglie wavelength of Helium Nucleus accelerated through a potential difference of 500V. **(04 Marks)**

Module-3

5 a. Distinguish between the types of optical fibres based on Refractive Index profile and number of modes of propagation. **(06 Marks)**

b. Obtain the expression for Energy density using Einstein's A and B coefficients. Draw inference on the condition $B_{12} = B_{21}$. **(10 Marks)**

c. A pulse from laser with power 1mW lasts for 10nS, if the number of photons emitted per pulse is 3.491×10^7. Calculate the wavelength of laser. **(04 Marks)**

OR

6 a. Discuss the construction and working of the CO_2 laser. Explain the significance of Helium gas in the CO_2 laser system. **(09 Marks)**

b. Give the basics of point to point communication using optical fibres. **(06 Marks)**

c. Calculate the NA , Relative RI , V number and the number of modes in an optical fiber of core diameter 50 μm and the core and cladding R.I are 1.41 and 1.40 respectively. Given Wavelength of source 820nm. **(05 Marks)**

Module-4

7 a. What is Fermi Factor? Discuss the dependence of Fermi factor on temperature and energy. **(08 Marks)**

b. Mention the four assumptions of Quantum free Electron theory and hence discuss any two success of Quantum free Electron theory. **(08 Marks)**

c. The resistivity of intrinsic germanium at 27°C is equal to 0.47 ohm meter. Assuming electron and hole concentration to be 0.38 $m^2 V^{-1} S^{-1}$ and $0.18 m^2 V^{-1} S^{-1}$. Calculate the Intrinsic carrier density. **(04 Marks)**

OR

8 a. What is Hall effect? Obtain expression for the Hall voltage in terms of charge density also state importance of Hall effect. **(08 Marks)**

b. Define Internal Field. Derive the Clausius – Mossotti equation. **(07 Marks)**

c. Find the temperature of which there is 1% probability that a state with an energy 0.2eV above Fermi level is occupied. **(05 Marks)**

Module-5

9 a. Explain the construction and working of X – Ray diffractometer. **(07 Marks)**

b. Describe in brief the construction and working, with Principle the Transmission Electron Microscope. **(08 Marks)**

c. Determine the crystal size when the peak width is 0.5° and peak position 30° for a cubic crystal. The wavelength of X rays used is 100A° and the Scherer's constant K = 0.92. **(05 Marks)**

OR

10 a. With a neat sketch, explain the principle , construction and working of Scanning Electron Microscope. **(09 Marks)**

b. Describe the construction, principle and working of X – ray Photoelectron Spectroscope. **(08 Marks)**

c. Mention applications of Atomic Force Microscope. **(03 Marks)**

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