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CAMBRIDGE INSTITUTE OF TECHNOLOGY

K.R. PURAM, BENGALURU-560036.

Department of Basic Sciences

Preparatory Examination - Odd Semester 2018-19

Sub. Name: Engineering Physics **Sub. Code**: 18PHY12 **Semester**: I

Date: 09-01-2019 **Time:** 9:00 AM **Duration**: 3Hours **Max. Marks**: 100

NOTE:

Answer five full questions, choosing one from each module, each full question carries maximum of 20 Marks.

Sl. No.	QUESTIONS	COs	RBT Levels	Marks
1	**MODULE-1**			
	a) A mass 0.5 kg causes an extension 0.03 m in a spring and the system is set for oscillations. Find force constant of the spring, angular frequency and period.	CO1	L1	04M
	b) Discuss the theory of damped vibrations.	CO1	L2	08M
	c) Demonstrate the generation of shock wave using Reddy shock tube.	CO1	L3	08M
	OR			
2	a) A mass of 4.3 g is attached to a spring of force constant 17 N/m. This mass spring system is executing SHM. Find the frequency of the external force which excites resonance in the system. Ignore the mass of the spring.	CO1	L1	04M
	b) Discuss the theory of forced vibrations and obtain the expression for amplitude and phase.	CO1	L2	08M
	c) Apply the laws of conservation of mass, energy and momentum to the shock wave by giving their statements and equations. Write any two properties of shock waves.	CO1	L3	08M
3	**MODULE-2**			
	a) A wire of length 2 m and radius 2 mm is fixed to the center of a wheel. A torque of magnitude 0.0395 Nm is applied to twist the wire. Find the rigidity modulus of the wire if the angular twist is 0.038 rad.	CO2	L1	04M
	b) Derive the relation between Poisson's ratio and Young's modulus and Rigidity modulus.	CO2	L2	08M
	c) Derive the relation between shear strain, elongation strain & compressive strain.	CO2	L3	08M

	OR			
4	a) Find the torque required 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.	CO4	L1	04M
	b) Discuss the term bending moment of a beam and derive the expression for it.	CO4	L2	08M
	c) Derive the expression for Young's modulus of a rectangular beam in the case of depression.	CO4	L3	08M
5	**MODULE-3**			
	a) Find the attenuation in an optical fiber of length 500 m, when a light signal of power 100 mW emerges out of the fiber with a power 90 mW.	CO3	L1	04M
	b) Discuss different types of optical fiber neat diagrams.	CO3	L2	08M
	c) Discuss the terms gradient of a scalar, divergence and curl of a vector. Discuss the three types of integrations.	CO3	L3	08M
	OR			
6	a) Consider a slab waveguide made of AlGaAs having RI for core and clad 3.6 and 3.55 respectively. Find how many modes can propagate in this waveguide if $d = 5\lambda$.	CO3	L1	04M
	b) Explain displacement current. Derive the expression for displacement current & write the four Maxwell's equations in differential form in vacuum.	CO3	L2	08M
	c) Derive an expression for numerical aperture in terms of refractive index of core and cladding & write the condition for ray propagation.	CO3	L3	08M
7	**MODULE-4**			
	a) The velocity of an electron was measured to be 5×10^5 m/s with an uncertainty of 1%. Determine the uncertainty involved in measurement of its position.	CO4	L1	04M
	b) Discuss the solutions for a particle in 1-D potential well of infinite height by the use of time independent Schrodinger's wave equation and hence determine eigen values and eigen functions.	CO4	L2	08M
	c) Determine the equation for energy density of radiation in terms of Einstein's coefficients.	CO4	L2	08M

	OR			
8	a) A pulse from laser with power 1 mW lasts for 10 ns. If the number of photons emitted per pulse is 3.491×10^7. Determine the wavelength of laser.	CO4	L1	04M
	b) Discuss the modes of vibrations of CO_2? Describe the construction and working of CO_2 laser with energy level diagram.	CO4	L2	08M
	c) Interpret the non-confinement of electrons in the nucleus by using Heisenberg's uncertainty principle. State Heisenberg's uncertainty principle.	CO4	L3	08M
9	**MODULE-5**			
	a) Find the temperature at which there is 1% probability that a state with energy 0.5eV above Fermi energy is occupied.	CO5	L1	04M
	b) Write the assumptions and success of quantum free electron theory?	CO5	L2	08M
	c) With a neat diagram explain Hall-Effect and hence derive the expression for Hall voltage and Hall coefficient.	CO5	L3	08M
	OR			
10	a) Find the Fermi energy in eV for a metal at 0^0K, whose density is 10500kg/m^3, atomic weight is 107.9, and it has one conduction electron per atom.	CO5	L1	04M
	b) Derive Clausius-Mossotti equation and write the expression for an internal field in case of solid in one dimension.	CO5	L2	08M
	c) Derive an expression for electrical conductivity for an intrinsic semiconductor.	CO5	L3	08M

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