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

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, B.E. - Semester End Examination; Dec. - 2019

Engineering Physics

(Common to All Branches)

Time: 3 hrs *Max. Marks: 100*

Note: I) PART - A is compulsory. **Two** marks for each question.

II) PART - B: Answer any **Two** sub questions (from a, b, c) for Maximum of **18 marks** from each unit.

Physical constants: *Electron mass, $m = 9.11\times10^{-31}$ kg, Electron charge, $e = 1.602\times10^{-19}$ C; Velocity of light, $c = 3\times10^{8}$ ms^{-1}; Planck's constant, $h = 6.626\times10^{-34}$ Js; Boltzmann constant, $K = 1.38\times10^{-23}$ JK^{-1}; Avogadro number, $N = 6.025\times10^{23}$/mole; Permittivity of free space, $\varepsilon_o = 8.85\times10^{-12}$ Fm^{-1}.*

Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	Define phase velocity and group velocity.	2
b.	Mention four types of polarization.	2
c.	Write an expression for density of states.	2
d.	What is fractional index change?	2
e.	Define free vibration and write formula for natural frequency.	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	State Heisenberg's uncertainty principle and show that no electrons present in the nucleus of an atom.	9
b.	Mention properties of wave function. Set up time-independent one dimensional Schrodinger's wave equation.	9
c.	i) Estimate the potential difference through which a proton is needed to be accelerated so that its deBroglie wavelength becomes equal to 1Å, given that its mass is 1.673×10^{-27} kg.	4
	ii) An electron is trapped in a 1-D potential well of infinite height and of width 0.1 nm. Calculate the energy required to excite it from its ground state to fifth excited state.	5
	UNIT - II	**18**
2 a.	Define Young's modulus. Derive the expression for bending moment of a beam with rectangular cross section.	9
b.	Define internal field. Obtain an expression for it in case of dielectric solids for one dimensional array of atoms.	9
c.	i) Define dielectric polarization. Explain briefly the electronic polarization.	4
	ii) What force is required to stretch a steel wire to double its length, when its area of cross section is 1 cm^2 and Young's modulus 2×10^{11} N/m^2.	5

Contd…2

UNIT - III **18**

3 a. Define Fermi level, Fermi temperatures, Fermi velocity and Fermi factor. Discuss the variations of Fermi factor with energy and temperatures. 9

b. Mention the expression for electron and hole concentrations. Derive the expression for electrical conductivity of an intrinsic semiconductor. 9

c. i) Briefly explain the Fermi level in extrinsic semiconductors. 4

ii) Calculate the Fermi energy in eV for a metal at zero Kelvin, whose density is 10500 kg/m^3, atomic weight is 107.9 and it has one conduction electron per atom. 5

UNIT - IV **18**

4 a. Describe the principle, construction and working of CO_2 laser. 9

b. With neat diagram, explain the different types of optical fibers. 9

c. i) Calculate the ration of stimulated to spontaneous emissions for a system in thermal equilibrium at 300 K in which radiations of wavelength 1.39 μm are emitted. 4

ii) The attenuation of light in an optical fiber is estimated to be 2.0 dB/km. What fraction of the initial intensity remains after 1 km and after 8 km? 5

UNIT - V **18**

5 a. Describe BCS theory and high temperature superconductors. 9

b. Give the theory of damped vibrations and discuss the three cases. 9

c. i) Write a Saline's formula for reverberation time and explain the notations. 3

ii) Describe a method of measuring velocity of ultrasonic waves in liquids. 6

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