Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN | | | | | | | | | | | **Course Code** | 2 | 1 | P | H | Y | 1 | 2 |

First Semester B.E. Degree Examinations, May 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: Planck's constant (h) = 6.626 $\times 10^{-34}$ J-s, Boltzmann constant =1.38$\times 10^{-23}$ J/K, Velocity of Light = 3×10^{8} m/s, Mass of electron = 9.109 $\times$ 10^{-31} kg, One electron Volt = 1.6 $\times$ 10^{-19} Joules, Avogadro number = 6.023$\times 10^{-26}$ /k mol, Acceleration due to gravity = 9.8 ms^{-2}, Permittivity of vacuum =8.854 $\times 10^{-12}$ Fm^{-1}

Q. No		Question	Marks	(RBTL:CO:PI)
		Module - 1		
1	a	What are matter waves? Explain de-Broglie hypothesis. Derive the other forms of de-Broglie wave length equations.	08	(2:1 : 1.1.1)
	b	Derive one dimensional Schrödinger wave equation for a particle in motion.	08	(2:1 : 1.2.1)
	c	An electron has a speed of 4.8×10^{5} m/s accurate to 0.012 %. With what accuracy position of the electron can be located.	04	(2:1 : 2.1.3)
		(OR)		
2	a	State Heisenberg's uncertainty principle and show that electrons do not exist in the nucleus.	08	(2:1 : 1.2.1)
	b	Using Schrodinger wave equation, derive the expression for energy of a particle in a potential well of infinite height and show that they are discrete.	08	(2:1 : 1.1.1)
	c	An automobile with a mass of 100 g moves at a speed of about 50 km/hr. Find their de Broglie wavelength.	04	(2:1 : 2.1.3)
		Module - 2		
3	a	Explain the assumptions of quantum free electron theory. Explain the merit of quantum free electron theory with one of the facts.	08	(2:2 : 1.1.1)
	b	Derive an expression for Hall coefficient in terms of Hall voltage. Mention any two applications of Hall effect.	08	(2:2 : 1.1.1)
	c	Calculate the Fermi energy for a metal at 0 K, whose density is 10500 kgm^{-3}, atomic weight is 107.9 and it has one conduction electron per atom.	04	(2:2 : 2.1.3)
		(OR)		
4	a	Derive the relation between Fermi energy and energy gap for an intrinsic semiconductor.	08	(2:2 : 1.2.1)
	b	What are dielectric materials? Mention different types of polarizations in dielectric materials and explain any two in detail.	08	(2:2 : 1.1.1)
	c	An elemental solid dielectric material has polarisability 7×10^{-40} Fm^{-2}. Assuming the internal field as Lorentz field, calculate the dielectric constant for the material if the material has 3×10^{28} atoms/m^{3}	04	(2:2 : 2.1.3)
		Module-3		
5	a	Mention the requisites of laser. Explicit the significance of metastable state and resonant cavity in the laser action.	05	(2:3 : 1.1.1)
	b	State the working principle of optical fiber. Derive an expression for numerical aperture for an optical fiber.	07	(2:3 : 1.1.1)

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

	c	With neat diagram, explain the application of laser in welding. Mention any two advantages over the conventional welding.	**05**	**(2:3 : 1.1.1)**
	d	Find the attenuation in the optical fiber of length 5 km, when the light signal of power 100 mW emerges out from the fiber with a power 90 mW.	**03**	**(2:3 : 2.1.3)**
		(OR)		
6	**a**	With neat energy level diagram, explain the working of CO_2 gas laser. Mention the role of nitrogen and helium in the laser system.	**08**	**(2:3 : 1.1.1)**
	b	Explain the point to point communication in an optical fibre. Mention any two advantages over the conventional communication.	**08**	**(2:3 : 1.1.1)**
	c	Calculate the wavelength of a laser source if the ratio of population of two energy levels is 1.059×10^{-30} at a temperature of 300 K.	**04**	**(2:3 : 2.1.3)**
		Module-4		
7	**a**	State Hooke's law. Briefly explain stress-strain graph.	**06**	**(2:4 : 1.1.1)**
	b	Derive an expression for Young's modulus of a rectangular material of a single cantilever beam.	**10**	**(2:4 : 1.2.1)**
	c	A rectangular solid has a dimension 6 × 6 × 2 cm. A force of 0.3 N is applied tangentially to the upper surface caused the displacement of 0.15 mm relative to the lower surface. Calculate the shearing rigidity modulus.	**04**	**(2:4 : 2.1.3)**
		(OR)		
8	**a**	Derive the expression for twisting couple of a solid cylinder	**08**	**(2:4 : 1.2.1)**
	b	Define the terms Young's modulus and Bulk modulus. Show that the relation between Young's modulus (Y), bulk modulus (K) and Poisson's ratio (σ) is $Y = 3K(1 - 2\sigma)$	**08**	**(2:4 : 1.2.1)**
	c	Calculate the angular twist of a wire of length 0.3 m and radius 0.2 mm, when torque of 5×10^{-4} Nm is applied. (Given: Rigidity modulus of the wire is 8×10^{10} Nm^{-2}).	**04**	**(2:4 : 2.1.3)**
		Module-5		
9	**a**	What is Simple Harmonic Motion? Derive the differential equation of SHM.	**06**	**(2:5 : 1.2.1)**
	b	With neat block diagram, explain the construction and working of x-ray diffractometer. Mention its applications.	**10**	**(2:5 : 1.1.1)**
	c	A mass of 0.5 kg causes an extension of 0.03 m in a spring and the system is set for oscillations. Calculate the time period of the oscillation.	**04**	**(2:5 : 2.1.3)**
		(OR)		
10	**a**	What are nano materials? Explain why the properties of bulk materials change at nanoscale.	**06**	**(2:5 : 1.1.1)**
	b	Define forced vibration. Establish the differential equation of forced vibration and hence derive the expression for amplitude and phase of the forced vibration.	**10**	**(2:5 : 1.2.1)**
	c	In the mass-spring system as shown in Figure.Q10(c), k_1=2000 Nm^{-1} and k_2 = 1500 Nm^{-1}, find the applied mass 'm' such that the system has a natural frequency of 10 Hz.	**04**	**(2:5 : 2.1.3)**

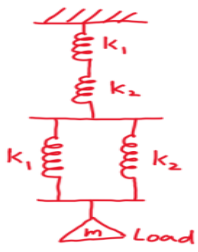

Figure.Q10(c)

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