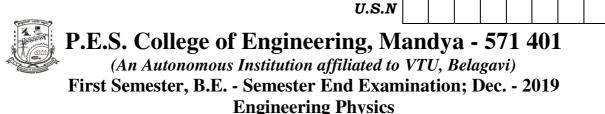
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(Common to All Branches)

Time: 3 hrs

Max. Marks: 100

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

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

Physical constants: Electron mass, $m = 9.11 \times 10^{-31}$ kg, Electron charge, $e = 1.602 \times 10^{-19}$ C; Velocity of light, $c = 3 \times 10^8$ ms⁻¹; Planck's constant, $h = 6.626 \times 10^{-34}$ Js; Boltzmann constant, $K = 1.38 \times 10^{-23}$ JK⁻¹; Avogadro number, $N = 6.025 \times 10^{23}$ /mole; Permittivity of free space, $\varepsilon_o = 8.85 \times 10^{-12}$ 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 1\AA , 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
с.	 i) Define dielectric polarization. Explain briefly the electronic polarization. ii) What force is required to stretch a steel wire to double its length, when its area of cross section is 1 cm² and Young's modulus 2×10¹¹ N/m². 	4 5

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	UNIT - III
3 a.	Define Fermi level, Fermi temperatures, Fermi velocity and Fermi factor. Discuss the
	variations of Fermi factor with energy and temperatures.
b.	Mention the expression for electron and hole concentrations. Derive the expression for
	electrical conductivity of an intrinsic semiconductor.
c.	i) Briefly explain the Fermi level in extrinsic semiconductors.
	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.

	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	4
	equilibrium at 300 K in which radiations of wavelength 1.39 μ m are emitted.	
	ii) The attenuation of light in an optical fiber is estimated to be 2.0 dB/km. What fraction of	5
	the initial intensity remains after 1 km and after 8 km?	
	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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