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Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2022

Fourth Semester

Core Course—OPTO-ELECTRONICS

(For the Programme B.Sc. Electronics)

(2013—2016 Admissions)

Time : Three Hours | Maximum Marks : 80

Part A

Answer **all** *questions.*

Each question carries 1 *mark.*

1. In the case of diode lasers, it is not necessary to use external mirrors to provide ———— feedback.
2. Longer wavelength LEDs fabricated from the InGaAsP/InP material system for operation at a wavelength around ———— μm are widely commercially available.
3. ———— is a semiconductor material for which the lowest energy absorption takes place by indirect optical transitions.
4. Phototransistors offer ———— response time as compared to photodiodes.
5. ———— is preferred for long distance communication.
6. Population inversion can be achieved in a material by an action called ————.
7. ———— is an efficient electro-optic modulator material.
8. In an optical fibre, the concept of Numerical aperture is applicable in describing the ability of ————.
9. A multimode step index fibre has a large core diameter of range ————.
10. In single mode fibres, the most beneficial index profile is ———— index.

(10 × 1 = 10)

Turn over

Part B

Answer any **eight** *questions.*
Each question carries 2 *marks.*

11. Explain the dual nature of light.

12. What are magneto-optic devices ?

13. What do you mean by avalanche breakdown ?

14. What is population inversion in lasers ?

15. What is meant by optical pumping in lasers ?

16. Draw the refractive index profiles of step index and graded index fibres.

17. Name the different types of display devices.

18. What is a Quantum Well structure ?

19. Write a short note on thermal detector.

20. Give the reasons of attenuation and distortion of light through the optical fibre.

21. What are the disadvantages of multimode step index fibre ?

22. Define numerical aperture of a step index fibre.

(8 × 2 = 16)

Part C

Answer any **six** *questions.*
Each question carries 4 *marks.*

23. What are the different pumping schemes for lasers ? Explain.

24. Why a single mode fibre is preferred for communication purpose ? Explain.

25. Explain the working of a solar cell and discuss the current voltage characteristics.

26. An InGaAsP surface emitter has an activation energy of 1 eV with a constant of proportionality (β_0) of $1.84 \times 10^7\ h^{-1}$. Estimate the CW operating lifetime for the LED with a constant junction temperature of 17ºC, if it is assumed that the device is no longer useful when its optical output power has diminished to 0.67 of its original value.

27. The total efficiency of an injection laser with a GaAs active region of 1.43eV. Calculate external power efficiency of the device.

28. Explain LED characteristics.

29. An optical fibre has an acceptance angle of 30º and a core of refractive index 1.4. Calculate the refractive index of cladding.

30. Distinguish between absorption and radiation in semiconductor devices. How it is related to energy band structures ? Explain.

31. Write a note on EL and CL displays.

(6 × 4 = 24)

Part D

Answer any **two** *questions.*
Each question carries 15 *marks.*

32. With the help of neat diagram explain the working of a liquid crystal display.

33. What is quantum efficiency ? Discuss the techniques and parameter needed to be optimized to maximize quantum efficiency of an LED.

34. Discuss in detail about the construction and working of photo conductors. Also explain its classification.

35. With the help of an energy level diagram explain the working of helium neon laser.

(2 × 15 = 30)