Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET - A

SCHOOL OF ENGINEERING
END TERM EXAMINATION - FEB 2023

Semester : Semester I - 2022
Course Code : PHY1002
Course Name : Sem I - PHY1002 - Optoelectronics and Device Physics
Program : B.Tech - (All Programs)

Date : 21-FEB-2023
Time : 1.00PM - 4.00PM
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.

PART A

ANSWER ALL THE QUESTIONS **(10 X 2 = 20M)**

1. A superconducting material on being subjected to the critical magnetic field changes to
a) Critical conductor (CO1) [Knowledge]
b) A material with superconductivity
c) Normal state
d) Remains uninfluenced

2. In a semiconductor, if the temperature increases then the resistivity
a) Increases (CO1) [Knowledge]
b) Decreases
c) Remains same
d) Fluctuates

3. When the band gap of LED is increased then the wavelength
a) Increases (CO2) [Knowledge]
b) Decreases
c) Remains same
d) Doubles

4. The device which converts optical energy to electrical energy

a) Solar cell (CO2) [Knowledge]

b) Resistor

c) Capacitor

d) Transistor

5. A simple PN Junction diode is fabricated using ---------- semiconductor and can be used as a ----------

a) Extrinsic, unidirectional switch (CO2) [Knowledge]

b) Intrinsic, unidirectional switch

c) Extrinsic, BIdirectional switch

d) Intrinsic, Bidirectional switch

6. If the momentum of a particle is increased four times, then the de Broglie wavelength becomes

a) twice (CO3) [Knowledge]

b) four times

c) one-fourth

d) half

7. Which one of the following objects, moving at the same velocity, has the greatest de Broglie wavelength?

a) Electron (CO3) [Knowledge]

b) Golf ball

c) Football

d) Tennis ball

8. Conventional light sources are an example for

a) Stimulated Emission (CO4) [Knowledge]

b) Spontaneous Emission

c) Stimulated Absorption

d) Both A & B

9. Which among the following is described by the concept of numerical aperture in an optical fibre?

a) Light collection (CO4) [Knowledge]

b) Light Scattering

c) Light Dispersion

d) Light Polarization

10. A ray of light will undergo total internal reflection if it

a) Goes from rarer medium to denser medium (CO4) [Knowledge]

b) Incident at an angle less than the critical angle

c) Strikes the interface normally

d) Incident at an angle greater than the critical angle

11. a) The silicon semiconductor at a temperature of 300 K has a 'p' number of free electrons 'q' the number of free holes. When the temperature of silicon is increased to 400 K, then the number of free electrons becomes 'P' and the number of free holes becomes 'Q'. Mention the relationship between the following quantities.
(1) p and q (2) q and Q (3) P and Q
b) Which are soft superconductors and explain them with 'M' and 'H' curve.

(CO1) [Comprehension]

12. a) Identify the device which conducts reverse biasing and explain it working principle
b) Gallium Arsenide (GaAs) LED has a band gap of 1.5 eV. Then the light emitted by it will be.

(CO2) [Comprehension]

13. a) It is observed that the sub microscopic particles in motion exhibit wave properties. Identify the waves and discuss their properties.
b) Calculate the de Broglie wavelength associated with electrons if the accelerating voltage is 6000 V.

(CO3) [Comprehension]

14. Explain stimulated absorption, spontaneous emission, and stimulated emission with a neat diagram.

(CO4) [Comprehension]

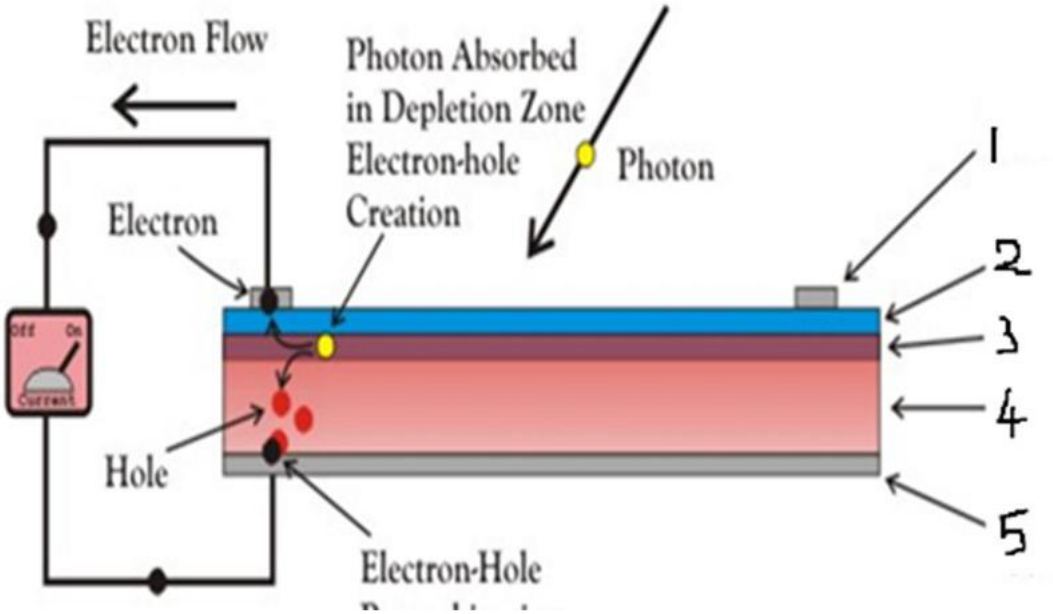
15. a) Why the refractive index of the core is kept more compared to the refractive index of cladding in optical fiber? Explain the mechanism of light propagation through optical fiber with diagram. (6M)
b) calculate the critical angle for a given refractive index core and cladding at 1.48 and 1.46.(4M)

(CO4) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **(2 X 15 = 30M)**

16.



a) The device shown in the figure develops meaningful voltage when exposed to sunlight. Identify the device. Mention the type of material used to make the device. Label the parts of the device and explain the principle and working of this device.

b) Calculate the uncertainty in the momentum of an electron if the uncertainty in its position is 2 Å

(CO2,CO3) [Application]

17. a) Identify the high bandwidth cable which is used in a communication system. Explain the communication process from transmitter to receiver with a schematic diagram.
b) The ratio of the population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 330K.

(CO4) [Application]

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