Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(An Autonomous Institute Affiliated to University of Mumbai)

End Semester Examination

May 2021

Max. Marks: 45 **Semester: I**

Course Code: AS101

Class: FY B.Tech. **Branch: ETRX / EXTC**

Name of the Course: Engineering Physics

Instructions:

(1) All Questions are Compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Question No.		Max. Marks	CO
Q1 (a)	Draw the energy band diagrams of an intrinsic semiconductor and a n-type semiconductor at room temperature. Why does Fermi level lie at the center of forbidden energy gap of an intrinsic semiconductor? Explain it qualitatively. OR Explain the formation of depletion region in a p-n junction with proper diagram. Can the barrier potential be measured using a voltmeter? Justify your answer.	(3+2)	CO1
Q1 (b)	A particle with energy $E = U_0/2$ is incident on a barrier of height U_0 and thickness L. Its transmission coefficient is T_0. If the barrier thickness is doubled, with its height and the particle energy remaining unchanged, express the new transmission coefficient in terms of T_0.	(5)	CO1
Q1 (c)	Differentiate between three level and four level pumping schemes in Laser with the help of diagram (minimum two points).	(4+1)	CO1

	Give an example of 3 level and 4 level laser. OR Distinguish (4 distinct points) between spontaneous and stimulated emission with necessary diagrams and write down the expression for the number of transitions in both.		
Q2 (a)	Describe the construction of a ruby laser using a schematic diagram. Explain its working with neat labeled energy level diagram. OR Describe the construction of a He-Ne laser using a schematic diagram. Explain its working with neat labeled energy level diagram.	(5)	CO3
Q2 (b)	Show that the solution of Schrodinger equation for a particle confined in a one dimensional infinite potential well leads to the concept of quantization of energy.	(5)	CO4
Q2 (c)	A three level laser emits laser light at a wavelength of 550 nm, near the center of the visible band. (i) If the optical pumping is shut off, what will be the ratio of the population of the upper level E_2 to that of the lower energy level E_1? (ii) At what temperature for the condition of (i) would the ratio of the population be ½?	(3+2)	CO2
Q3 (a)	A p-type Silicon must have resistivity of 10 ohm-cm. What fraction of Boron atoms must be added to achieve the desired resistivity? The mobility of holes is $0.048 m^2/VS$ and atomic density of Silicon is 5×10^{28} atoms/m^3.	(5)	CO2
Q3 (b)	Find the probability of finding a particle trapped in a box of width L in the region from 0.2L to 0.4L for the ground state.	(5)	CO2

Q3 (c)	The resistivity of a doped Si sample is 9.27×10^{-3} Ω m and the Hall coefficient is 3.84×10^{-3} m^3/C. Identify the type of the semiconductor. Calculate the carrier density and mobility of the carrier.	(5)	CO2

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