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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; April - 2021

Engineering Physics

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Understand the basic concepts and principles of Physics describing the phenomena associated with Engineering field.

CO2: Explain/Describe the properties of various materials, light and sound related to Engineering applications.

CO3: Formulate/Derive the Expressions for the concepts of Physics pertaining to Engineering field.

CO4: Apply the knowledge of Physics to analyze/solve the numerical problems allied to Engineering field.

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, $\varepsilon_o = 8.85x10^{-12}$ Fm^{-1}.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	Mention any two characteristics of matter waves.	2			
b.	Define Young's modulus and bulk modulus of a material.	2			
c.	Calculate the Fermi temperature of an electron in silver with Fermi energy 5.5 eV.	2			
d.	Mention any two advantages of laser welding.	2			
e.	What is Resonance? Give an example for Resonance.	2			
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	i) Derive an expression for the deBroglie wavelength using the concept of group velocity.	5			
	ii) An electron is trapped in one dimensional potential well of width 3Å and infinite height. Find the amount of energy required to excite the electron to its second excited state from the ground state.	4			
b.	i) Using Heisenberg's uncertainty principle show that a free electron cannot exist within the nucleus of an atom.	5			
	ii) An electron has a deBroglie wavelength of 1.66×10^{-10} m. Find its kinetic energy and group velocity of the deBroglie wave associated with it	4			
c.	Explain the probability density and energy for the first three states of a particle in a one dimensional infinitely deep potential well. Sketch the probability densities.	9			

Contd… 2

UNIT - II **18**

2 a. Define bending moment. Show that the bending moment of a thin uniform bar of rectangular cross section is $\frac{q}{R} I_g$. 9

b. What is internal field? Obtain an expression for the internal field in case of one dimensional solid dielectric material. 9

c. What is polarization? Explain four mechanisms of polarization in dielectric materials. 9

UNIT - III **18**

3 a. Derive an expression for the electron concentration at a given temperature in conduction band and mention the hole concentration in valence band of an intrinsic semiconductor. 9

b. Write down the assumptions of quantum free electron theory. Describe the success of quantum free electron theory in accounting for three discrepancies in the values calculated as per classical theory. 9

c. i) Discuss the dependence of Fermi factor on temperature.

ii) Calculate the probability of an electron occupying an energy level 0.02 eV above the Fermi level at 300 K in a metal. 9

UNIT - IV **18**

4 a. Discuss the principle, construction and working of CO_2 laser with energy level diagram. 9

b. What is Attenuation? Derive an expression for Attenuation coefficient. Discuss the causes for Attenuation in an optical fiber. 9

c. Derive an expression for energy density of incident radiation in terms of Einstein's coefficients. 9

UNIT - V **18**

5 a. Describe Type-I and Type-II superconductors. Give a brief account of high temperature superconductivity. 9

b. What are ultrasonic waves? Explain the non-destructive method of testing the materials using ultrasonic's. 9

c. Set up the equation of motion for a damped harmonic oscillator. Explain under damping case. 9

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