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

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, B.E. - Semester End Examination; June - 2016

Engineering Physics

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

***Physical Constants:** Electron mass = 9.11x10^{-31} kg, Planck's constant = 6.63x10^{-34}Js, Electron charge = 1.602x10^{-19}C, Boltzmann constant = 1.38x10^{-23}J/K, Avogadro number = 6.025x10^{26}/k mole, Permittivity of free space = 8.854x10^{-12} F/m, Velocity of light = 3x10^{8} m/s.*

UNIT - I

1 a. Explain stream line flow and conservation of mass. Obtain the expression for equation of continuity for a fluid. 8

b. Explain Bernoulli's equation in a fluid. Mention the applications of venturi tube. 7

c. A solid elemental dielectric has a density 3.08x10^{28} atoms/m^3 and its relative permittivity is 4. Calculate electronic polarizability. 5

2 a. Explain four types of polarizations. 8

b. Derive the equation for internal field in solids for one dimensional array of atoms. 7

c. The radius of the aorta is about 0.01 m and the blood flowing through it has a speed of about 0.3 ms^{-1}. Calculate the average speed of the blood in the capillaries using the fact that although each capillary has a diameter of about 8x10^{-6} m, there are literally millions to them so that their total cross section is about 0.2 m^2. 5

UNIT - II

3 a. Explain Planck's law, Wien's law, Rayleigh-Jeans law and Stefan-Boltzmann law. 8

b. Explain group velocity. Derive the expression for deBroglie wavelength using the concept of group velocity. 7

c. An electron is bound in a one dimensional box of width 4x10^{-10} m. Compute the energy and deBroglie wavelength of ground and first excited states. 5

4 a. Explain the significance of wave function. Setup time independent Schrodinger's wave equation. 8

b. State and explain Heisenberg's uncertainty principle. Show that the electron does not exist inside the nucleus. 7

c. Calculate the deBroglie wavelength of a 1000 kg automobile travelling at 100 m/s and a 0.1 kg bullet travelling at 500 m/s. 5

Contd…2

UNIT - III

5	a.	What are the merits of chemical free electron theory? Explain the failures of it.	8
	b.	Obtain an expression for density of energy states in metals.	7
	c.	Find the relation between Fermi level and energy gap of an intrinsic semiconductor.	5
6	a.	Distinguish between conductors, semiconductors and insulators on the basis of band theory. Explain the Fermi level in an intrinsic semiconductor.	8
	b.	Derive an expression for density of charge carriers in an intrinsic semiconductor.	7
	c.	Find the temperature at which there is 10% probability that a state with energy 0.5 eV above Fermi level will be occupied.	5

UNIT - IV

7	a.	Explain 0 - D, 1 - D, 2 - D and 3 - D nano systems with examples.	8
	b.	Explain the types, properties and applications of carbon nano tube.	7
	c.	Write a note on SQUIDS.	5
8	a.	Explain Meissner's effect and discuss magnetic levitation.	8
	b.	Define critical current and isotopic effect for superconductors. Discuss BCS theory of super conductors.	7
	c.	Describe working of scanning tunnelling electron microscope.	5

UNIT - V

9	a.	Explain the term 'Stimulated emission' and obtain an expression for energy density of radiation in terms of Einstein's coefficients.	8
	b.	Discuss different types of optical fibres.	7
	c.	The volume of a room is 600 m^3. The total area of a room is 460 m^2 and the average absorption coefficient is 0.24. Calculate the reverberation time.	5
10	a.	Explain the terms 'reverberation time' and 'absorption coefficient'. Discuss the various factors affecting the acoustics of an auditorium.	8
	b.	How ultrasonics is used to determine the flows in a material by non destructive method of testing?	7
	c.	Find attenuation in optical fibre of length 500 m, when a light signal of power 100 mW emerges out of fibre with 90 mW.	5

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