

TM144420C

Reg. No:.....

Name:.....

M. Sc. DEGREE (C.S.S.) EXAMINATION, MARCH 2017
(Supplementary – 2014 Admission)
SEMESTER IV - PHYSICS
PHY40E - OPTOELECTRONICS

Time: Three Hours

Maximum weight: 30

PART A

I. Answer any six questions. Each question carries a weight of 1

1. What do you mean by compensation doping?
2. Define waveguide dispersion.
3. Define non degenerate semiconductors.
4. What is optical gain coefficient.
5. Define Q factor of laser.
6. What is meant by absorption coefficient of a photodiode material?
7. Why cannot Silicon diodes be used in optical communications at $1.3 \mu\text{m}$?
8. Explain the term phase matching in non linear optics.
9. Explain second harmonic generation in non linear optics.
10. What is meant by Pockel and Kerr effect?

(6 x 1 = 6)

PART B

II. Answer any four questions. Each question carries a weight of 2

11. A 2 Km length optical fibre has input power of 20mW and an output power of $150\mu\text{W}$. Find the loss in db/km.
12. A GaAs LED fabricated from fairly lightly doped materials has an effective recombination region of width $.1\mu\text{m}$. If it is operated at current density of $2 \times 10^7 \text{Am}^{-2}$. Estimate the modulation bandwidth that can be expected
13. Consider a He-Ne gas laser operating at 632.8nm. The tube length $L= 40\text{cm}$, tube diameter is 1.5mm and mirror reflectances are approximately 99.9% and 98%. The line width $\Delta\nu=1.5\text{GHz}$, the loss coefficient $\gamma \approx 0.05 \text{m}^{-1}$, spontaneous decay time constant $\tau_{sp}=1/A_{21} \approx 300\text{ns}$, $n \approx 1$. What is the threshold gain and population inversion?
14. A Si pin photodiode has an active light receiving area of diameter 0.4 mm. when radiation of wavelength 700 nm and intensity 0.1mW cm^{-2} is incident it generates photocurrent of 56.6 nA. What is the responsivity and quantum efficiency of the photodiode at 700 nm?
15. Discuss noise equivalent power of a photodetector.
16. Discuss optical polarization- birefringence and retardation plates.

(4 x 2 = 8)

PART C

III. Answer all questions. Each question carries a weight of 4

17. a) Write notes on-

- i) Heterostructure LED.
- ii) Optical laser amplifier.

OR

b) i) Explain working of an optical fiber on a waveguide

- ii) What is the difference between performance of a step index fiber and a graded index fiber.

19. a) Discuss quantum well lasers

OR

20. b) Discuss different techniques of mode locking.

21. a) Discuss avalanche photodiode in detail.

OR

22. b) Discuss the principles of a photovoltaic device. Also discuss pn junction photovoltaic I-V characteristics.

23. (a) Discuss second and third order non linear process.

Explain the term optical mixing in non linear optics.

OR

24. (b) Describe the principle used in electro-optic modulator. Explain the working of an electro optic modulator circuit. Point out the relative merits.

(4 x 4 = 16)