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P.E.S. College of Engineering, Mandya - 571 401
(An Autonomous Institution affiliated to VTU, Belgaum)
First Semester, B.E. : Make – up Examination; Jan/Feb. - 2016
Engineering Physics
(Common to all Branches)

Time: 3 hrs | Max. Marks: 100

*Note: Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*

Physical Constants: Electron mass = 9.11×10^{-31} kg, Planck's constant = 6.63×10^{-34} Js, Electron Charge = 1.602×10^{-19} C, Boltzmann Constant = 1.38×10^{-23} J/K, Avogadro number = 6.025×10^{26}/k mole, Permittivity of free space = 8.854×10^{-12} F/m, Velocity of light = 3×10^{8} m/s.

UNIT - I

1 a. State and explain Bernoulli's equation for incompressible fluid. Derive Euler's equation of motion along a stream line. | 8

b. Define Stream line flow and Turbulent flow. Obtain an expression for equation of continuity. | 7

c. What are dielectrics? Explain electronic and ionic polarization mechanisms. | 5

2 a. Define internal field and obtain an expression for it in case of one dimensional array of atoms in dielectric solids. | 8

b. i) Deduce Clausius-Mosotti relation for elemental solid dielectrics.

ii) A solid elemental dielectric with concentration 3×10^{28} atoms/m^3 shows an electronic polarisability of 10^{-40} F-m^2. Calculate the dielectric constant of the material. | 7

c. Explain the working principle of atomizer in spraying of water into air. | 5

UNIT - II

3 a. What are matter waves? Derive an expression for deBroglie wavelength using group velocity concept. | 8

b. Give an account of the attempts made through three laws to explain the blackbody radiation spectrum. | 7

c. An electron is confined to a one dimensional box of width 1 nm. Calculate the first three Eigen values in eV. | 5

4 a. Solve Schrodinger's wave equation for allowed energy values in case of a particle in a potential box. | 8

b. Sate and explain Heisenberg's uncertainty principle. Illustrate it using gamma ray microscope. | 7

c. State Stefan's law of radiation. Estimate the amount of energy radiated by unit surface area of a black body in one hour maintained at a temperature of 1500 K. | 5

UNIT - III

5 a. What are the assumptions of Classical free electron theory? Mention its merits and demerits.   8

  b. Define density of states. Derive the expressions for carrier concentration and Fermi energy of metal at 0 K.   7

  c. Calculate the intrinsic carrier density and conductivity of germanium semiconductor at 300 K. Given that; mobility of electrons = 0.36 m^2/Vs, mobility of holes = 0.17 m^2/Vs and energy gap of Ge = 0.7 eV. Assuming that $m_e^* = m_h^* = m_e$.   5

6. a. Explain the significance of Fermi level in an intrinsic semiconductor. Show that the Fermi level is at the middle of the band gap of an intrinsic semiconductor.   8

  b. Derive an expression for the density of holes in the valance band of an intrinsic semiconductor.   7

  c. Show that the sum of probability of an electron occupying an energy level 0.03 eV at a temperature of 300 K above the Fermi level and below the Fermi level is one.   5

UNIT - IV

7 a. What are nanomaterials? Write a note on CNT's and mention few important applications.   8

  b. Explain the variation of density of states for different quantum structures.   7

  c. Explain Meissner effect.   5

8 a. Discuss briefly BCS theory of superconductivity. Write a note on Magnetic levitation.   8

  b. Explain Type - I and Type - II superconductors.   7

  c. Explain the working of scanning tunnelling microscope with a neat diagram.   5

UNIT - V

9 a. Define the following terms :

    i) Induced absorption   ii) Spontaneous emission   iii) Stimulated emission.   5

  b. Derive an expression for numerical aperture.   5

  c. Explain how a flaw in a solid can be detected by non-destructive method using ultrasonics.   5

  d. Explain the factors affecting the architectural acoustics of a building.   5

10 a. Write a note on :

    i) Metastable state   ii) Laser cavity.   5

  b. Define angle of acceptance of numerical aperture. Calculate the numerical aperture and the acceptance angle of an optical fiber from the following data. Refractive index of the core is 1.55 and the refractive index of cladding is 1.5.   5

  c. Describe the experimental determination of velocity of ultrasonics in liquids.   5

  d. What is meant by reverberation time? Discuss Sabine' formula.   5

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