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

G.R./PRN No.	

PAPER CODE	U112-204A (Reg)

DECEMBER 2022 (INSEM+ ENDSEM) EXAM

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

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**

Q No.	Question Description	Marks	CO mapped	Blooms Taxonomy Level
Q.1	i) Find the displacement of a spring mass system at time 2.5819 sec, if it is given as $u(t) = (5cm)\sin(6.2t - 0.3)$. a) 5 cm b) 0 cm c) -1.5 cm d) 1.5 cm	[2]	[1]	A
	ii) What is the phase in the following equation $u(t) = Im\{e^{-i(\omega_n t - \phi_0)}\}$ a) $\cos(\omega_n t - \phi_0)$ b) $\sin(\omega_n t - \phi_0)$ c) $\omega_n t - \phi_0$ d) ϕ_0	[2]	[1]	U
	iii) If time period of a system is increased 4 times, then its corresponding maximum amplitude of acceleration will be a) ¼ of its initial value b) $\frac{1}{16}$ of its initial value c) half of its initial value d) double of its initial value	[2]	[1]	A
	iv) A spring mass system oscillates under harmonic external force with angular frequency ω inside a medium with damping ratio ζ, _____ , once steady state is achieved. a) the amplitude of oscillations will gradually decrease. b) the time period of oscillations will decrease.	[2]	[1]	R

	c) time period and amplitude of oscillation will remain constant d) none of the above			
	v) What is the damping coefficient for a damped spring mass system with $\frac{\omega_D}{\omega_n}$ =0.9025, given m=1 kg, k = 16 N/m. a) 3.4455 Nm/s b) 1.0975 Nm/s c) 2.498 Nm/s d) 0.10975 Nm/s	[2]	[1]	A
	vi) Calculate the resonance frequency for a forced damped spring mass system with k = 32N/m and mass 2kg, damping ratio ζ is 0.05625 a) 3.987Hz b) 0.634Hz b) c) 0.634 rad/s d) 0.3987Hz	[2]	[1]	A
	vii) If a sinusoidal exciting force with an amplitude of F_0=10N, initial phase = 0 radians and an angular frequency ω=0.01rad/s is applied to a spring mass system with a spring constant k =10N/m and a mass of m = 0.04kg, then the amplitude of displacement is approximately equal to a) 100 b) 20 c) 1 d) none of the above	[2]	[1]	A
	viii) Ratio of 5th to 11th amplitude is 10, what is logarithmic decrement for this free damped spring mass system a) 3.3 b) 0.46 c) 2.302 d) 0.383	[2]	[1]	A
	ix) At 300K, Ge is doped with $1.3x10^{16}$ /cm^3 acceptor atoms, what are the minority charge carriers and their concentration (in /cm^3) if intrinsic charge carrier concentration is $2.5x10^{13}$ /cm^3 a) holes, $4.807x10^{10}$ b) holes, 520 c) electrons,520 d) electrons, $4.807x10^{10}$	[2]	[2]	A
	x) Find the temperature of Si for which the intrinsic charge carrier concentration becomes 10 times as compared to intrinsic concentration at 300K, E_g = 1.1 eV. (Note: Assume effective density of states to be temperature independent) a) 100K b) 370K c) 400K d) 336K	[2]	[2]	A
	xi) According to free electron theory relation of electron energy E with momentum vector k in a crystal is a) linear b) exponential c) circular d) parabolic	[2]	[2]	R
	xii) If the donor concentration in the p-n junction diode at 300 K is doubled then built in potential will increase by _____ from the initial value. a) 0.018 V b) 2V c) 0.5V d) 0.25V	[2]	[2]	U

	xiii) Compare the current through a diode at 1V to that at 0.9 V for T= 300K, a) 0.0113 b) 0.0207 c) 48.23 d) 88	[2]	[2]	A
	xiv) If doping concentration in p-type semiconductor is increased then difference between Fermi level and bottom edge of conduction band ..... a) increases b) decreases c) remain same d) none of the options	[2]	[2]	U
	xv) At T = 0 K, energy levels above Fermi level are a) half-filled b) half empty c) completely filled d) completely empty	[2]	[2]	R
Q2	**Solve any three out of four** a) Explain what is meant by dispersion in an optical fibre. Derive the expression for RMS intermodal dispersion.	**[15]** [5]	[3]	U
	b) Find the length of the optical fibre for which data can be transmitted at 10 Mbps assuming material dispersion being the only reason for putting a limit on the data transfer rate. Given $\Delta\lambda$=40nm at 900nm, material dispersion $\left\lvert\lambda^2 \frac{d^2 n_1}{d\lambda^2}\right\rvert$=0.024.	[5]	[3]	A
	c) By drawing neat labelled diagrams, derive the expression for numerical aperture of an optical fibre in terms of the refractive indices of core and cladding.	[5]	[3]	R
	d) What is meant by attenuation through optical fibre. How many repeaters should be used to send a signal of 500 μW to a distance of 100 km if the fibre loss parameter is 2 dB/km and your detector can detect signal strength above 5 μW.	[5]	[3]	A
Q.3	**Solve any three out of four** a) Explain Monochromaticity and coherence length. To show the relationship between coherence and monochromaticity, derive an expression for coherence length.	**[15]** [5]	[4]	U
	b) Explain the following terms: i) Active medium (ii) Pumping mechanism iii) Optical cavity.	[5]	[4]	R
	c) A laser of wavelength 1550 nm is emitted through an aperture of 1mm. Find the intensity of the beam at distance equal to Rayleigh length, if the output power of laser is 20 mW.	[5]	[4]	A
	d) With the help of a neat labelled diagram explain construction and working of Single Hetero-junction Laser (SHL).	[5]	[4]	U