Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–I (NEW) EXAMINATION – WINTER 2023

Subject Code:2110011 Date:24-01-2024

Subject Name:Physics

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

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

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

(a) **07**

1. The frequency of Infrasonic wave is

(a) f > 20 Hz (b) f > 20 kHz (c) f < 20 kHz (d) f < 20 Hz

2. The LASER can be produced by

(a) spontaneous emission (c) stimulated emission

(b) Induced absorption (d) Instantaneous emission

3. Which one is not correct for Ultrasonic waves?

(a) Type of sound wave (c) transverse wave

(b) longitudinal wave (d) mechanical wave

4. Solar cells operate on the principle of

(a) Electrostriction effect (c) Photovoltaic effect

(b) Magnetostriction effect (d) Josephson effect

5. Superconducting materials are the type of

(a) Diamagnetic materials (c) Ferromagnetic materials

(b) Dielectric materials (d) Paramagnetic materials

6. Dielectric materials are also termed as

(a) Conductors (c) Insulators

(b) semiconductors (d) superconductors

7. The maximum operating temperature of class Y insulating materials is _____.

(a) above 180 ^{0}C (b) 155 ^{0}C (c) 130 ^{0}C (d) 90 ^{0}C

(b) **07**

1. _____ materials are used to make permanent magnets.

(a) Diamagnetic (b) Paramagnetic (c) Soft magnetic (d) Hard magnetic

2. The grain size of nanomaterials is in the range of

(a) 0.1 to 1 nm (b) 1 to 10 nm (c) 1 to 100 nm (d) 10 to 100 nm

3. The life time of an atom in meta stable state is of order of _____ seconds.

(a) $10^{-9} - 10^{-8}$ (b) $10^{-8} - 10^{-6}$ (c) $10^{-6} - 10^{-3}$ (d) $10^{-3} - 10^{-2}$

4. _____ is a naturally available dielectric material.

(a) air (c) sulphurhexafluoride

(b) nitrogen (d) inert gas

5. Unit of loudness is _____.

(a) Hertz (b) phon (c) second (d) sabine-m^2

6. For superconductors magnetic susceptibility χ_m = _____.

(a) 0 (b) 1 (c) –1 (d) ∞

7. Nd:YAG is ____ type of LASER.

(a) solid (b) liquid (c) gas (d) semiconductor

Q.2 **(a)** Describe the possible mechanism of polarization in a dielectric material. **03**

(b) Define superconductivity. Write three properties of superconductors. **04**

(c) (1) Define and distinguish between hard and soft magnetic materials. **07**

(2) What are the properties of metallic glasses? Mention some important applications.

(3) What are ferrites? Give properties and uses of ferrites.

Q.3 **(a)** The volume of a room is 600 m^3. The wall area of the room is 220 m^2, the floor area is 120 m^2 and ceiling area is 120 m^2. The average sound absorption coefficient for the wall is 0.03, for the ceiling is 0.8 and for the floor it is 0.06. Calculate reverberation time. **03**

(b) Define magnetic materials. Classify diamagnetic, paramagnetic and ferromagnetic materials in detail giving their differences. **04**

(c) (1) Compare type-I and type-II superconductor. **07**

(2) What is solar cell? Discuss a few materials that are used in solar cell design.

(3) Give applications of superconductivity mentioning Josephson devices and magnetic levitation in detail.

Q.4 **(a)** Discuss the applications of lasers in various fields. **03**

(b) Explain with neat sketch carbon nanotubes giving its structure, properties and applications. **04**

(c) (1) Define and describe ‘surface to volume ratio’ and ‘quantum confinement effects’. **07**

(2) Give the difference between metallic and non-metallic glasses.

(3) Give any six applications of nanomaterials.

Q.5 **(a)** The pulse arrival times from the steel bar of 50 mm thickness during the detection of possible defects using pulse echo method are 30 μs and 60 μs. Find out the distance of defect in a steel bar from the entrance end of ultrasonic waves. **03**

(b) Explain: Quantum confinement. **04**

(c) (1) What do you understand by electronic and ionic polarizability? **07**

(2) What are hard and soft magnetic materials? Compare them on the basis of hysteresis curve, Give examples of each type.

Q.6 **(a)** What is the resultant sound level in bel, when a 9 bel sound is added to a 90 dB sound? **03**

(b) Derive an expression for Claussius – Mosotti relation and explain the assumptions involved. **04**

(c) (1) Discuss: Maglev effect. **07**

(2) Distinguish between magnetic and optical storage devices.

(3) Mention the advantages of hard disk over floppy disk.

Q.7 **(a)** Calculate the atomic polarisability of hydrogen gas with a density of 9.8×10^{26} atoms/m^3. Given the radius of the hydrogen atom to be 0.50×10^{-10} m. ($\varepsilon_0 = 8.85 \times 10^{-12}$) **03**

(b) (1) What is Meissner effect? **04**

(2) Prove that superconducting materials are perfect diamagnetic materials.

(c) Write the answers of below given questions based on the ultrasonic waves production method using ferromagnetic material. **07**

(1) What is the principle for ultrasonic wave production?

(2) Draw a figure of the oscillatory circuit.

(3) Write the working of the ultrasonic wave production method.

(4) Give merits and demerits of the method.

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