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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; October - 2022

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, $m = 9.11\times10^{-31}$ 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	BLs	COs	POs
	I : PART - A	**10**			
1 a.	What is a matter wave? Mention the expression for its wavelength.	2	L1	CO1	PO1
b.	Define stress and strain.	2	L1	CO1	PO1
c.	Mention the expression for Fermi temperature and Fermi factor.	2	L2	CO2	PO1
d.	Write the expression for numerical aperture and fractional index change of optical fibre.	2	L2	CO2	PO1
e.	Define Mach number and Mach angle.	2	L1	CO1	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
2 a.	i) Define group velocity and Particle velocity.	2	L1,3	CO1,4	PO1
	ii) Derive an expression for de-Broglie wavelength using group velocity.	7			
b.	i) Define Eigen functions.	2	L1,3	CO1,3	PO1
	ii) Set up one dimensional time independent Schrodinger's wave equation.	7			
c.	i) What are the assumptions of Planck's law of radiation?	4			
	ii) An electron has a speed of 300 m/s accurate to 0.01% with what fundamental accuracy can locate the position of the electron?	5	L1,3	CO1,5	PO1,2
	UNIT - II	**18**			
3 a.	i) Define Young's modulus, Bulk modulus and Rigidity modulus.	3	L1,3	CO1,4	PO1
	ii) Derive the relation between elastic constants q, k, n and σ.	6			
b.	Define dielectric material and explain briefly the four types of dielectric	9	L1,2	CO1,3	PO1

c.	i) Derive Clausius-Mossotti relation for a dielectric material.	6			
	ii) Calculate the couple per twist of a wire of length 0.3 m, and radius 0.2×10^{-3} m when a torque of 5×10^{-4} Nm is applied, if the rigidity modulus of the material is 8×10^{10} N/m^2.	3	L3	CO5	PO2,1
	UNIT - III	**18**			
4 a.	Define density of states and obtain an expression for it in solids.	9	L1,3	CO1,3	PO1
b.	i) What are conduction electrons?	1			
	ii) Derive an expression for concentration of electrons in an intrinsic semiconductor.	8	L1,3	CO3	PO1
c.	i) Show the relation between Fermi energy and energy gap for an intrinsic semiconductor.	5			
	ii) The free electron density of aluminium is 18.10×10^{28} m^{-3}. Calculate its Fermi energy at 0 K.	4	L3,2	CO5	PO2,1
	UNIT - IV	**18**			
5 a.	i) With a neat diagram, discuss the process of Induced Absorption.	3			
	ii) Obtain an expression for energy density of radiation under equilibrium condition in terms of Einstein's coefficients.	6	L2,3	CO2,3	PO1
b.	Define optical fiber. Obtain the expression for angle of acceptance and numerical aperture.	9	L1,3	CO1,3	PO1
c.	i) Calculate the ratio of Einstein's coefficient for a system in thermal equilibrium at 300 K in which radiations of wavelength 1.3 μm are emitted.	4			
	ii) Calculate the numerical aperture and angle of acceptance of a given optical fiber if the refractive indices of the core and cladding are 1.563 and 1.498 respectively.	5	L3	CO4	PO1,2
	UNIT - V	**18**			
6 a.	i) Define absorption, reverberation and time of reverberation.	3			
	ii) With a neat diagram, explain the measurement of ultrasonic velocity in a liquid.	6	L1,2	CO1,2	PO1
b.	What are shock waves? Explain the construction and working of Reddy shock tube.	9	L1,2	CO1,2	PO1
c.	i) Mention the basic requirements of the acoustics of building.	4			
	ii) The distance between two pressure sensors in a shock tube is 100 mm. The time taken by a shock wave to travel this distance is 200 μs. If the velocity of sound under the same condition is 340 m/s. Find the Mach number and Mach angle of the shock wave.	5	L2,3	CO1,4	PO1

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