Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN | | | | | | | | | | | Course Code **21PHY12/22**

First/Second Semester B.E. Degree Examinations, September/October 2022

ENGINEERING PHYSICS

(Common to all Branches)

Duration: 3 hrs **Max. Marks: 100**

Note: 1. Answer any **FIVE** *full questions, choosing* **ONE** *full question from each module.*

2. Missing data, if any, may be suitably assumed

Physical constants: Velocity of light (C)=3×10^8 m/s ; Plank's constant (h)=6.63×10^{-34} J-S ; Mass of the Electron (m)=9.11×10^{-31} Kg ; Boltzmann constant (K)=1.38×10^{-23} J/K ; Avogadro number (N_A)= 6.02×10^{26} /K mole

Q. No		Question	Marks	(RBTL:CO:PI)
		Module - 1		
1	a	State and explain Heisenberg's uncertainty principle. Show that electron cannot exist inside the nucleus.	08	(2:1 : 1.1.1)
	b	Starting from Schrodinger wave equation, derive the expression for energy Eigen value and Eigen function for an electron in one dimensional potential well of infinite height.	08	(2:1 : 1.1.1)
	c	An electron is bound in a 1-dimensional potential well in infinite height of width 1 Å. Calculate its energy values in the ground state and also in the first two excited states.	04	(2:1 : 2.1.3)
		(OR)		
2	a	Derive the one dimensional time independent Schrodinger wave equation.	06	(2:1 : 1.1.1)
	b	Derive deBroglie wave length equation and explain the properties of wave function.	10	(2:1 : 1.1.1)
	c	A particle of mass 0.5 MeV/C^2 has kinetic energy 100 eV. Calculate its de Broglie wavelength, where C is velocity of light.	04	(2:1 : 2.1.3)
		Module - 2		
3	a	Write the assumptions of classical free electron theory and explain the failures of CFET.	08	(2:2 : 1.2.1)
	b	Define Fermi factor. Explain the variation of Fermi factor with temperature and draw the probability curve.	08	(2:2 : 1.1.1)
	c	Calculate the probability of an electron occupying energy level 0.02 eV above the Fermi level at 200 K in a material.	04	(2:2 : 2.1.3)
		(OR)		
4	a	Explain Hall effect? Derive the expression for Hall coefficient, and express Hall voltage in terms of Hall coefficient.	10	(2:2 : 1.1.1)
	b	Explain polar, non-polar dielectrics and mention the relation between dielectric constant and polarization.	06	(2:2 : 1.1.1)
	c	The resistivity of intrinsic germanium at 27^0 C is equal to 0.47 Ω-m. Assuming the electron and hole mobilities as 0.38 and 0.18 m^2/V-Sec respectively. Calculate intrinsic carrier density.	04	(2:2 : 2.1.3)
		Module-3		
5	a	Derive the expression for energy density interms of Einstein's coefficient.	08	(2:3 : 1.1.1)
	b	Explain the construction and working of semiconductor laser with neat energy level diagrams.	08	(2:3 : 1.2.1)
	c	Calculate the wavelength of laser emitted from an intrinsic semiconductor laser if the band gap energy is 0.02 eV.	04	(2:3 : 2.1.3)

(RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)

(OR)

6	a	Explain numerical aperture, acceptance angle and derive the expression for numerical aperture and acceptance angle of an optical fiber.	08	(2:3 : 1.1.1)
	b	Describe different types of optical fibers with neat diagrams including geometry, refractive index profile and propagation of waves.	08	(2:3 : 1.2.1)
	c	The refractive indices of core and cladding are 1.50 and 1.48 respectively in an optical fiber. Calculate the numerical aperture and acceptance angle.	04	(2:3 : 2.1.3)

Module-4

7	a	State Hooke's law and explain the nature of elasticity with the help of stress-strain diagram.	08	(2:4 : 1.2.1)
	b	Define Poisson's ratio. Derive relation among Young's modulus (Y), Rigidity modulus (η) and Poisson's ratio (σ).	08	(2:4 : 1.1.1)
	c	Calculate the force required to produce an extension of 1 mm in steel wire of length of 2 m and diameter 1 mm.(Given $Y = 2 \times 10^{11} N/m^2$)	04	(2:4 : 2.1.3)

(OR)

8	a	Derive relation for Young's modulus of the material of a single cantilever in terms of depression at the free end.	08	(2:4 : 1.1.1)
	b	Derive an expression for couple per unit twist for a solid cylinder with a diagram.	08	(2:4 : 1.1.1)
	c	Calculate the twisting couple on a solid cylindrical rod of length 1.5 m and radius 80 mm when it is twisted through an angle 0.6^0. (Given $\eta = 93\times10^9 N/m^2$)	04	(2:4 : 2.1.3)

Module-5

9	a	Define simple harmonic motion with two examples and derive differential equation for SHM.	08	(2:5 : 1.1.1)
	b	Explain the theory of forced oscillations and obtain equation for amplitude.	08	(2:5 : 1.1.1)
	c	Calculate the frequency of a spring of force constant 1974 N/m carrying a mass of 2 kg.	04	(2:5 : 2.1.3)

(OR)

10	a	Explain principle, construction and working of X-Ray diffractometer with a neat diagram.	10	(2:5 : 1.2.1)
	b	Explain principle, construction and working of scanning electron microscope with a neat diagram.	10	(2:5 : 1.2.1)

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(RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)