



**PRESIDENCY UNIVERSITY
BENGALURU**

SET A

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2024**

Semester : Semester I - 2023

Course Code : PHY1002

Course Name : Sem I - PHY1002 - Optoelectronics and Device Physics

Program : B.Tech.

Date : 13-JAN-2024

Time : 9:30AM - 12:30 PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.
- (v) Given: $k=1.38 \times 10^{-23}$ J/K, $h=6.626 \times 10^{-34}$ Js, $m_e=9.1 \times 10^{-31}$ kg and $c=3 \times 10^8$ m/s.

PART A

ANSWER ALL THE QUESTIONS

4 X 5M = 20M

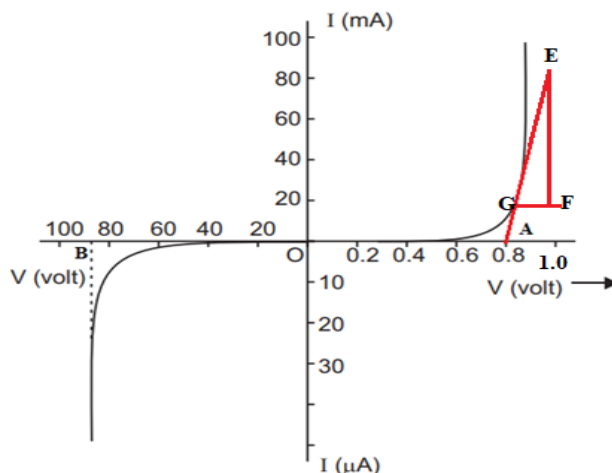
1. Differentiate intrinsic and extrinsic semiconductors. (CO1) [Knowledge]
2. Discuss the conditions required for laser action. (CO4) [Knowledge]
3. State and explain Hall effect with a neat labelled diagram. (CO1) [Knowledge]
4. What are optical fibers? What are the advantages of optical fiber communication system. (CO4) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS

5 X 10M = 50M

5. It is observed that electron- lattice -electron interaction leads to the formation of cooper pairs below a threshold temperature. Explain the formation of cooper pairs and how this leads to zero resistance. (CO1) [Comprehension]
6. The voltage current characteristics of a pn junction device which operates in reverse bias conditions is shown in the figure
 - a) Name the device.
 - b) Identify and explain the points A and B.
 - c) Explain the possible breakdown mechanisms in the device.

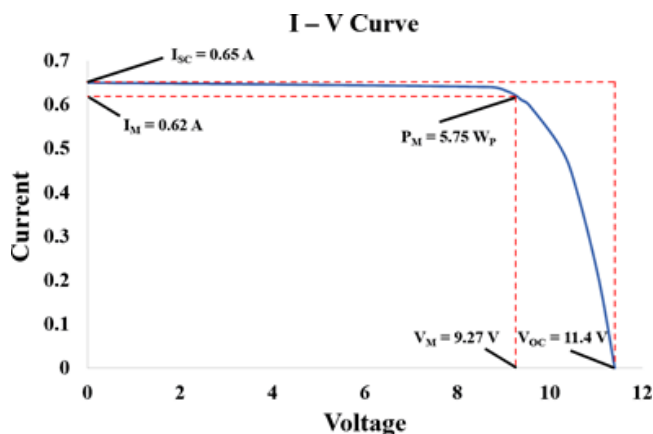


(CO2) [Comprehension]

7. a) Name the high bandwidth cable which is used in a communication system. With a neat labelled diagram explain the communication process from transmitter to receiver.
 b) Calculate the minimum uncertainty in the energy state of an atom, if an electron remains in this state for 10^{-9} s.

(CO4,CO3) [Comprehension]

8. The voltage current characteristics of a photovoltaic cell is given below. Analyze the graph and calculate ideal power, Maximum power and fill factor.



(CO2) [Comprehension]

9. a) Calculate the momentum of an electron and the de Broglie wavelength associated with it, if its kinetic energy is 3.5 KeV.
 b) The ratio of population of two energy levels is 1.358×10^{-30} . The wavelength of light emitted at 642 nm. Calculate the thermal equilibrium temperature of the system.

(CO3,CO4) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS

2 X 15M = 30M

10. a) Compare the energy of a photon with that of a neutron when both are associated with a de Broglie wavelength of 3.5 Å. Given mass of neutron is 1.674×10^{-27} kg.
 b) The position and momentum of a 15 keV electron are determined simultaneously. If its position is located within 2 Å, what is the percentage uncertainty in its momentum?

(CO3) [Application]

11. It is noted that, a pn junction device emits light when forward biased. Name the device. Explain the construction, principle, working and voltage current characteristics of the device with suitable diagrams.

(CO2) [Application]