TM193620T

Reg. No: .....

Name: .....

**M. Sc. DEGREE (C.S.S.) EXAMINATION, NOVEMBER 2024**

**2018, 2019 Admissions ( Supplementary)**

**SEMESTER III – CORE COURSE (PHYSICS)**

**PH3EA1TM - OPTOELECTRONICS AND DIGITAL SIGNAL PROCESSING**

**Time: Three Hours** **Maximum Marks: 75**

## PART A

**I. Answer any five questions. Each question carries 3 marks.**

1. What are the differences between photodiode and avalanche photodiode?
2. Explain two reasons for homogeneous broadening.
3. Explain time scaling and shifting property of signals with examples.
4. What is meant by mode locking?
5. What are continuous time signal and discrete time signal? Give examples.
6. Define fill factor of solar cell and explain its significance.
7. Outline the principle of Kerr modulators.

**(5 x 3 = 15)**

## PART B

**II. Answer any six questions. Each question carries 5 marks.**

8. Explain the working of phototransistor.
9. Explain different types of standard CT signals.
10. The radiative and non radiative recombination life time of minority carriers in the active region of an LED are 30 nS and 150nS respectively. Determine the total carrier recombination and the internal quantum efficiency.
11. Derive an equation for relation between Einstein's coefficients.
12. Explain the working of plasma display.
13. Explain the construction of optical isolator using Faraday effect.
14. Write notes on optical bistability and saturable absorber.
15. A laser amplifier with gain $60m^{-1}$ and length 0.12 m has one mirror 100% reflecting. What should be the reflectance of the other mirror?
16. Explain impulse invariant method in IIR filter design.

**(6 x 5 = 30)**

## PART C

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

17. Outline the Q-switching theory. Explain three techniques for Q-switching.
18. Categorize different types of liquid crystals and explain the properties of them. Also, discuss the working of a liquid crystal display.
19. Write an essay on second order nonlinear optical effect highlighting three consequences. Explain why SHG is absent in liquids.
20. Define Z transform of a sequence. Explain six properties of it. Find ZT and ROC of the following signals $(i)\ \left(\frac{1}{2}\right)^n\ U(n-1)(ii)\ \delta(n)-\delta(n-2)\ and\ (iii)a^nU(n)$

**(2 x 15 = 30)**