U.S.N.										

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

Autonomous Institute Affiliated to VTU

February / March 2025 Semester End Main Examinations

Programme: B.E. **Semester: I / II**

Branch: Civil Engineering **Duration: 3 hrs.**

Course Code: 22PH1BSPCV / 22PH1BSPCV **Max Marks: 100**

Course: Applied Physics for Civil Engineering

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, $m_e = 9.1\times10^{-31}$ kg
Electronic charge, $e = 1.602\times10^{-19}$ C
Boltzmann constant, $k_B = 1.38\times10^{-23}$ J/K
Permittivity of free space, $\varepsilon_o = 8.85\times10^{-12}$ F/m
Speed of light, $c = 3\times10^{8}$ m/s
Planck constant, $h = 6.626\times10^{-34}$ Js
Mass of neutron, $m_n = 1.67\times10^{-27}$ kg
Mass of proton, $m_p = 1.67\times10^{-27}$ kg

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			MODULE - I	CO	PO	Marks
1	a)		Describe the construction and working of semiconductor diode LASER.	CO1	PO1	**08**
	b)		Define attenuation. Discuss the various loss factors in optical fiber communication.	CO1	PO1	**08**
	c)		A laser medium at thermal equilibrium temperature 300 K has two energy levels with a wavelength separation of 1μm. Find the rate of population densities of the upper and lower energy levels.	CO2	PO2	**04**
			OR			
2	a)		Derive an expression for energy density of radiation under thermal equilibrium conditions in terms of Einstein's coefficients.	CO1	PO1	**08**
	b)		Write a note on fiber optic displacement sensor and fiber optic temperature sensor.	CO1	PO1	**08**
	c)		A step index optical fiber has diameter of 60 μm, a core index of 1.48 and the cladding of 1.41. If the wavelength of the light source is 0.81 μm, determine the number of modes present in the fiber.	CO2	PO2	**04**
			MODULE - II			
3	a)		Derive an expression for period and frequency of a particle exhibiting simple harmonic motion.	CO1	PO1	**08**
	b)		Explain briefly the three cases of damping vibrations.	CO1	PO1	**08**
	c)		The Q factor of a spring loaded with 0.3 kg is 60. It vibrates with a frequency of 2 Hz. Calculate the force constant.	CO1 CO2	PO1 PO2	**04**
			OR			
4	a)		Obtain an expression for amplitude of forced vibration.	CO1	PO1	**08**

		b)	Mention any two characteristics of periodic motion. Discuss the conversion of kinetic energy to potential energy in SHM	CO1	PO1	**08**
		c)	A 3.94 kg mass extends a spring 15.7 cm from its unstretched position. This mass is removed and a 0.520 kg object is suspended from the same spring and is set into oscillations. Find the period of oscillation.	CO2	PO2	**04**
	MODULE - III					
	5	a)	Derive the relation between atomic radius and lattice constant in SCC, BCC and FCC lattice.	CO1	PO1	**08**
		b)	Elucidate briefly the principle, construction and working of X-ray photoelectron spectroscopy (XPS).	CO1	PO1	**08**
		c)	Draw the following planes in a cubic unit cell $(1\ 0\ 0)$, $(0\ 1\ 1)$, $(1\ \bar{1}\ 2)$ and $(\bar{1}\ 3\ 2)$.	CO2	PO2	**04**
	OR					
	6	a)	State Bragg's law. Describe the construction and working of Bragg's X-ray diffractometer.	CO1	PO1	**08**
		b)	With a neat diagram explain seven crystal systems.	CO1	PO1	**08**
		c)	First order spectrum is formed when the x-rays of wavelength 1.5 Å is incident on a crystal at 12^o. Calculate the interplanar spacing of the crystal.	CO2	PO2	**04**
	MODULE - IV					
	7	a)	Derive an expression for couple per unit twist of a solid cylinder.	CO1	PO1	**08**
		b)	Explain tensile stress and compressive stress. Show that shearing stress is equivalent to an equal linear tensile stress and an equal linear compressive stress at right angles to each other.	CO1	PO1	**08**
		c)	Calculate the force required to produce an extension of 1 mm in steel wire of length 2 m and diameter 1mm. Young's modulus for steel is 2×10^{11} N/m^2.	CO2	PO2	**04**
	OR					
	8	a)	Deduce an expression for the bending moment of a rectangular beam.	CO1	PO1	**08**
		b)	Define stress and strain. Obtain the relation between elastic constants Y, K, η and σ.	CO1	PO1	**08**
		c)	Calculate the torque required to twist a wire of length 1.5 m, radius 0.0425×10^{-2} m, through an angle $\left(\frac{\pi}{45}\right)$ radian, if the value of rigidity modulus of its material is 8.3×10^{10} N/m^2	CO2	PO2	**04**
	MODULE - V					
	9	a)	Summarize the measurement of earthquake and their adverse effects.	CO1	PO1	**08**
		b)	Discuss the engineering structures to withstand Tsunami and their adverse effects.	CO1	PO1	**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.	CO2	PO2	**04**
	OR					
	10	a)	Describe the causes of forest fires. Explain the detection and monitoring of forest fires using remote sensing.	CO1	PO1	**08**
		b)	Write a brief note on types of land sliding.	CO1	PO1	**08**
		c)	Calculate the intensity of earthquake of magnitude 6.5 assuming the base intensity as I_0.	CO1	PO1	**04**

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