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

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, B.E. - Semester End Examination; Sep. / Oct. - 2023

Engineering Physics

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Recall the fundamental Definitions or Laws of physics relevant to Engineering field

CO2: Mention the various Properties and Applications by understanding the course topics pertaining to Engineering field.

CO3: Explain various Concepts and Principles used in the topics to understand the theory related to Engineering field.

CO4: Derive the expressions for the Physical Quantities on the topics of the course by applying the theory relevant to Engineering field.

CO5: Solve the numerical problems by applying proper solutions to verify the theoretical concepts related 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 a 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**			
1 a.	Define Phase velocity and Group velocity.	2	L1	CO1	PO1
b.	What is Young's modulus? Write the relation between q, n, k and σ.	2	L1	CO1	PO1
c.	List any two Merits of quantum free-electron theory.	2	L1	CO1	PO1
d.	Define fractional index change and mention the expression for it.	2	L1	CO1	PO1
e.	Mention Sabine's formula for time of reverberation.	2	L1	CO1	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
2 a.	What are matter waves? Arrive at the expression for de-Broglie wavelength using the concept of group velocity.	9	L1	CO1,3	PO1
b.	Write the condition for normalized wave function. Derive the expression for one dimensional time independent Schrodinger's wave equation.	9	L1	CO1,3	PO1
c.	i) Natural uncertainty in the measurement of speed of an electron in an atom is estimated to be 2.2×10^{4} m/s. Estimate the minimum width about which the electron stays confined in the atom.	4	L2	CO4	PO2
	ii) For an electron in one-dimensional potential well of width 1×10^{-9} m. Find its wavelength and energy at ground state and first two excited states.	5			
	UNIT - II	**18**			
3 a.	What is a beam? Derive the expression for bending moment of rectangular beam.	9	L1	CO1,3	PO1

Contd....2

b.	State Internal field and arrive at the expression for internal field in solid dielectric materials.	9	L1	CO1,3	PO1
c.	i) Define Cooper pairs and briefly discuss BCS theory of Super conductors.	5	L1	CO1,2	PO1
	ii) A wire of 3 m long and 0.625×10^{-4} m^2 in cross section is found to stretch 0.002 m under a tension of 1100 kg, what is the Young's modulus of the material of the wire.	4	L2	CO4	PO2
	UNIT - III	**18**			
4 a.	Define density of states and derive the expression for density of states in metals.	9	L1	CO1,3	PO1
b.	What are intrinsic and extrinsic semiconductors? Obtain the relation for conductivity and resistivity of an intrinsic semiconductor in terms of mobility of charge carriers.	9	L1	CO1,3	PO1
c.	i) Show that $E_g = \frac{E_F}{2}$, for an intrinsic semiconductor.	5	L1	CO3	PO1
	ii) Calculate the density of states for copper at Fermi level for T = 0 K. Given that, electron density of copper is 8.5×10^{28} electrons/m^3.	4	L2	CO4	PO2
	UNIT - IV	**18**			
5 a.	Derive an expression for energy density of radiation at thermal equilibrium in terms of Einstein's coefficients.	9	L1	CO3	PO1
b.	State total internal reflection. Arrive at the expression for angle of acceptance and numerical aperture in an optical fiber.	9	L1	CO1,3	PO1
c.	i) Calculate the population ratio of two energy levels, if the wavelength of light emitted is 640 nm at 330 K.	4			
	ii) The angle of acceptance of an optical fiber is 30^o when placed in air. Find the angle of acceptance when it is immersed in water of R.I, 1.33.	5	L2	CO4	PO2
	UNIT - V	**18**			
6 a.	Define time of reverberation. Briefly explain the requisites and remedies for acoustically good auditorium.	9	L1	CO1,2	PO1
b.	Explain with the neat diagram, the construction and working of Reddy's Shock tube. List any three applications of Shock waves.	9	L1	CO2	PO1
c.	i) A hall of volume 5500 m^3 is found to have a reverberation time of 2.4 seconds. The sound absorbing surface of the hall has an area of 760 m^2. Calculate the average absorption coefficient.	4			
	ii) Find the depth of a submarine, if an ultrasonic pulse reflected from the submarine is received after a delay of 0.38 seconds after sending out the signal. Given the velocity of ultrasonic sound in sea water is 1440 m/s.	5	L2	CO4	PO2

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