U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2023 Semester End Main Examinations

Programme: B.E. **Semester: I**
Branch: CV **Duration: 3 hrs.**
Course Code: 22PH1BSPCV **Max Marks: 100**
Course: Applied Physics for Civil Engineering Stream **Date: 08.04.2023**

Instructions:
1. Answer any FIVE full questions, choosing one full question from each module.
2. Missing data, if any, may be suitably assumed.

Physical constants:

Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
Electronic charge, $e = 1.602 \times 10^{-19}$ C
Boltzmann constant, $k_B = 1.38 \times 10^{-23}$ J/K
Permittivity of free space$= 8.85 \times 10^{-12}$ F/m
Speed of light, $c = 3 \times 10^{8}$ m/s
Planck constant, $h = 6.626 \times 10^{-34}$ Js
Mass of neutron, $m_n = 1.67 \times 10^{-27}$ kg
Mass of proton, $m_p = 1.67 \times 10^{-27}$ kg

Module-I

1	a)	Derive an expression for energy density in terms of Einstein's coefficients under thermal equilibrium.	**08**
	b)	Define coefficient of attenuation and give its formula. Discuss the causes of attenuation.	**08**
	c)	A medium in thermal equilibrium at temperature 300 K has two energy levels with a wavelength separation of 1 μm. Find the ratio of population densities of the upper and lower levels.	**04**

OR

2	a)	Define numerical aperture. Derive an expression for numerical aperture of an optical fibre.	**08**
	b)	Describe with energy band diagram the construction and working of a semiconductor diode laser.	**08**
	c)	The numerical aperture of an optical fibre is 0.2 when surrounded by air. Determine the refractive index of its core given the refractive index of the cladding is 1.59. Also find the acceptance angle when the fiber is in water. Assume the refractive index of water as 1.33.	**04**

Module-II

3	a)	Explain the terms logarithmic decrement, relaxation time and quality factor.	**08**
	b)	What are forced oscillations? Arrive at the expression for amplitude in case of forced oscillations.	**08**
	c)	An electric motor weighing 50 kg is mounted on 4 springs each of which has a spring constant 2×10^3 N/m. The motor moves only in vertical direction. Find the natural frequency and time period of the system.	**04**

Module-III

4	a)	Define packing factor. Calculate atomic packing factor for BCC and FCC crystal.	**08**
	b)	Explain powder diffraction method of structure determination.	**08**
	c)	Calculate the glancing angle for incidence of X-rays of wavelength 0.58Å on the plane (1 3 2) of NaCl which results in the second order diffraction maxima taking the lattice spacing as 3.81 Å.	**04**

OR

5	a)	State Bragg's law. Derive an expression for interplanar spacing in terms of Miller indices.	**08**
	b)	Describe the construction and working of a Bragg's spectrometer and hence explain how it is used for determination of structure of a crystal.	**08**
	c)	Draw the following planes in the cubic unit cell (0 1 1), (2 0 0) and (1 $\bar{1}$ 0).	**04**

Module-IV

6	a)	State Hooke's law. Describe stress-strain diagram.	**08**
	b)	Define Young's modulus, bulk modulus and modulus of rigidity. If Y, K and n represent these modulii respectively, prove the relation $Y = 9nK/(3K+n)$.	**08**
	c)	Calculate the torque required to twist a wire of length 1.5m, radius 0.0425×10^{-2} m through an angle ($\pi/45$) radian, if the value of rigidity modulus of the material is 8.3×10^{10} N/m².	**04**

Module-V

7	a)	Discuss the classification of earthquakes.	**08**
	b)	Define landslide and describe the causes for landslides.	**08**
	c)	The intensity of one earthquake is 100 times the intensity of the other. If the magnitude of the first earthquake is 8.9 estimate the magnitude of the other.	**04**

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