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.*

Note: Answer **FIVE** full questions, selecting **ONE** full question 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	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 x 10^3 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 x 10^{-10} m. compute the energy and de-Broglie wavelengths in ground state and first excited state.	5	CO5	L3	PO2

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UNIT – III					
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 $E_F = \left(\frac{E_C + E_V}{2}\right) - \frac{3}{4}kT\ln\left(\frac{m_e^*}{m_h^*}\right)$.	5	CO3	L3	PO1
6 a)	(i) Define density of states. (ii) Derive an expression for the density of states for conduction electrons for unit volume of metal.	1 7	CO1, CO4	L1, 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.	5	CO5	L3	PO2
UNIT - IV					
7 a)	(i) What are superconductors? (ii) Write a note on temperature dependence of resistivity and critical magnetic field in a superconductor.	2 6	CO1, CO1	L1, L2	PO1
b)	Write a brief note on Carbon nanotubes and their types with some important properties.	7	CO1	L2	PO1
c)	(i) Define Isotopic effect. (ii) In a superconducting material Isotopic mass is 199.5 amu and critical temperature is 5 K. Calculate isotopic mass at 5.2 K.	5	CO1, CO5	L1, L3	PO1, PO2
8 a)	Explain the confinement of electron energy states in 0D, 1D, 2D and 3D system.	8	CO2	L2	PO1
b)	Explain Meissner's effect and Type–II superconductor.	7	CO2	L2	PO1
c)	Discuss briefly on Scanning Tunneling Microscope (STM).	5	CO2	L2	PO1
UNIT - V					
9 a)	(i) Define metastable state. (ii) Write a note on population inversion.	2 3	CO1, CO1	L1, L2	PO1
b)	(i) Define angle of acceptance and numerical aperture. (ii) With a neat diagram, explain step index multimode optical fiber.	2 3	CO1, CO2	L1, L2	PO1
c)	(i) What is meant by non-destructive method of testing the materials? (ii) An ultra sound pulse sent by a source 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.	2 3	CO1, CO5	L1, L3	PO1, PO2
d)	Discuss the various factors affecting the acoustics of an auditorium.	5	CO2	L2	PO1
10 a)	A pulse from laser with power 1 mW last for 9 ns. If the number of photons emitted per second is 3.41×10^7, calculate the wavelength of laser.	5	CO5	L3	PO1
b)	Calculate the numerical aperture and angle of acceptance of a given optical fiber, if the refractive index of core and cladding are 1.55 and 1.50 respectively.	5	CO5	L3	PO2
c)	Write a brief note on applications of ultrasonic waves in different fields.	5	CO3	L2	PO1
d)	What are the basic requirements of a good acoustics?	5	CO1	L1	PO1

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