Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–I & II(NEW) EXAMINATION – WINTER 2022

Subject Code:2110011 Date:04-03-2023

Subject Name:Physics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Question No. 1 is compulsory. Attempt any four out of remaining Six questions.**
1. **Make suitable assumptions wherever necessary.**
2. **Figures to the right indicate full marks.**
3. **Simple and non-programmable scientific calculators are allowed.**

Q.1 **Objective Question (MCQ)** **Mark**

(a) **07**

1. Dipole moment is defined as the _____ of one of the charge and separation between the charges.
(a) product (b) sum (c) ratio (d) none

2. SQUID is used to measure _____ associated with brain and chest.
(a) Power (b) energy(c) stress (d) voltages

3. Laser radiation is:
(a) highly monochromatic (b) partially monochromatic (c) white light (d) none

4. Nanostructures have sizes in between:
(a) 1 and 100Å(b) 1 and 100 nm
(c) 100 and 1000 nm (d) None of the above

5. The magnetic susceptibility of a diamagnetic material is:
(a) zero (b) positive(c) negative (d) infinity

6. The device which converts the light energy into electric energy is known as_____.
(a) LED (b) solar cell(c) battery (d) diode

7. The frequency of ultrasonic wave is_____.
(a) $f > 20kHz$ (b)$f < 20kHz$ (c) $20\ Hz < f < 20\ kHz$ (d) $f = 20Hz$

(b) **07**

1. Unit of absorption coefficient is_____.

(a) Sabine (b) Second(c) O.W.U(d) a & c both

2. The current required to destroy the superconducting property is equal to

(a) $I_c = 2\pi r H_o$ (b) $I_c = 2\pi H_c$ (c) $I_c = 2\pi r H_c$ (d) $I_c = 4\pi r H_o$

3. ____dB is the sound level for the threshold of pain.

(a) 120 dB (b) 60 dB(c) 20 dB (d) 0 dB

4. The magnetic induction is equal to B=

(a) ϕA (b) $\frac{\phi}{A}$ (c) $\frac{\phi A}{H}$ (d) $\frac{\phi H}{A}$

5. LASER light consists of _____.

(a) coherent photons (b) cosmic rays (c) UV rays (d) neutrons

6. _____ is the process to synthesize metallic glasses.

(a) CVD (b) melt spinning(c) plasma arching (d) ball milling

7. Weber Fechner law is_____.

(a) $L = K/\log_{10} I$ (b) $I = K \log_{10} L$

(c) $I = K/\log_{10} L$ (d) $L = K \log_{10} I$

Q.2 **(a)** An elemental dielectric material has a relative dielectric constant of 12. It also contains 5×10^{28} atoms m^{-3}. Calculate the electric polarisability assuming the Lorentz field. **03**

(b) Distinguish between type-I & type-II superconductors. **04**

(c) Explain types of dielectric materials in detail. Mention its specific applications. **07**

Q.3 **(a)** A paramagnetic material has a magnetic field intensity of $10^4 A\, m^{-1}$. If the susceptibility of the material at room temperature is 3.7×10^{-3}, calculate the magnetization and flux density of the material. **03**

(b) Derive Claussius-Mosotti equation. **04**

(c) Compare properties of diamagnetic, paramagnetic and ferromagnetic materials. **07**

Q.4	**(a)**	Calculate the frequency to which a piezoelectric oscillator circuit should be tuned so that a piezoelectric crystal of 0.1 cm thickness vibrates in its fundamental mode to generate ultrasonic waves. (Young's modulus and density of the materials of the crystal are 80GPa and 2654 $kg\ m^{-3}$).	**03**
	(b)	Explain ferromagnetic domains. Draw B-H curve for hard and soft ferromagnetic materials and define remnant and coercive fields on the curve.	**04**
	(c)	With neat diagram describe construction, working, merits and demerits of magnetostriction generator.	**07**
Q.5	**(a)**	Calculate the critical current for a wire of lead having a diameter of 1 mm at 4.2 K. Critical temperature for lead is 7.18 K and $H_c(0) = 6.5 \times 10^4\ A\ m^{-1}$.	**03**
	(b)	Give the differences between Step Index Fiber and Graded Index optical Fiber.	**04**
	(c)	What are the characteristics of LASER? Describe the principle, construction and working of Nd-YAG Laser with suitable diagrams.	**07**
Q.6	**(a)**	An optical fiber has a diameter of 6 μm and its core refractive index is 1.47 and for cladding, it is 1.43. How many modes can propagate into the optical fiber if the wavelength of the source is 1.5 μm?	**03**
	(b)	Explain shape memory alloy. Discuss some important applications of shape memory alloys.	**04**
	(c)	List out the techniques used in synthesis of nanomaterial's. Discuss any two of them in detail.	**07**
Q.7	**(a)**	A loudspeaker emits energy in all directions at the rate of 1.5 $J\ s^{-1}$.What is the intensity level at a distance of 20 m? Standard intensity level of sound is $10^{-12} W\ m^{-2}$.	**03**
	(b)	Explain carbon nanotubes (CNTs). Discuss about different structure and types of CNTs.	**04**
	(c)	Discuss in detail about the different types of biomaterials and their applications in the medical field.	**07**

****