Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– 1st / 2nd • EXAMINATION – WINTER 2013

Subject Code: 110011   **Date: 26-12-2013**
Subject Name: Engineering Physics
Time: 10:30 am – 01:00 pm   **Total Marks: 70**
Instructions: 1. Attempt any five questions.
　　　　　　2. Make suitable assumptions wherever necessary.
　　　　　　3. Figures to the right indicate full marks.

Q.1	**(a)**	(i) Define : Intensity(I) and Intensity level (I_L) for sound wave, hence derive the formula for the Intensity level (I_L) in terms of dB.	**04**
		(ii) For a simple cubic crystal find: (1) the ratio of intercepts on the three axes by (123) plane, (2) the ratio of spacing of (110) and (111) planes, (3) the ratio of nearest neighbour distance to the next nearest neighbour distance.	**03**
	(b)	Explain the acoustic grating method of determining the velocity of ultrasonic waves in liquids.	**04**
	(c)	In a Hall coefficient experiment a current of 0.25A is sent through a metal strip having thickness 0.2mm and width 5mm. The hall voltage is found to be 0.15mV when magnetic field of 0.2T is used, find: (1) The carrier concentration (2) Drift velocity of the carriers.	**03**
Q.2	**(a)**	(i) Describe the construction and working of CO_2 laser with necessary diagrams.	**04**
		(ii) A light ray enters from air to fibre. The refractive index of air is 1. The refractive index of core is 1.5 (n_1) and cladding is 1.48 (n_2), find: (1) the critical angle (2) fractional refractive index (3) acceptance angle (4) numerical aperture	**03**
	(b)	Define: Austenite and Martensite phase for shape memory alloys. Explain temperature induced transformation in shape memory alloys.	**04**
	(c)	The data is given for copper: (i) Density = 8.92 x 10^3 kg/m^3 (ii) Resistivity = 1.73 x 10^{-8} Ωm (iii) Atomic weight = 63.5. Calculate: (1) the mobility (2) the average time collision of electrons in copper – obeying classical laws.	**03**
Q.3	**(a)**	(i) Write a note on YBCO type of high - T_c superconductor.	**04**
		(ii) The volume of a room is 1200 m^3. The wall area of the room is 220m^2, the floor area is 120m^2 and the ceiling area is 120m^2. The average sound absorption coefficient (i) for walls is 0.03 (ii) for the ceiling is 0.80 (iii) for the floor is 0.06. Calculate: (1) the average sound absorption coefficient (2) the reverberation time.	**03**
	(b)	Define: Non Destructive Testing (NDT). Discuss general objectives of NDT.	**04**
	(c)	Explain ultrasonic welding process with proper diagram.	**03**
Q.4	**(a)**	(i) Compare: Step index fibre with Graded index fibre.	**04**
		(ii) Determine the critical current for a superconducting ring of diameter 10^{-3}m at temperature 4.2K. Given the critical temperature (T_c) for sample is 7.18K and critical magnetic field at 0K ($H_c(0)$) is 6.5 x 10^4 A/m.	**03**
	(b)	Explain laser instrumentation for material processing with schematic diagram.	**04**
	(c)	Calculate the glancing angle of the (110) plane of simple cubic crystal (a = 2.814Å) corresponding to second order diffraction maxima for the X-rays of wavelength 0.710Å.	**03**
Q.5	**(a)**	(i) Discuss quantum free electron theory of metal with its main assumptions.	**04**
		(ii) Calculate the thickness of a quartz crystal needed to produce ultrasonic waves of frequencies (i) 2MH$_z$ (ii) 30 kH$_z$. (Given Young's modulus = 8 x 10^{10} N/m^2, density of material of crystal is 2650 kg/m^3).	**03**
	(b)	Give the properties and applications of nanomaterials.	**04**
	(c)	Differentiate between stimulated emission and spontaneous emission.	**03**
Q.6	**(a)**	(i) Explain the X –ray radiography method for detecting the defects in material.	**04**
		(ii) Calculate the intensity level in dB at a distance 20m from a source which radiates energy at the rate of 3.56W. The reference intensity is 100Wm^{-2}.	**03**
	(b)	With a neat block diagram explain fibre optic communication link.	**04**
	(c)	What is p-n diode? Discuss effect of temperature on I-V characteristic of p-n diode.	**03**
Q.7	**(a)**	(i) Define Miller indices. Give the procedure to obtain Miller indices.	**04**
		(ii) Calculate refractive indices of the core and cladding material of a fibre from the given data: (1) NA = 0.22, (2) fractional refractive index (Δ) = 0.012.	**03**
	(b)	Explain working of varactor diode. Also write its applications.	**04**
	(c)	Write a note on Josephson effect.	**03**

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