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 describing the phenomena associated with Engineering field.*

CO2: ***Explain/Describe*** *the properties of various materials, light and sound related to Engineering applications.*

CO3: ***Formulate/Derive*** *the Expressions for the concepts of Physics pertaining to Engineering field.*

CO4: Apply the knowledge of Physics to ***analyze/solve*** *the numerical problems allied to Engineering field.*

Note: Answer **FIVE** full questions, selecting **ONE** full question 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	CO	BL	PO
	UNIT - I				
1 a)	Obtain an expression for Poisson's ratio in terms of Young's modulus, Bulk modulus and Rigidity modulus of the material.	8	CO3	L1	PO1
b)	What are dielectric materials? Derive Clausius-Mossotti relation for a dielectric material.	7	CO1 & CO3	L1	PO1
c)	A wire of 3m long and 0.625 x 10^{-4} m^2 in cross section is found to stretch 0.003 m under a tension of 1200 kilograms. What is the Young's modulus of the material of the wire?	5	CO4	L2	PO2
2 a)	Explain four types of dielectric polarization mechanisms.	8	CO2	L1	PO1
b)	Deduce an expression for the bending moment of a beam with rectangular cross section.	7	CO3	L1	PO1
c)	Calculate the polarization of dielectric constant 16 in presence of an electric field of 1000 V/m.	5	CO4	L2	PO2
	UNIT – II				
3 a)	State Stefan's law of radiation. Explain the salient features of blackbody radiation spectrum.	8	CO1 & CO2	L1	PO1
b)	State Heisenberg's uncertainty principle with an expression. Show that the electron doesn't exist inside the nucleus of an atom.	7	CO1 & CO2	L1	PO1
c)	Compare the energy of photons with that of an electron when both are associated with a wavelength of 0.2 nm.	5	CO4	L2	PO2
4 a)	Derive the expression for energy Eigen value and Eigen function for an electron in a potential well of infinite depth.	8	CO3	L1	PO1
b)	Mention the characteristics properties of matter wave. Obtain the relation between group velocity, phase velocity and velocity of light.	7	CO1 & CO3	L1	PO1
c)	Find the energy of an electron (eV) in a ground state and first excited state when it is trapped in an infinite potential well of width 1.5 Å.	5	CO4	L2	PO2

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UNIT – III					
5 a)	Explain the significance of Fermi-level in an n-type semiconductor and obtain the expression for intrinsic charge carrier concentration.	8	CO2	L1	PO1
b)	Describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory.	7	CO1	L1	PO1
c)	The following data are given for intrinsic germanium at 300 K. n_i = 2.4 x $10^{19}/m^3$, μ_e = 0.39 m^2/Vs, μ_h = 0.19 m^2/Vs. Calculate the conductivity and resistivity of the sample.	5	CO1	L1	PO1
6 a)	Define Fermi energy and Fermi factor. Discuss the dependence of Fermi factor with energy and temperature.	8	CO1	L1	PO1
b)	(i) Explain the significance of Fermi level in an intrinsic semiconductor. (ii) Find the relation between Fermi level and energy gap of an intrinsic semiconductor.	7	CO2 & CO4	L1 & L2	PO1 & PO2
c)	Calculate the probability of an electron occupying an energy level 0.05 eV above the Fermi level at 300 K and 500 K in a metal.	5	CO4	L2	PO2
UNIT - IV					
7 a)	With a neat diagram, discuss briefly the construction and working of Carbon dioxide laser.	8	CO1	L1	PO1
b)	Define Lambert's law. Obtain an expression for attenuation co-efficient in an optical fiber of length L.	7	CO1 & CO3	L1	PO1
c)	Write a note on Lasers in range finder with their advantages.	5	CO1	L1	PO1
8 a)	Distinguish between Single mode step index and Graded Index multimode optical fiber	8	CO1	L1	PO1
b)	Obtain the expression for energy density of radiation under equilibrium condition in terms of Einstein's coefficients.	7	CO3	L1	PO1
c)	A step index optical fiber has diameter of 60 µm, a core index of 1.48 and the cladding index of 1.41. If the wavelength of the light source is 0.8 µm, determine the number of modes present in the fiber.	5	CO4	L2	PO2
UNIT - V					
9 a)	(i) Describe the experimental determination of velocity of ultrasonic in solids. (ii) Mention the basic requirements of the acoustically auditorium.	8	CO1	L1	PO1
b)	Describe the experiment to prove that a superconductor is a perfect diamagnet.	7	CO1	L1	PO1
c)	Discuss sharpness of resonance.	5	CO2	L1	PO1
10 a)	(i) Define reverberation and reverberation time; and write an expression for reverberation time. (ii) Find the depth of a submarine if ultrasonic pulse reflected from the submarine is received in 0.33 s after sending out the ultrasonic waves. Given that the velocity of ultrasonic's in sea water is 1440 m/s.	8	CO1, CO2 & CO4	L1 & L2	PO1 & PO2
b)	Write a note on (i) Superconducting magnet and (ii) Maglev vehicle	7	CO1	L1	PO1
c)	Define forced, damped and un damped vibration.	5	CO1	L1	PO1

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