SEE MODEL QUESTION PAPER

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21PHY12

First Semester B.E Degree Examination, March- 2022

ENGINEERING PHYSICS

Time: 3 hrs. **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.

Q. No.		MODULE - 1	Marks
1	a	Develop the relation between young's modulus, rigidity modulus and Poisson's ratio.	5
	b	Build the expressions for equivalent force constant for two springs in (a) series and (b) parallel.	5
	c	Identify the differences between free and forced oscillations. Establish an equation for amplitude and phase in forced oscillations.	5
	d	In streching 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. Apply suitable formula to find the Young's modulus of the material of the wire.	5
		OR	
2	a	Utilize single cantilever of rectangular cross-section to build an expression for Young's modulus of a beam.	6
	b	Summarize the salient features by drawing the stress-strain curve for an elastic material.	4
	c	Identify the three cases for damped vibration with suitable examples for each case.	6
	d	Simplify the expression in terms of amplitude of 0.5m to obtain the frequency of oscillation of a free particle executing simple harmonic motion in a straight line. The maximum velocity during any oscillation of a free particle is 62.8ms^{-1}.	4
		MODULE - 2	
3	a	Arrive at the expression for de Broglie wavelength of an accelerated electron.	5
	b	State and explain Heisenberg's uncertainty principle and give its physical significance.	3
	c	Solve the time independent Schrodinger's equation to obtain Eigen functions & Eigen values for a particle in a box.	8

	d	Identify with what fundamental accuracy can we locate the position of an electron if the speed is $4x10^5$ ms^{-1} accurate to 0.01%.	4

OR

4	a	Utilize Heisenberg's uncertainty principle to prove that the electron does not exist inside the nucleus.	5
	b	Summarize the properties and physical significance of a wave function.	5
	c	Setup the one dimensional time independent Schrodinger wave equation.	5
	d	Compute the first three permitted energy values for an electron in a box of width $4x10^{-10}$ m	5

MODULE - 3

5	a	Make use of Einstein's A & B coefficients to build an expression for energy density.	5
	b	Identify the requisites and conditions for lasing action with suitable diagrams.	4
	c	Formulate an expression for numerical aperture & angle of acceptance in an optical fiber.	6
	d	Estimate the wavelength of light emitted at 330K if the ratio of population of two energy levels is $1.059x10^{-30}$.	5

OR

6	a	Summarize the construction and working of He-Ne LASER	7
	b	Mention any four merits and demerits of optical communication.	4
	c	Distinguish between single mode, step-index multimode and Graded Index (GRIN) multimode fibers.	5
	d	The numerical aperture of an optical fiber is 0.2 when surrounded by air. Determine the refractive index of its core given the refractive index of cladding as 1.59. Also find the acceptance angle when it is in the medium of refractive index 1.33.	4

MODULE - 4

7	a	Interpret the variation of Fermi factor with respect to energy & temperature.	6

	b	Build an expression for internal field in solids for one dimension.	5
	c	Build an expression for electrical conductivity in a semiconducting material.	5
	d	Evaluate the Fermi velocity and the mean free path for conduction electrons in aluminium, given that its Fermi energy is 11.63 eV, and the mean collision time for electrons is 7.3×10^{-15} s.	4

OR

8	a	Make use of Fermi factor at T= 0K and $E < E_f$, deduce an expression for Fermi energy.	6
	b	Estimate the static dielectric constant of a dielectric material utilizing suitable diagrams.	5
	c	How do you conclude that quantum free electron theory is successful over the classical free electron theory?	5
	d	A parallel plate capacitor has an area of 7.45×10^{-4} m^2 and its plates are separated by a distance of 2.45mm across which a potential of 10V is applied. If a material with dielectric constant 6 is introduced between the plates, determine the capacitance, the charge stored in each plate, the dielectric displacement D and polarization P.	4

MODULE - 5

9	a	Explain the density of states for various quantum structures.	5
	b	Elaborate the ball milling process to synthesize nano materials.	5
	c	Organize the steps involved in the construction & working of Transmission Electron Microscope (TEM) with two applications.	10

OR

10	a	Outline the arc discharge method for the synthesis of carbon nano tubes.	5
	b	Discuss five applications of nanomaterials in different fields.	5
	c	Organize the steps involved in the construction & working of Fourier Transform Infrared (FTIR) spectroscope with two applications.	10

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