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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, B.E. – Make-up Examination, July/Aug. - 2015

Engineering Physics

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

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

***Physical Constants :** Electron mass, $m = 9.11 \times 10^{-31}$ kg, Electron charge, $e = 1.602 \times 10^{-19}$C; Velocity of light, $c = 3 \times 10^{8} ms^{-1}$, Planck's constant, $h = 6.62 \times 10^{-34}$ Js; Boltzmann constant, $K = 1.38 \times 10^{-23} JK^{-1}$, Avogadro number, $N = 6.025 \times 10^{23}$/mole; Permittivity of free space, $\varepsilon_0 = 8.85 \times 10^{-12} Fm^{-1}$.*

UNIT - I

1 a. Define stream line and Turbulent flow. Write a note on Mechanical energy and Efficiency of fluids. 8

b. State Bernoulli's theorem. Mention its limitations. 7

c. A parallel plate capacitor consists of 2 plates each of area 5×10^{-4} m^2. They are separated by a distance 1.5×10^{-3} m and filled with a dielectric of relative permittivity 6. Calculate the charge on the plates of Capacitor, if it is connected to a 100 V D.C. supply. 5

2 a. Explain the term internal field. Derive an expression for internal field in case of one dimensional array of atoms in dielectric solids. 8

b. Define the terms dipole moment and polarization? Describe in brief
(i) ionic polarization and (ii) Electronic polarization 8

c. Describe briefly conservation of mass and momentum for flow system. 4

UNIT - II

3 a. Define group velocity. Derive an expression for deBroglie wavelength using the concept of group velocity. 8

b. Describe the Ultraviolet catastrophe. Explain how Planck's law of radiation overcomes it. 7

c. In a measurement that involved a maximum uncertainty of 0.003% the speed of an electron was found to be 800 m/s. Calculate the corresponding uncertainty involved in determining its position. 5

4 a. Define a wave function. Setup time independent Schrodinger wave equation in one dimension. 7

b. State and explain Heisenberg's uncertainty principle. Illustrate it with gamma ray microscope. 8

c. A fast moving neutron is found to have an associated deBroglie wavelength of 2×10^{-12}m. Find its kinetic energy and the phase and group velocities of the deBroglie waves ignoring the relativistic change in mass (Given mass of neutron = 1.675×10^{-27} kg). 5

Contd…2

UNIT - III

5 a. Based on classical free electron theory derive an expression for electrical conductivity of metals. 7

b. Define Fermi energy and Fermi factor. Discuss the probability of occupation of various energy states by electrons at T = 0 K and T > 0 K on the basis of Fermi factor. 8

c. Explain the significance of Fermi level in intrinsic semiconductor. 5

6. a. Write a note on the significance of Fermi level in n-type and p-type extrinsic semiconductor. 8

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

c. Find the temperature at which there is 1% probability that a state with energy 0.5 eV above Fermi energy is occupied. 5

UNIT - IV

7 a. Explain the construction and working of Scanning Tunneling Microscope with a neat diagram. 7

b. What are nanomaterials? Explain the properties and application of Carbon nanotubes. 8

c. Describe the BCS theory of superconductivity. 5

8 a. Describe Type - I and Type - II superconductors. 7

b. Explain the two applications of superconductivity
(i) Superconducting magnet (ii) Maglev vehicle. 8

c. Discuss the various quantum structures. 5

UNIT - V

9 a. Derive the expression for energy density of radiation using Einstein's coefficients. 7

b. With neat diagram explain (i) acceptance angle and (ii) numerical aperture. Obtain an expression for numerical aperture in terms of refractive induces of core and cladding. 7

c. What are ultrasonic? Explain the experimental method of determining the velocity of ultrasonics in liquids. 6

10 a. Discuss the different types of optical fibers with suitable diagrams. 7

b. Explain with a diagram how a flaw in solid material is detected by non destructive method using ultrasonics. 7

c. Define stimulated emission of radiation.
The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 300 K. 6

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