Model Question Paper-I with effect from 2021 (CBCS Scheme)

USN | | | | | | | | | | |

First Semester Engineering Degree Examination

Subject Title 21PHY12/22

TIME: 03 Hours **Max. Marks: 100**

Note:
01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Draw neat sketches where ever necessary.
03. **Constants :** Speed of Light "c" = 3 $\times 10^8$ ms^{-1},Boltzmann Constant "k" = 1.38 $\times 10^{-23}$ JK^{-1}, Planck's Constant "h" = 6.625 $\times 10^{-34}$ Js, Acceleration due to gravity "g" = 9.8 ms^{-2}, Permittivity of free space "ε_0"=8.854 $\times 10^{-12}$ F m^{-1}.

		Module -1	**Marks**
Q.01	a	Define SHM and mention any two examples. Derive the differential equation using Hooke's law.	07
	b	With a neat diagram, explain the construction and working of Reddy's shock tube. Mention the any three applications of shock waves.	09
	c	A free particle is executing S.H.M in straight line with a period of 5 seconds after it has crossed the equilibrium point, the velocity is found to be0.7m/s. Find the displacement at the end of10 seconds ,and also the amplitude of oscillation.	04
		OR	
Q.02	a	What are damped oscillations. Discuss the theory of damped oscillations. Represent overdamping, critical damping and under damping by graph.	10
	b	Define Mach number. Distinguish between Ultrasonic, subsonic, supersonic, and hypersonic waves.	06
	c	The distance between two pressure sensors in a shock tube is 200 mm. The time taken by a shock wave to travel this distance is 0.4ms. If the velocity of sound under the same condition is 340 m/s. Find the Mach number of the shock wave,	04
		Module-2	
Q. 03	a	State Wein's law and Rayleigh-Jeans law and mention their draw backs.	06
	b	Assuming the time independent Schrodinger's wave equation discuss the solution for a particle in one dimensional potential well of infinite height and hence obtain the normalized wave equation.	10
	c	A particle having mass of 0.5MeV/c^2 has a kinetic energy of 100 eV. Calculate the deBroglie wavelength, where c is the velocity of light.	04
		OR	
Q.04	a	Starting from Planck's quantum theory of radiation arrive at Wein's law and Rayleigh-Jean's law.	08
	b	State Heisenberg uncertainty Principle. Show that electron does not exists inside the nucleus by this Principle.	07
	c	A quantum particle confined to one dimensional box of width 'a' is in its first excited state. What is the probability of finding the particle over an interval of 'a/2' marked symmetrically at the center of the box.	05
		Module-3	
Q. 05	a	Define the terms population inversion and Meta stable state. Explain the construction and working of semiconductor laser.	09

	b	With neat diagram explain the working of Intensity based displacement sensor using optical fiber.	07
	c	Estimate the attenuation in an optical fiber of length 500m when a light signal of power 100mW emerges out of fiber with a power 90Mw.	04
		OR	
Q. 06	a	Derive the expression for numerical aperture of an optical fiber. Mention any two merits and demerits of optical communication.	10
	b	Explain how laser find application in eye surgery	05
	c	The ratio of population of two energy levels out of which upper one corresponds to a metastable state is 1.059×10^{-30}. Find the wavelength of light emitted at 330 K.	05
		Module-4	
Q. 07	a	Mention any four assumptions of Drude-Lorentz model and discuss the success of Quantum free electron theory.	10
	b	Derive Clausius-Mossotti equation.	05
	c	Show that occupation probability at an energy $E_F+\Delta E$ is equal to non-occupation probability at the energy $E_F-\Delta E$	05
		OR	
Q. 08	a	What is Hall effect. Obtain the expression for the Hall coefficient	08
	b	Obtain expression for electrical conductivity in metals on quantum model	08
	c	Find the temperature at which there is 1% probability that a state with an energy 0.5 eV above the fermi energy is occupied.	04
		Module-5	
Q. 09	a	With neat diagram, explain the principle, construction and working of Atomic Force Microscope.	10
	b	Explain in brief how crystal size is determined by Scherrer's equation.	05
	c	Determine the wave length of X-rays for crystal size of 1.188×10^{-6} m, peak width is 0.5^0 and peak position 30^0, for a cubic crystal. Given Scherrer's constant k=0.92.	05
		OR	
Q. 10	a	Explain the construction and working of X-Ray diffractometer.	07
	b	With neat diagram, explain the principle, construction and working of X-ray photoelectron spectroscope.	08
	c	The first order Bragg reflection occurs when a monochromatic beam of X-rays of wavelength 0.675A° is incident on a crystal at a glancing angle of 4°. What is the glancing angle for third order Bragg's reflection to occur?	05

Table showing the Bloom's Taxonomy Level, Course Outcome and Program Outcome

Question		Bloom's Taxonomy Level attached	Course Outcome	Program Outcome
Q.1	(a)	L1	CO.1	PO-1,2,12
	(b)	L2	CO.1	PO-1.2,12
	(c)	L3	CO.1	PO-1
Q.2	(a)	L3	CO.1	PO-1,2,12
	(b)	L2	CO.1	PO1,2.12
	(c)	L3	CO.I	PO-1
Q.3	(a)	L2	CO.2	PO-1,2,12
	(b)	L3	CO.2	PO-1,2,12
	(c)	L3	CO.2	PO-1
Q.4	(a)	L2	CO.2	PO-1,2,12
	(b)	L3	CO.2	PO1,2,12
	(c)	L3	CO.2	PO-1

Q.5	(a)	L1	CO.3	PO-1,2,12
	(b)	L2	CO.3	PO-1,2,12
	(c)	L3	CO.3	PO-1
Q.6	(a)	L2	CO.3	PO1,2,12
	(b)	L2	CO.3	PO-1,2,12
	(c)	L3	CO.3	PO-1
Q.7	(a)	L2	CO.4	PO-1,2,12
	(b)	L3	CO.4	PO-1,2,12
	(c)	L3	CO.4	PO-1
Q.8	(a)	L1	CO.4	PO-1,2,12
	(b)	L2	CO.4	PO-1,2,12
	(c)	L3	CO.4	PO-1
Q.9	(a)	L2	CO.5	PO-1,2,12
	(b)	L3	CO.5	PO-1,2,12
	(c)	L3	CO.5	PO-1
Q.10	(a)	L2	CO.5	PO-1,2,12
	(b)	L2	CO.5	PO-1,2,12
	(c)	L3	CO.5	PO-1

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering(knowledge):L_1	Understanding Comprehension): L_2	Applying (Application): L_3
	Higher order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6