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 Make-up Examinations, August 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) = 6.625 × 10^{-34} J-s, Mass of electron (m) = 9.1 × 10^{-31} kg, Charge of electron (e) = 1.602 × 10^{-19} C, Boltzmann constant (k) = 1.38 × 10^{-23} J/K, Velocity of light (c) = 3 × 10^{8} m/s.

Q. No		Question	Marks	(RBTL:CO:PI)
		Module - 1		
1	a	Derive One-dimensional time independent Schrödinger wave equation.	08	(2:1 : 1.1.1)
	b	State and explain Heisenberg Uncertainty principle. Show that the electron emitted during Beta-decay does not pre-exist inside the nucleus using uncertainty principle.	08	(2:1 : 1.1.1)
	c	A particle of mass 0.5 MeV/c^2 has free energy 100 eV. Find its de-Broglie wavelength; where 'c' is the velocity of light.	04	(2:1 : 2.1.3)
		(OR)		
2	a	Staring from Schrödinger time independent wave equation, derive the expression for energy Eigen value and Eigen function for an electron present in 1-dimensional potential well of infinite depth.	10	(2:1 : 1.1.1)
	b	What are matter waves? Mention their properties?	06	(2:1 : 1.2.1)
	c	An electron is bound in a one dimensional potential well of width 1A^0 of infinite height. Calculate the energy value of first two allowed state?	04	(2:1 : 2.1.3)
		Module - 2		
3	a	Write the assumptions of quantum free electron theory. Discuss two success of quantum free electron theory.	08	(2:2 : 1.2.1)
	b	Explain Fermi level in intrinsic semiconductor and hence derive the expression for Fermi level in terms of energy gap of intrinsic semiconductor.	08	(2:2 : 1.1.1)
	c	Calculate the Fermi energy and Fermi velocity of a metal at 0 K whose density is 10500 kg/m^3, atomic weight is 107.9 and has one free electron per atom.	04	(2:2 : 2.1.3)
		(OR)		
4	a	Define internal field in case of solid dielectrics. Derive Clausius-Mossotti equation.	08	(2:2 : 1.1.1)
	b	Explain the Hall Effect? Obtain the expression for Hall voltage in terms of Hall co-efficient.	08	(2:2 : 1.1.1)
	c	If NaCl crystal is subjected to an electric field of 1000 V/m and the resulting polarization is 4.3×10^{-8} C/m^2. Calculate the dielectric constant of NaCl?	04	(2:2 : 2.1.3)

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

Module-3

5	**a**	With a proper energy band diagram explain the construction and working of Semiconductor laser. Mention any two applications of Semiconductor laser.	**08**	**(2:3 : 1.2.1)**
	b	Explain the three types of attenuation in optical fiber. Obtain the expression for attenuation coefficient.	**08**	**(2:3 : 1.1.1)**
	c	A pulsed laser emits photons of wavelength is 780 nm with 20 mW average power/pulse. Calculate the number of photons contained in each pulse of the pulse duration is 10 n-sec.	**04**	**(2:3 : 2.1.3)**

(OR)

6	**a**	With neat diagrams explain different types of optical fiber. Define V number?	**08**	**(2:3 : 1.2.1)**
	b	Derive an expression for energy density of radiation under equilibrium condition in terms of Einstein coefficients?	**08**	**(2:3 : 1.1.1)**
	c	The attenuation of light in an optical fiber is 3.6 dB/km. What fractional initial intensity remains that after (i) 1 km, (ii) after 3 km?	**04**	**(2:3 : 2.1.3)**

Module-4

7	**a**	Define bending moment. Derive the expression for bending moment in terms of moment of inertia.	**08**	**(2:4 : 1.1.1)**
	b	Derive the expression for twisting couple of a solid cylinder.	**08**	**(2:4 : 1.1.1)**
	c	Calculate the force required to produce an extension of 1mm in steel wire of length 2m and diameter 1mm. ($Y=2.1\times10^{11}N/m^2$)	**04**	**(2:4 : 2.1.3)**

(OR)

8	**a**	Derive the relation between bulk modulus (K), Young's modulus (Y) and Poisson's ratio.	**08**	**(2:4 : 1.1.1)**
	b	State and explain the Hook's law? Explain the nature of elasticity with the help of stress-strain diagram?	**08**	**(2:4 : 1.2.1)**
	c	Calculate the required torque to twist a wire of length 1.5 m, radius 0.0425×10^{-2} m through an angle ($\pi/45$) radian, if the value of rigidity modulus of its material is 8.3×10^{10} N/m^2.	**04**	**(2:4 : 2.1.3)**

Module-5

9	**a**	What are damped oscillations? Derive the expression for decaying amplitude and hence discuss the case of critical damping.	**10**	**(2:5 : 1.1.1)**
	b	Explain the construction and working of X-ray diffractometer?	**06**	**(2:5 : 1.2.1)**
	c	A mass of 4.3 gm is attached to a spring of force constant 17 N/m. This mass spring system is executing SHM. Calculate the frequency of the external force which excites resonance in the system. Ignore the mass of the spring.	**04**	**(2:5 : 2.1.3)**

(OR)

10	**a**	Starting from Hooke's law, derive the differential equation for SHM. Explain the Characteristics of SHM.	**08**	**(2:5 : 1.1.1)**
	b	Explain the construction and working of Scanning Electron Microscope. Mention its application.	**08**	**(2:5 : 1.2.1)**
	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 oscillations.	**04**	**(2:5 : 2.1.3)**

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