(18)

Total No. of Questions – [3] Total No. of Printed Pages: [IV]

G.R. No.	

PAPER CODE	U123-204A (REG)

MAY 2023 (INSEM+ ENDSEM) EXAM

F.Y. B. TECH. (SEMESTER - II)

COURSE NAME: ENGINEERING PHYSICS

COURSE CODE: ES10204A

(PATTERN 2020)

Time: [2Hr] [Max. Marks: 60]

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data where ever required**

Question No.	Question Description	Marks	CO mapped	Blooms Taxonomy Level
Q.1	**Solve the following** i) A vibration represented by a cosine function is a (a) Random vibration (b) Aperiodic vibration (c) Simple Harmonic vibration (d) combination of random and periodic vibration	[2]	[1]	Remember
	ii) Starting from the expression for displacement for undamped oscillations $u(t) = A\cos\omega_n t + B\sin\omega_n t$, the velocity v(t) is given by (a) $-B\omega_n \sin\omega_n t + A\omega_n \cos\omega_n t$ (b) $-A\omega_n \cos\omega_n t + B\omega_n \sin\omega_n t$ (c) $-A\sin\omega_n t + B\cos\omega_n t$ (d) $-A\omega_n \sin\omega_n t + B\omega_n \cos\omega_n t$	[2]	[1]	Understand
	iii) In viscously damped oscillations, which of the following statement is true? (a) Velocity is proportional to the displacement (b) Damping is proportional to the velocity (c) There is no dissipation of energy (d) Amplitude remains constant	[2]	[1]	Remember
	iv) For a critically viscously damped free oscillation, the damped time period is (a) Finite and small (b) finite and large (c) infinite (d) indeterminate	[2]	[1]	Understand

	v) The complementary solution of forced harmonic oscillations with viscous damping corresponds to (a) Resonant state (b) The steady state (c) Undamped free oscillation (d) damped free oscillation	[2]	[1]	Understand
	vi) For an underdamped free oscillation (viscously damped), which of the following statements is false (a) ω_D is finite. (b) T_D is finite. (c) There is oscillatory behaviour with the amplitude decreasing exponentially (d) $\zeta > 1$	[2]	[1]	Analysis
	vii) The logarithmic decrement for a viscously damped oscillation, if the amplitudes for 2nd and 4th oscillations are 10 cm and 2cm, respectively, is (a) $e^{0.8}$ (b) 0.008 (c) 0.08 (d) 0.80	[2]	[1]	Analysis
	viii) The displacement of a simple harmonic motion is represented by the equation, $u(t) = (3.1\ cm)\ \sin(2.57t - 0.04)$. The angular frequency and initial displacement are: (a) 2.75 rad/s, 0.0022cm (b) 2.57 rad/s, 0.0022cm (c) 2.75rad/s, -0.0022cm (d) 2.57rad/s, -0.124cm	[2]	[1]	Analysis
	ix) In an n-type semiconductor, with decreased doping concentrations, the Fermi level (a) shifts towards the conduction band (b) shifts towards the valence band (c) shifts towards the centre (d) none of the options	[2]	[2]	Understand
	x) The charge on a p-type semiconductor sample is (a) positive (b) negative (c) neutral (d) none of these	[2]	[2]	Understand
	xi) Which of these statements regarding a p-n junction diod false? (a) The depletion region is depleted of free charge carriers. (b) The depletion layer consists of immobile positive charges on the n-side and immobile negative charges on the p side (c) The depletion layer has no mobile electrons and holes (d) The depletion layer has free charges both holes and electrons	[2]	[2]	Understand
	xii) For p-type GaAs with a band gap of 1.424eV, if E_{Fi}-E_{Fp}=0.5eV, then E_{Fp}-E_v is equal to	[2]	[2]	Analysis

	(a) 0.924eV (b) 0.212eV (c) 1.012eV (d) 1.212eV xiii) For two samples A and B of n-type semiconductor having the same intrinsic carrier concentration, the doping concentration of donor impurities is $1\times10^{20}\ m^{-3}$ and $3\times10^{20}\ m^{-3}$, respectively. If the hole concentration in sample A is $9\times10^{12}\ m^{-3}$, then the hole concentration in sample B is (a) $3\times10^{12}\ m^{-3}$ (b) $1\times10^{12}\ m^{-3}$ (c) $27\times10^{12}\ m^{-3}$ (d) $9\times10^{12}\ m^{-3}$	[2]	[2]	Analysis
	xiv) If the value of Fermi Dirac distribution function is 0.95 for T = 300K and given Boltzmann's constant $k = 8.6 \times 10^{-5}\ eV/K$, then the value of $E-E_F$ is (a) 0.076 eV (b) 0.076 J (c) -0.076 eV (d) 0.05 eV	[2]	[2]	Analysis
	xv) The value of gamma integral Γ (1/2) is $\sqrt{\pi}$ then the value of Γ (9/2) is (a) $(9\times\sqrt{\pi})/2$ (b) $(945\times\sqrt{\pi})/32$ (c) $(15\times\sqrt{\pi})/8$ (d) $(105\times\sqrt{\pi})/16$	[2]	[2]	Analysis
Q2	**Solve any three out of four**	**[15]**		
	(a) Explain in brief what is meant by dispersion. If RMS material dispersion and RMS intermodal dispersion are 15 ns and 8 ns respectively, what will be its total dispersion and maximum speed at which digital bits can be sent.	[5]	[3]	**Analysis**
	(b) If optical fibre has a core refractive index of 1.49 with fractional refractive index is 0.001. Calculate numerical aperture, what is the max data speed that can be achieved for a length of 20 Km if we consider only RMS intermodal dispersion.	[5]	[3]	**Analysis**
	(c) What is attenuation in optical fibre. Explain in detail factors responsible for attenuation.	[5]	[3]	**Understand**
	(d)A pulse with a power of 0.02 mW is launched into an optical fibre with a fibre loss parameter of 2 dB/km. What is	[5]	[3]	**Analysis**

	the distance after which the power drops to 0.0002mW, which is detection light of the light sensor used to detect the signal at the end of this unbroken fibre. If 10 repeaters are used to extend the distance over which the signal can be transmitted then what is the total distance achieved.			
Q.3	**Solve any three out of four**	**[15]**		
	(a) What is meant by Rayleigh range, drive its relation with the help of a neat labeled diagram.	[5]	**[4]**	**Understand**
	(b) An Argon Laser has a wavelength of 514 nm with a width of gain curve about 4 GHz. The length of the optical cavity is 20 cm. Calculate the following: 1. mode number m 2. peak frequency 3. width of the gain curve in terms of wavelength ($\Delta\lambda$) 4. mode separation frequency ν_{ms} 5. how many modes are allowed in the width of the gain curve.	[5]	**[4]**	**Analysis**
	(c) Explain the phenomena of absorption, spontaneous emission and stimulated emission of light by matter with the help of neat labelled diagrams.	[5]	**[4]**	**Understand**
	(d)With a neat labelled diagram explain the principle, construction and working of Single Hetero Junction Laser Diode.	[5]	**[4]**	**Understand**