First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Physics

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing one full question from each module.*
   2. *Physical constants : $h = 6.63 \times 10^{-34} JS$; $m_e = 9.1 \times 10^{-31} kg$; $m_n = 1.675 \times 10^{-27} kg$,*
   $C = 3 \times 10^8 m/s$; $N_A = 6.025 \times 10^{26}/k\ mole$; $K_B = 1.38 \times 10^{-23} JK$; $e = 1.6 \times 10^{-19} C$,
   $L_{ev} = 1.6 \times 10^{-19} C$.

Module-1

1   a.   What is Plank's law? Show that how Plank's law reduces to Wein's law and Rayleigh – Jeans law under certain conditions.   **(06 Marks)**
   b.   Show that group velocity is equal to particle velocity.   **(04 Marks)**
   c.   State and explain Heisenberg's Uncertainty principle and show that electrons does not exist in nucleus.   **(06 Marks)**
   d.   An electron is bound in one dimensional potential well of width 0.18nm. Find the energy value in eV of the second excited state.   **(04 Marks)**

2   a.   What are Matter waves? Mention their characteristic properties.   **(05 Marks)**
   b.   Set up one dimensional time independent Schrodinger wave equation in case of a free particle.   **(07 Marks)**
   c.   What is Wave function? Mention important properties of wave function.   **(04 Marks)**
   d.   A particle of mass $0.5 Mev/C^2$ has kinetic energy 100eV. Find its de-Broglie wave length , where 'C' is the velocity of light.   **(04 Marks)**

Module-2

3   a.   Discuss merits of quantum free Electron theory.   **(06 Marks)**
   b.   Explain Type – I and Type – II super conductors.   **(04 Marks)**
   c.   Write the expression for electron and hole concentrations in an intrinsic semiconductors and hence derive an expression for Fermi level in an intrinsic semi conductor.   **(06 Marks)**
   d.   Calculate the Fermi energy in eV for a metal at $0^0 K$ if it has 5.86×10^{28} conduction electrons per cubic metre.   **(04 Marks)**

4   a.   What is Hall effect? Derive expression for Hall voltage in terms of Hall coefficient.
                                                                                          (07 Marks)
   b.   Define the terms Fermi level, Fermi factor and Fermi – Dirac statistics.   **(04 Marks)**
   c.   Explain Density of states.   **(04 Marks)**
   d.   Describe in brief BCS theory of super conductivity.   **(05 Marks)**

Module-3

5   a.   Derive an expression for energy density of radiation in terms of Einstein's coefficients.
                                                                                          (07 Marks)
   b.   Explain Propagation mechanism of light in an optical fiber and hence obtain expression for critical anlgle.   **(05 Marks)**
   c.   Discuss Point – to – Point communication system using an optical fiber with block diagram.
                                                                                          (04 Marks)
   d.   The average output power of laser source emitting a laser beam of wavelength 633nm is 5mw. Find the number of Photons emitted per second by the laser source.   **(04 Marks)**

6 a. Explain the construction and working of carbon dioxide laser with energy level diagram and illustrate modes of vibration of CO_2 molecules. **(08 Marks)**
   b. Define Acceptance angle and Numerical aperture and derive an expression for NA in terms of refractive indices of core and cladding. **(06 Marks)**
   c. Describe the recording of holographic image. **(03 Marks)**
   d. The angle of acceptance of an optical fiber is 30^0, when kept in air, what will be the angle of acceptance when the same is kept in a medium of Refractive index 1.33. **(03 Marks)**

Module-4

7 a. Explain in brief Seven Crystal Systems, with neat diagram. **(07 Marks)**
   b. Explain briefly the Principle and working of Liquid crystal display. **(06 Marks)**
   c. Calculate the atomic packing factor of BCC and FCC. **(04 Marks)**
   d. Derive Bragg's law. **(03 Marks)**

8 a. Describe how Bragg's X – ray spectrometer is used for determination of crystal structure. **(07 Marks)**
   b. What are Miller indices and explain the procedure to find Miller indices. **(04 Marks)**
   c. Explain the terms Polymorphism and Allotropy with examples. **(04 Marks)**
   d. X – rays of wavelength $0.82A^0$ undergo first order Bragg reflection from a crystal of cubic lattice with lattice constant $3A^0$ at a glancing angle of 7.855^0. Identify the Possible Planes which give rise to this reflection in terms of their Miller indices. **(05 Marks)**

Module-5

9 a. Explain the terms i) Mach number ii) Acoustic iii) Ultrasonic and iv) Shock wave. **(04 Marks)**
   b. Explain the construction and working of Reddy's shock tube. **(06 Marks)**
   c. What is Carbon nano tube? Discuss important properties and explain how it is synthesized using Pyrolysis method. **(07 Marks)**
   d. Mention three applications of SEM. **(03 Marks)**

10 a. Derive the Normal shock relationship using Rankine – Hugonit equations. **(06 Marks)**
   b. Explain the Principle , Construction and Working of Scanning Electron microscope. **(07 Marks)**
   c. Explain Synthesis of Nano materials using Ball Milling method. **(04 Marks)**
   d. Mention three Properties of Shock Waves. **(03 Marks)**

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