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

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, B.E. - Semester End Examination; Dec - 2017/Jan - 2018

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.	UNIT - I	Marks	CO	BL	PO
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	L3	PO1
b)	(i) Define dipole moment. (ii) Derive Clausius-Mossotti relation for a dielectric material.	1 6	CO1, CO4	L1, L3	PO1
c)	(i) State Hook's law. (ii) Explain stress-strain diagram.	1 4	CO1, CO2	L1, L2	PO1
2 a)	Explain four types of dielectric polarization mechanisms.	8	CO2	L2	PO1
b)	Derive an expression for Young's modulus (q) by uniform bending method.	7	CO4	L3	PO1
c)	(i) What are dielectric materials? (ii) Calculate the polarisability of a dielectric material of dielectric constant 16 in presence of an electric field of 1000 V/m.	2 3	CO1, CO5	L1, L3	PO1, PO2
	UNIT - II				
3 a)	(i) What is ultraviolet catastrophe? (ii) Discuss in brief Wien's law and Rayleigh-Jeans laws to explain blackbody radiation spectrum.	2 6	CO1, CO2	L1, L2	PO1
b)	(i) State and explain Heisenberg's uncertainty principle. (ii) Prove that the electron doesn't exist inside the nucleus of an atom.	2 5	CO1, CO4	L1, L3	PO1
c)	Calculate the de-Broglie wavelength associated with an electron of a kinetic energy 2000 eV. Also find its momentum.	5	CO5	L3	PO2
4 a)	Explain the physical significance of a wave function and mention its properties.	8	CO2	L2	PO1
b)	(i) Define group velocity? (ii) Derive the relation between group velocity and particle velocity.	1 6	CO1, CO4	L1, L3	PO1
c)	Find the energy of an electron (eV) in a ground state when it is trapped in an infinite potential well of width 1.2 Å.	5	CO5	L3	PO2

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Q. No.	UNIT - III	Marks	CO	BL	PO
5 a)	Derive an expression for intrinsic carrier concentration of an intrinsic semiconductor in terms of energy gap.	8	CO4	L3	PO1
b)	Describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory.	7	CO2	L2	PO1
c)	Distinguish between conductors, insulators and semiconductors on the basis of band theory of solids.	5	CO2	L2	PO1
6 a)	(i) Define density of states. (ii) Obtain an expression for density of states in solids.	1 7	CO1, CO4	L1, L3	PO1
b)	(i) Define Fermi energy and Energy gap. (ii) Show that $E_F = \left(\frac{E_C + E_V}{2}\right)$	2 5	CO1, CO3	L1, L3	PO1
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 material.	5	CO5	L3	PO2
	UNIT - IV				
7 a)	Write a note on: i) Critical temperature ii) Critical magnetic field iii) Critical current iv) Isotopic Effect.	8	CO1	L2	PO1
b)	Discuss the variation of physical properties from bulk to thin film and thin film to nanomaterials.	7	CO2	L2	PO1
c)	Calculate the critical current for a wire of lead having a diameter of 3 mm at 5 K. The critical temperature for lead is 8 K and critical field is 5×10^4 Am^{-1} at 0 K.	5	CO5	L3	PO2
8 a)	(i) What are nanomaterials? (ii) Write important applications of nanomaterials.	2 6	CO1, CO3	L1, L2	PO1
b)	Describe the experiment to prove that a superconductor is a perfect diamagnet.	7	CO2	L2	PO1
c)	Write a brief note on: (i) Length scales and (ii) Mesoscopic state.	5	CO1	L2	PO1
	UNIT - V				
9 a)	(i) What is LASER? (ii) Explain briefly the term Laser cavity.	1 4	CO1, CO2	L1, L2	PO1
b)	Derive the expression for numerical aperture of an optical fiber.	5	CO4	L3	PO1
c)	Explain how the elastic constants in solid can be determined using ultrasonics.	5	CO2	L2	PO1
d)	(i) What is Echelon effect? (ii) A cinema theatre has a volume of 7500 m^3. What should be the total absorption in the theatre if reverberation time of 1.5 s is to be maintained?	2 3	CO1, CO5	L1, L3	PO1, PO2
10 a)	With a neat diagram, discuss briefly the working of Semiconductor diode laser.	5	CO2	L2	PO1
b)	An optical fiber has clad of refractive index 1.5 and numerical aperture 0.39. Find the refractive index of the core and the acceptance angle.	5	CO5	L3	PO2
c)	(i) What are ultrasonics waves? (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 ultrasonics in sea water is 1440 m/s.	2 3	CO1, CO5	L1, L3	PO1, PO2
d)	(i) Define reverberation and reverberation time. (ii) Discuss Sabine's formula.	2 3	CO1, CO2	L1, L2	PO1

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