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

G.R. No.	

PAPER CODE	U123-204A (RF)

MAY 2023 (INSEM+ ENDSEM) EXAM

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

COURSE NAME: ENGINEERING PHYSICS

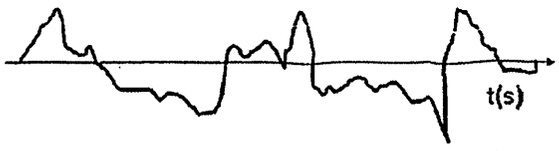
COURSE CODE: ES10204A

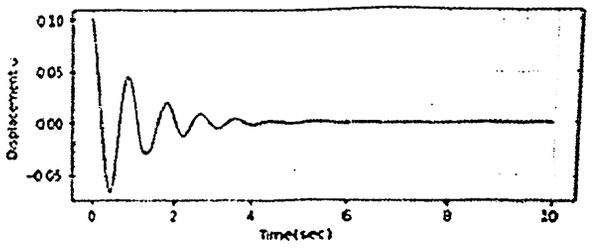
(PATTERN 2020)

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	Bloom's Taxonomy Level
Q.1	**Solve the following** i) The impact of internal and external frictional losses in the system on the oscillations is to (a) Increase the amplitude with time (b) decrease the amplitude with time (c) © increase and then decrease the amplitude with time (d) Keep the amplitude constant with time	[2]	1	Understand
	ii) The following is a representation of a  (a) Periodic vibration (b) Random vibration (c) Simple Harmonic vibration (d) No vibration	[2]	1	Understand
	iii) In the representation given below, what is the value of the damping factor?	[2]	1	Apply



(a) 1 (b) less than 1 but not 0 (c) 0 (d) greater than 1

iv) In forced harmonic oscillations, on the application of external force with the progress of time to infinity, which of the following statements is true? (a) Only natural frequency free oscillations remain (b) Both natural frequency free oscillations and forced oscillations exist superposed on each other. (c) Only forced oscillations persist (d) No oscillations exist	[2]	1	Analys
v) In Forced Harmonic Oscillations with Viscous Damping, when the frequency of the harmonic driving force is much less than the natural frequency of the system ($\omega \ll \omega_n$), the deformation response factor is governed by (a) The mass of the system (b) The damping coefficient of the system (c) The stiffness of the system (d) None of these factors	[2]	1	Analysis
vi) In free damped vibrations, $\frac{\omega_D}{\omega_n}$ _____ as ζ tends to zero? (a) tends to 1 (b) tends to 0 (c) becomes infinitely large (d) takes a complex value	[2]	1	Analysis
vii) For a damped spring mass system with m=5kg, k=150N/m, ζ=0.03, u(0)= -12cm , v(0) = -1 cm/s , the exponential envelop at 2 s in terms of the amplitude is (a) $0.72u_o$. (b)$1/(0.72u_o)$ (c) $(1/0.72)u_o$ (d) $0.72/u_o$	[2]	1	Apply
viii) In a critically damped system, which of the following statements is false? (a) The value of the damping ratio is unity. (b) There is no oscillation. © The angular frequency is imaginary. (d) The time period is infinite.	[2]	1	Apply
ix) In a conductor, the the Fermi level is (a) an average value of all available energy levels (b) an energy level at top of the valence band (c) the highest occupied energy level at 0°C (d) the highest occupied energy level at 0K	[2]	1	Understand

	x) In an unbiased p-n junction diode at equilibrium (a) Intrinsic Fermi energy E_{Fi} is higher on the p-side than that on the n-side (b) Intrinsic Fermi energy E_{Fi} is lower on the p-side than that on the n-side (c) Intrinsic Fermi energy E_{Fi} is equal on the p-side and the n-side (d) none of the options	[2]	1	Understand
	xi) The barrier potential V_{bi} in a p-n junction diode is due to (a) electrons on the n-side (b) holes on the p-side (c) immobile positive charges on the n-side and immobile negative charges on the p side (d) (iv)immobile negative charges on the n-side and immobile positive charges on the p side	[2]	2	Understand
	xii) If the probability of finding the electron at an energy 0.1eV below E_F is 0.95 at a given temperature, then the probability of absence of an electron 0.1eV above E_F is (a) 0.95 (b) 0.1 (c) 0.05 (d) 1.05	[2]	2	Apply
	xiii) A diode has reverse saturation current I_0=1nA. On application of a forward voltage V_A=0.4V at T = 300K (given k/e = 8.6×10^{-5} eV/K), the value of current through the diode is (a) 5.4nA (b) 5.4μA (c) 5.4mA (d) 5.4A	[2]	2	Apply
	xiv) For p-type GaAs with a band gap of 1.424eV, if E_{Fi}-E_{Fp}=0.3eV, then E_{Fp}-E_v is equal to (a) 4.121eV (b) 0.412eV (c) 4.12eV (d) 1.412eV	[2]	2	Apply
	xv) In a p-type silicon sample, the hole concentration is 2.15 $\times10^{15}$ cm^{-3}. If the intrinsic carrier concentration is 1.25 $\times10^{10}$ cm^{-3}, the electron concentration is (a) Zero (b) 10^{10} cm^{-3} (c) 0.73×10^5 cm^{-3} (d) 1.5×10^{10} cm^{-3}	[2]	2	Apply
Q2	**Solve any three out of four**	**[15]**		
	a) With the help of the attenuation versus wavelength plot, explain why 1500nm is chosen as an optimum wavelength for the source of light?	[5]	3	Understand & Analysis
	b) Derive an expression for the RMS inter-modal dispersion in a multi-mode step refractive index optical fibre. Discuss how this dispersion can be reduced. What consequences will this have on the light gathering capacity of the optical fiber when an attempt is made to reduce this dispersion by the above method.	[5]	3	Understand & Analysis

	c) An optical fibre has refractive indices n_1=1.5 and n_2=1.4995 for the core and the cladding. What is the value of the critical bending radius if the wavelength of the light used in optical telecommunication application is 1.5μm. What would be your instructions to the technician laying the cable in factory: should he keep the bending radius smaller or larger than R_c so that there is no loss of optical power. Explain why?	[5]	3	Understand & Analysis
	d) Analyze the path travelled by the rays of light in multi-mode step refractive index, multi-mode graded refractive index and single mode fibres to predict their inter-modal dispersion behaviour. Which of these optical fibers is to be chosen for reduced intermodal dispersion?	[5]	3	Apply & Analysis
Q.3	**Solve any three out of four**	**[15]**		
	a) Explain the construction and working of an Optical Fiber Laser with the help of neatly labelled diagram/s.	[5]	4	Understand
	b) In an engineering application of drilling, calculate the focal length of the lens which could be used to focus a laser beam of wavelength 1500nm and 4.5 mm diameter so that the focussed beam could drill a hole of 4.5 μm. What is the type of beam profile assumed in this calculation?	[5]	4	Apply
	c) Which of the following; fibre laser, CO_2 and Nd:YAG lasers are suitable for the welding application. Explain why?	[5]	4	Understand
	d) What is population inversion? How is it obtained and sustained? How is an optical cavity used for obtaining a monochromatic laser beam?	[5]	4	Understand