SEE MODEL QUESTION PAPER 1

UG

First Semester B.E. Degree Examination

Engineering Physics

Time: 3 hrs. **Course code: 20 PHY12** **Max. Marks: 100**

***Note: Answer any Five full questions, choosing ONE full question from each module*.**

Physical constants: $m_e = 9.11\times10^{-31}$ kg, h= 6.625×10^{-34} Js, e=1.602×10^{-19}C, g=9.8m/s^2, $\varepsilon_o=8.854\times10^{-12}$F/m, k= 1.38×10^{-23} JK^{-1}, $N_A=6.023\times10^{26}$/kmole.

		Module 1	Marks
1	a	Derive the relation between young's modulus, rigidity modulus and poisson's ratio.	5
	b	Define spring constant. Derive the expressions for equivalent force constant for two springs in (a) series and (b) parallel.	5
	c	What are free and forced oscillations? Establish an equation for amplitude and phase in forced oscillations.	5
	d	In stretching experiment, the extension produced in a wire for a load of 1.5 kg is 0.2×10^{-2} m. The length of the wire is 2m and its radius is 0.013×10^{-2}m. Find the young's modulus of the material of the wire.	5
		OR	
2	a	Derive an expression for young's modulus of a beam of rectangular cross-section using single cantilever.	6
	b	Define Hooke's law. Describe the stress-strain graph for an elastic material.	4
	c	Discuss the three cases for damped vibration with suitable examples for each case.	6
	d	A free particle is executing simple harmonic motion in a straight line. The maximum velocity it attains during any oscillation is 62.8ms^{-1}. Find the frequency of oscillation, its amplitude is 0.5 m.	4
		Module – 2	
3	a	Derive an expression of energy density in terms of Einstein's A & B coefficients	5
	b	Discuss the requisites and conditions for lasing action.	3
	c	Using time independent Schrodinger's equation, arrive at the Eigen function & Eigen value for a particle in a box.	8
	d	The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 330K.	4
		OR	
4	a	Explain the construction & working of a He-Ne LASER	6
	b	Discuss the properties of wave function.	4
	c	Derive the time independent Schrodinger wave equation.	6
	d	An electron has a speed of 4×10^5 ms^{-1} accurate to 0.01%. With what fundamental accuracy can we locate the position of electron?	4

Module – 3			
5	a	Describe the arc discharge method for the synthesis of carbon nano tubes.	5
	b	Discuss the different types of biomaterials and their applications.	5
	c	Explain the principle, construction & working of Transmission Electron Microscope (TEM). Give two applications of TEM.	10
		OR	
6	a	Describe the ball milling process to synthesize the nano materials.	6
	b	Explain the principle, construction & working of Scanning Tunneling Microscope (STM). Mention two applications of STM.	8
	c	Distinguish between austenite and martensite phase of Shape Memory Alloys (SMAs). State four applications of SMAs.	6
Module - 4			
7	a	Define Fermi energy. Derive an expression for Fermi energy at 0K.	6
	b	Discuss the success of quantum free electron theory.	4
	c	Discuss the types of electric polarization	6
	d	Find the probability that an energy level at 0.2 eV below Fermi level being occupied at temperatures 300 K and 1000 K	4
		OR	
8	a	Explain the static dielectric constant of a dielectric material with suitable diagrams.	5
	b	Derive an expression for internal fields in solids for one dimension.	5
	c	Discuss the variation of Fermi factor with respect to energy & temperature	6
	d	Calculate the Fermi velocity and the mean free path for conduction electrons in aluminum, given that its Fermi energy is 11.63 eV, and the mean collision time for electrons is 7.3×10^{-15} s.	4
Module - 5			
9	a	Discuss gauss divergence theorem.	5
	b	List the Maxwell's equations in vacuum & also in differential form using suitable laws.	5
	c	Derive the expression for numerical aperture & angle of acceptance in an optical fiber.	6
	d	Determine the constant c such that the vector $\vec{A} = (x + ay)\hat{a}_x + (y + bz)\hat{a}_y + (x + cz)\hat{a}_z$ is solenoid.	4
		OR	
10	a	Explain Biot-savart's law & faraday's laws of electromagnetic induction.	5
	b	Discuss the application of optical fibers in point-to-point communication.	5
	c	Distinguish between single mode, step index multimode & graded index multimode optical fibers.	6
	d	An optical fiber of 600 m long has input power of 120 mW which emerges out with power of 90 mW. Find the attenuation in the fiber.	4