

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

(An Autonomous Institution affiliated to VTU, Belagavi)
First Semester, B.E. Examination;

Engineering Physics

Time: 3 hrs (Common to All Branches) Max. Marks: 100

Course Outcome

The Students will be able to:

CO1: Understand the basic concepts and principles of Physics in describing the phenomena related to engineering field.

CO2: Explain the properties of various materials like metals, dielectrics, semiconductors, superconductors, nanomaterials applicable to engineering field.

CO3: Apply the knowledge of Physics allied with the field of engineering applications.

CO4: Formulate the expressions for the concepts of Physics pertaining to engineering field.

CO5: Analyze by solving the problems in Physics for better understanding of engineering concepts.

<u>Note</u>: Answer <u>FIVE</u> full questions, selecting <u>ONE</u> full question from each <u>Unit</u>

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, $K = 1.38x10^{-23}$ JK¹; Avogadro number, $N = 6.025x10^{23}$ /mole; Permittivity of free space, $\varepsilon_o = 8.85x10^{-12}$ Fm⁻¹.

Q. No	Questions	Marks	co	BL	PO				
UNIT - I									
1 a)	(i) Define the three modulli of elasticity.(ii) Explain the Poisson's ratio must lies between -1 and 0.5 using the relation between three modulli of elasticity.	2 6	CO1, CO2	L1, L2	PO1				
b)	(i) Define Piezoelectricity and Ferroelectricity.(ii) Mention the applications of dielectric materials.	3 4	CO1, CO3	L1	PO1				
c)	(i) What is bending of beam? (ii) Explain I-shaped girders.	5	CO1, CO2	L1, L2	PO1				
2 a)	(i) Define Dielectric loss. (ii)Derive Clausius-Mossotti equation for a dielectric material.	2 6	CO1, CO4	L1, L3	PO1				
b)	Derive an expression for Yong's modulus (q) by uniform bending method.	7	CO4	L3	PO1				
c)	The dielectric constant of sulphur is 3.4, assuming the internal field as Lorentz field; calculate the electronic polarizability of sulphur. Give that density of sulphur = $2.07 \times 10^3 \text{ kg/m}^3$ and atomic weight = 32.07 .	5	CO5	L3	PO2				
	UNIT - II		•						
3 a)	How black body radiation spectrum can be explained using Planck's law, Wien's law and Rayleigh-Jeans law.	8	CO1	L1	PO1				
b)	(i) What is wave function?(ii) Explain the physical significance of a wave function.	7	CO1, CO2	L1, L2	PO1				
c)	Compare the de-Broglie wavelength of a 2000 kg automobile travelling at a speed of 50 m/s and 0.2 kg bullet travelling at a speed of 250 m/s.	5	CO5	L2	PO2				
4 a)	Solve Schrodinger's wave equation for allowed energy values in case of a particle in an infinite potential well.	8	CO4	L3	PO1				
b)	(i) Mention the characteristics properties of matter wave.(ii) Obtain the relation between group velocity, phase velocity and velocity of light.	2 5	CO1, CO3	L1, L3	PO1				
c)	An electron is bound in one dimensional potential box of width 4×10^{-10} m. compute the energy and de-Broglie wavelengths in ground state and first excited state.	5	CO5	L3	PO2				

5 a) Derive an expression for the hole concentration in an intrinsic semiconductors. 8 CO4 L3 PO1 b) Explain the variation of Fermi energy with temperature at T = 0K and T > 0K. 7 CO2 L2 PO1 c) Show that $E_r = \left(\frac{E_c + E_c}{2}\right)^{-3} \frac{3}{4} R \ln \left(\frac{m_c}{m_c}\right)^{-3}$. 5 CO3 L3 PO1 6 a) (i) Define density of states of conduction electrons for unit volume of metal. 1 CO1, L1, CO4 L1, CO4 L3 PO1 b) Explain the significance of Fermi level in intrinsic and extrinsic semiconductors. 7 CO2 L2 PO1 c) Calculate the probability of an electron occupying an energy level of 0.05 eV at 500 K above and below the Fermi level. VIII VIII CO5 L2 PO1 UNIT - IV Value a brief note on temperature dependence of resistivity and critical magnetic field in a superconductors? CO2 L2 PO1 L2 PO1 b) Write a brief note on Carbon nanotubes and their types with some important properties. 7 CO1 L2 PO1 c) Define Isotopic effect. (ii) Write a brie		UNIT – III								
c) Show that $E_F = \left(\frac{E_c + E_v}{2}\right)^{-3} \frac{1}{4} Y \ln \left(\frac{m_s^2}{m_s^2}\right)^{-3}$ (i) Define density of states. (ii) Derive an expression for the density of states for conduction electrons for unit volume of metal. (i) Explain the significance of Fermi level in intrinsic and extrinsic semiconductors. (ii) Explain the probability of an electron occupying an energy level of 0.05 eV at 500 K above and below the Fermi level. (ii) What are superconductors? (iii) Write a note on temperature dependence of resistivity and critical magnetic field in a superconductor. (iii) Write a note on Carbon nanotubes and their types with some important properties. (iv) In a superconducting material Isotopic mass is 199.5 amu and critical temperature is 5 K. Calculate isotopic mass at 5.2 K. 8 a) Explain the confinement of electron energy states in 0D, 1D, 2D and 3D system. 8 CO2 1.2 PO1 (iv) Designe Isotopic effect. (iv) In a superconducting material Isotopic mass at 5.2 K. 8 a) Explain the confinement of electron energy states in 0D, 1D, 2D and 3D system. 8 CO2 1.2 PO1 (b) Explain Meissner's effect and Type-II superconductor. (c) Discuss briefly on Scanning Tunneling Microscope (STM). (iv) Designe material state. (iv) Write a note on population inversion. (iv) Define enable of acceptance and numerical aperture. (iv) With a near diagram, explain step index multimode optical fiber. (iv) Observable and the properties in sea is reflected by a submerged target at a distance 597.5m and reaches the sources after 0.83s. Find the velocity of sound in sea water. (d) Discuss the various factors affecting the acoustics of an auditorium. 5 CO2 1.2 PO1 10 a) A pulse from laser with power 1 mW last for 9 ns. If the number of photons entitled per second is 3.41 x 10', calculate the wavelength of laser. (ii) Write a brief note on applications of ultrasonic waves in different fields. 5 CO3 1.3 PO2	5 a)	Derive an expression for the hole concentration in an intrinsic semiconductors.	8	CO4	L3	PO1				
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