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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; May / June - 2019

Engineering Physics

(Common to All Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

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	COs	BL	POs
	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 3 m long and 0.625×10^{-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 values and Eigen functions 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 of an intrinsic semiconductor.	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. $n_i = 2.4 \times 10^{19}/m^3$, $\mu_e = 0.39\ m^2/Vs$, $\mu_h = 0.19\ m^2/Vs$. 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 coefficient 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 (ii) Maglev vehicle	7	CO1	L1	PO1
c.	Define forced, damped and un damped vibration.	5	CO1	L1	PO1

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