



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

August 2021

Max. Marks: 60

Class: FY B.Tech.

Semester: I

Course Code: AS101

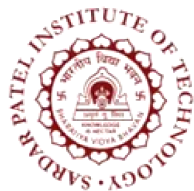
Branch: COMP/ I.T.

Name of the Course: Engineering Physics

Instructions:

- (1) All Questions are Compulsory
- (2) Explain with the help of neat diagrams, wherever applicable
- (3) Assume suitable data if necessary

Question No.		Max. Marks	CO
Q1 (a)	<p>Draw the energy band diagrams of an insulator and a n-type semiconductor at room temperature.</p> <p>Why does Fermi level lie at the center of forbidden energy gap of an intrinsic semiconductor? Explain it qualitatively.</p> <p style="text-align: center;">OR</p> <p>Explain the origin of Hall voltage using suitable diagram. Mention the important applications of Hall effect.</p>	(3+2)	CO1
Q1 (b)	<p>Justify the second ad-hoc postulate of Bohr's atomic model by de Broglie's hypothesis using the right mathematical expressions and diagram. Define the new meaning of quantum number.</p>	(4+1)	CO1
Q1 (c)	<p>Explain the role of Meta stable state and Population Inversion to generate laser light.</p> <p style="text-align: center;">OR</p> <p>Explain the terms: Induced Absorption and Stimulated Emission with the help of suitable diagrams.</p>	(2+3)	CO1



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Q1 (d)	<p>Explain the working of a solar cell with a neat diagram and write two important advantages and two applications of it.</p> <p style="text-align: center;">OR</p> <p>Explain the working of a LED with a neat diagram and write two important advantages and two applications of it.</p>	(3+2)	CO1
Q2 (a)	The He-Ne system is capable of lasing at several different wavelengths, the prominent one being at 3.3913 μm . Determine the energy difference in eV between the upper and lower lasing levels and the frequency of this laser radiation?	(4+1)	CO2
Q2 (b)	<p>A rod of p-type Ge is 6 mm long, 1 mm wide and 0.5 mm thick has an electrical resistance of 120 ohm. Determine its conductivity and impurity concentration. Name the majority charge carriers.</p> <p>Given: $\mu_h = 0.19 \text{ m}^2/\text{V-s}$.</p>	(3+1+1)	CO2
Q2 (c)	The resistivity of two sides of a p-n junction are 4 $\Omega \text{ cm}$ on p-side and 2 $\Omega \text{ cm}$ on n-side at 300 K. Calculate the barrier potential, given that the intrinsic carrier density is $2.25 \times 10^{19}/\text{m}^3$, mobility of electrons is $0.38 \text{ m}^2/\text{V-s}$ and mobility of holes is $0.18 \text{ m}^2/\text{V-s}$.	(5)	CO2
Q2 (d)	A proton beam of 5.0 eV is incident on a barrier of height 6.0 eV and thickness 0.35 nm and at a rate equivalent to a current of 1.0 kA. Calculate the average time taken for one proton to be transmitted?	(5)	CO2
Q2 (e)	A pulsed Ruby LASER has its active medium a synthetic Ruby Crystal in the form of a cylinder 6 cm long and 1 cm in diameter. Ruby consists of Al_2O_3 in which in this case – one Al^{+3} in every 3500 has	(5)	CO2



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	<p>been replaced by Cr^{+3}. These Cr^{+3} ions accounts for the lasing transitions at a wavelength of 694.3 nm.</p> <p>Suppose that all the Cr^{+3} ions are in metastable state. How much energy is available for release in single pulse of laser light if all these ions revert to the ground state in a single stimulated emission chain reaction?</p> <p>Given the density of Al_2O_3 is 3700 kg/m³ and its molar mass is 102gm/mol.</p>		
Q3 (a)	What is an optical resonator? What role does it play in the generation of laser? Explain it with the help of relevant diagrams.	(5)	CO4
Q3 (b)	<p>Derive the energy levels of an electron confined in a 1D box of infinite height and show that these levels are discrete.</p> <p>Derive Eigen functions and show that the probability of finding the particle varies as a function of the distance 'x' with the help of the diagram.</p>	(5+5)	CO3

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