COURSE CODE……..

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RV COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
I Semester B.E. April -2023 Examinations
DEPARTMEN OF PHYSICS
COURSE TITLE: CONDENSED MATTER PHYSICS FOR ENGINEERS
(2022 SCHEME)
(Integrated Course – Lab + Theory)

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, and 9 and 10, and 11 lab components (compulsory).

PART-A (Objective type for one or two marks)
(True & false and match the following questions are not permitted)

		UNIT-IV	
1	1.1	Distinguish between matter waves and electromagnetic waves?	10
7	1.2 a	What is zero point energy of an electron? Explain how Zener diode is different from ordinary pn-junction diode. Explain the function of Zener diode with the help of its I-V characteristics.	10+4
	1.3 b	Define density of states in metals. Explain the avalanche breakdown mechanism in diode.	
	1.4	What is pumping in laser? **OR**	
	1.5	Write the pumping mechanism, explain the graphical method of analyzing the working of a	
8	1.6 a	Mention one advantage of optical fiber on conventional cable. transistor as an amplifier in common emitter mode. Discuss the merits of common emitter amplifier.	
	1.7 b	What is the advantage of common emitter configuration over other configurations? Sketch the characteristics of input and output transistor characteristics.	
	1.8	What is polarization in dielectrics?	
	1.9	Mention the principle of strain guage sensor.	
	1.10	What is Seebeck effect?	

PART-B (Maximum subdivisions is limited to 2 in each question)

		UNIT-I	
2	a	Apply the time independent Schrodinger's wave equation to find the solutions for a particle in an infinite potential well of width 'a'. Hence obtain normalized wave function.	10+4
	b	The position and momentum of 1 keV electron are simultaneously determined. If its position is located within 1Å. What is the percentage of uncertainty in its momentum?	
		UNIT-II	
3	a	Discuss the variation of fermi factor with temperature in metals. Show that fermi factor is symmetrical with respect to fermi level.	10+4
	b	Find the temperature at which there is 1% probability that a state with energy 0.5 eV above Fermi energy is occupied.	
		OR	
4	a	Derive an expression for electron concentration in the conduction band of an intrinsic semiconductor.	
	b	A sample of silicon is doped with 107 phosphorous atoms/cm 3 . Find the Hall voltage, if the sample is 100µm thick, the current passing through the sample is 1 mA and the applied magnetic field is 10-5Wb/m2.	

		UNIT-III	
5	a	Explain the importance of population inversion in laser. With the neat sketch explain the construction and working of semiconductor laser.	
	b	Calculate the ratio of i) Einstein Coefficients, ii) Stimulated to spontaneous emissions, for a system at 300K in which radiations of wavelength 1.39µm are emitted.	

Write a note on Ultrasonic piezoelectric sensor and mention its applications

LAB COMPONENT

11 a

What is Fermi energy of a metal? With a brief procedure, explain the determination of Fermi energy of copper.

Using the following data, find the slope of resistance Vs temperature graph using least square fit method and calculate the Fermi energy of copper in eV.

Temperature (^{0}C)	84	82	80	78	76	74
Resistance (Ohm)	9.66	9.63	9.58	9.53	9.48	9.42

10+10

b

Mention the condition for diffraction phenomenon of light. With a brief procedure, explain the method of determination of wavelength of given laser source.

Given data: Distance between the grating and the screen, d= 90cm.

Grating constant: 5.08×10^{-5}m.

Diffraction order	Distance Xn (cm)
1	1.3
2	2.6
3	3.9
4	4.9
5	6.2
6	7.9