



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

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, B.E. - Make-up Examination; July - 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. Write short notes on :
- i) Venturimeter ii) Water discharging from large tank. 8
- b. State and explain Bernoulli's equation. Derive an expression for Euler's equation of motion along streamline. 7
- c. If the relative permittivity is 4.0, calculate its atomic polarizability. Given that sulphur in cubic form has a density of 2.08×10^3 kgm⁻³ and its atomic weight is 32. 5
- 2 a. Explain the following :
- i) Electronic polarization ii) Ionic polarization iii) Dielectric loss. 8
- b. Define dielectric constant. Derive Clausius-Mosotti equation of dielectrics. 7
- c. The pipe near the lower end of a large water storage tank develops a small leak in a hole and a stream of water shoots from it. The top of water in the tank is 20 m above the point of leak. 5
- (i) With what speed does the water rush from the hole?
- (ii) If the hole has an area of 5×10^{-2} m², how much water flows out in one second?

UNIT - II

- 3 a. Define group velocity and particle velocity. Show that group velocity is equal to particle velocity. 8
- b. i) State and explain Wien's law and Rayleigh-Jean's law of radiation.
- ii) Find the temperature at which the emissive power of a blackbody is four times its emissive power at temperature 1500 K. 7
- c. Using uncertainty principle, prove that a free electron does not exist inside the nucleus. 5
- 4 a. i) State Heisenberg's uncertainty principle and illustrate it using γ -ray microscope.
- ii) Find the energy of an electron in the ground state, when it is trapped in an infinite potential well of width 2\AA . 8

- b. Setup one dimensional time-independent Schrodinger's wave equation. 7
- c. Explain the distribution of energy in blackbody radiation spectrum. 5

UNIT - III

- 5 a. What are the merits of Classical free electron theory? Explain how the Quantum free electron theory overcomes the failures of classical free electron theory? 8
- b. Define Fermi factor and density of states. Show that the probability of occupation above the Fermi level is equal to non occupation probability below the Fermi level. 7
- c. Obtain the relation between Fermi energy level (E_F) and energy gap (E_g) of an intrinsic semiconductor. 5
6. a. Define electron concentration. Obtain an expression for it in an intrinsic semiconductor. 8
- b. i) Explain the significance of Fermi level in p-type semiconductor.
ii) The electron mobility and hole mobility of silicon at room temperature are $0.17 \text{ m}^2\text{V}^{-1}\text{s}^{-1}$ and $0.033 \text{ m}^2\text{V}^{-1}\text{s}^{-1}$ respectively. Find the conductivity and resistivity of silicon, if its carrier density is $1.1 \times 10^{16} \text{ m}^{-3}$. 7
- c. Discuss the Fermi factor $f(E)$ at $E < E_F$, $E > E_F$ at $T = 0 \text{ K}$ and $E = E_F$ at $T > 0 \text{ K}$. 5

UNIT - IV

- 7 a. i) Explain the variation of Physical properties from bulk to nanomaterials. 8
ii) Write a note on carbon nanotubes.
- b. Explain density of state for various quantum structures. 7
- c. What are superconductors? Write a note on high temperature superconductors. 5
- 8 a. Write a note on : 8
i) Magnetic levitation ii) SQIDS.
- b. Differentiate between Type-I and Type-II superconductors. 7
- c. With a neat figure, write a note on Scanning Tunneling Microscope. 5

UNIT - V

- 9 a. i) Explain spontaneous and stimulated emission of radiation.
ii) An optical fiber has clad of refractive index 1.50 and numerical aperture 0.39. Find the refractive index of the core and the acceptance angle. 8
- b. What are ultrasonics? How they are used to determine the flaws in a material by non destructive method of testing? 7
- c. Discuss the various factors affecting the acoustics of buildings and give their remedies. 5
- 10 a. i) Describe the method of measuring velocity of ultrasonic waves in liquids. 8
ii) What are the requisites for a good auditorium?
- b. What are Lasers? Explain laser welding and cutting processes with diagrams. 7
- c. With the help of a block diagram, explain point to point optical fibers communication system. 5