Reg. No ..... Name **21P4029**

M. Sc. DEGREE END SEMESTER EXAMINATION - APRIL 2021

SEMESTER 4 : PHYSICS

COURSE : **16P4PHYT15EL : OPTOELECTRONICS**

(For Regular - 2019 Admission and Supplementary - 2018/2017/2016 Admissions)

Time : Three Hours Max. Marks: 75

PART A

Answer All (1 mark each)

1. For distributed freed back laser in a medium of refractive index 'n' and corrugation period Λ the Bragg wavelength λ_B is given by
   (A) $q\frac{n}{\lambda_B} = 2\Lambda$ (B) $q\frac{\lambda_B}{n} = 2\Lambda$ (C) $\frac{n}{q\lambda_B} = 2\Lambda$ (D) $\frac{\lambda_B}{qn} = 2\Lambda$.
2. Among the dispersion which has higher magnitude in a silica fiber
   (A) Multimode dispersion (B) Material dispersion (C) Waveguide dispersion
   (D) Refractive index profile dispersion
3. In a laser optical gain coefficient(g) is defined on,
   (A) Power/unit distance (B) Power/unit area (C) Power/unit volume (D) Output power/input power.
4. The photocurrent in a photodiode is caused by
   (A) Minority carriers (B) Majority carriers (C) Both (A) and (B) (D) Dark current.
5. Self-focusing Phenomenon
   (A) Does not alter the frequency of the wave (B) Does not alter the refractive index of the medium (C) Alter the intensity of the beam (D) Alter the frequency of the beam

(1 x 5 = 5)

PART B

Answer any 7 (2 marks each)

6. Distinguish between intrinsic and extrinsic semiconductors
7. Explain the difference in radiative and non radiative recombinations.
8. What is an evanescent wave?
9. Give the difference between active and passive Q-switching.
10. What is meant by internal quantum efficiency of a semiconductor laser?
11. Explain the principle of quantum well laser
12. Why photodiode is operated in the reverse bias condition.
13. Write a short note on solar energy spectrum.
14. Differentiate between Longitudinal and transverse electro – optic modulators.
15. Explain the phenomena of self-focusing.

(2 x 7 = 14)

PART C

Answer any 4 (5 marks each)

16. Given that the refractive index 'n' of GaAS has a temperature dependance $\frac{dn}{dT} = 1.5 \times 10^{-4} K^{-1}$. Estimate the change in the emitted wave length 870 nm per degree change in the temperature between mode hops. 'n' of GaAs = 3.7.

17. What are the advantages of double hetrostructure lasers?

18. What is meant by Q- switching? How it is achieved using electro-optic method?
19. Define shot noise and quantum noise in photo detectors.
20. Explain the working of a phototransistor. What are their advantages over an avalanche photodiode?
21. Write a short note on Kerr modulators.

(5 x 4 = 20)

PART D

Answer any 3 (12 marks each)

22.1. Explain heterojunction high intensity LED's with a suitable constructional design. Also discuss double heterostructure LED's.

OR

Explain the different types of modal and wave guide dispersions in the planar wave guide.

2.

23.1. Obtain laser oscillation conditions. Explain why homojunction laser have high threshold current density.

OR

Explain with necessary theory how high power periodic pulses are obtained by mode –

2. locking.

24.1. Define the quantum efficiency and responsivity of a photodetector and derive an expression for the responsivity of an intrinsic photodetector.

OR

2. Describe the principle used in Acousto -optic modulator. Explain Raman - Nath and Bragg types.

(12 x 3 = 36)