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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 = 9.11x10^{-31} kg, Electron charge, e = 1.602x10^{-19} C; Velocity of light, c = 3x10^8 ms^{-1}; Planck's constant, h = 6.626x10^{-34} Js; Boltzmann constant, K = 1.38x10^{-23} JK^{-1}; Avogadro number, N = 6.025x10^{23}/mole; Permittivity of free space, ε_o = 8.85x10^{-12} Fm^{-1}.

Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	Define bending moment of a beam and write an expression for it.	2
b.	State Stefan's law of radiation.	2
c.	Define Fermi energy and Fermi temperature.	2
d.	Define Meissner effect.	2
e.	Write an expression for Sabine's formula and explain the notations.	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	Define Hooke's law. Obtain the expression for Poisson's ratio in terms of q, k and n.	9
b.	What are dielectrics? Derive an expression for internal field in one dimensional array of atoms in dielectric solid.	9
c.	i) Explain briefly electronic and Ionic polarization in dielectrics.	6
	ii) Calculate the elastic constant for an iron wire 1 m length and 0.1 mm radius elongates by 0.3 mm when stretched by a load of 5 kg.	3
	UNIT - II	**18**
2 a.	How blackbody radiation spectrum can be explained by Wien's law, Rayleigh-Jeans law and Planck's law of radiation?	9
b.	Solve Schrodinger's wave equation for a normalized Eigen wave function in case of a particle in an infinite potential well.	9
c.	i) Define deBroglie wavelength. Obtain an expression for it using group velocity concept.	6
	ii) An electron has a speed of 1000 m/s with an accuracy of 0.005%. Calculate the certainty with which we can locate the position of the electron.	3
	UNIT - III	**18**
3 a.	What are the merits of classical free electron theory? Explain how quantum free electron theory overcomes the failures of classical free electron theory?	9

b. Define electron concentration and derive an expression for it in an intrinsic semiconductor. 9

c. i) Show that $2E_F = E_g$. 5

ii) Find the probability of an electron occupying an energy level 0.04 eV above and below the Fermi level at a temperature of 400 K and show that sum of these two is unity. 4

UNIT - IV 18

4 a. What are nano materials? Explain the variation of density of states in 3D, 2D, 1D and 0D systems. 9

b. What are superconductors? Distinguish between Type-I and Type-II superconductors. 9

c. i) Discuss briefly Scanning Tunneling Microscope (STM). 5

ii) Discuss briefly BCS theory of superconductivity. 4

UNIT - V 18

5 a. Explain the terms :

i) Spontaneous emission

ii) Stimulated emission 9

iii) Induced absorption of radiation

b. i) With a neat diagram, obtain an expression for acceptance angle of an optical fiber. 6

ii) Calculate the numerical aperture of an optical fiber, if the refractive indices of the core and cladding are 1.56 and 1.49 respectively. 3

c. i) Describe an experimental determination of velocity of ultrasonics in liquids. 5

ii) Discuss the four important factors affecting the acoustics of an auditorium. 4

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