

26024151



26024151



Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, MAY 2026

Fourth Semester

Faculty of Science

Branch II - Physics (A) - Pure Physics

PH4OE1—OPTOELECTRONICS

(2016-2018 Admissions—Mercy Chance)

Time : Three Hours

Maximum Weight : 30

Part A

*Answer any **six** questions.*

Each question carries a weight of 1.

1. What is compensation doping ?
2. What is the principle of operation of an LED ?
3. What is a symmetric planar dielectric slab waveguide ?
4. What is active Q-switching ?
5. Define a quantum well laser.
6. What is the absorption co-efficient, and how does it affect photodiode materials ?
7. Define photoconductive gain.
8. What is meant by an anisotropic crystal in the context of non-linear optics ?
9. What conditions are necessary for a material to exhibit second-order non-linear optical effects ?
10. Name any *two* non-linear optical materials.

(6 × 1 = 6)

Part B

*Answer any **four** questions.*

Each question carries a weight of 2.

11. An *n*-type Si wafer has been doped uniformly with 10^{16} antimony (Sb) atoms cm^{-3} . Calculate the position of the Fermi energy with respect to the Fermi energy E_{F_i} in intrinsic Si.

Turn over





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12. A single mode optical fibre has a core of diameter $8\text{ }\mu\text{m}$ and a refractive index of 1.46. The normalized index difference is 0.3 %. The cladding diameter is $125\text{ }\mu\text{m}$. Calculate the numerical aperture, acceptance angle and the single mode cut-off wavelength of the fibre.
13. What is a single frequency solid state laser ? Mention its applications.
14. What is an avalanche photodiode ? Explain its working and advantages.
15. A Si PIN photodiode has quoted NEP of $1 \times 10^{-13}\text{ WHz}^{-1/2}$. What is the optical signal power it needs for a signal to noise ratio (SNR) of 1 if the bandwidth of operation is 1 GHz ?
16. What are third-order non-linear optical processes ? Explain briefly.

(4 × 2 = 8)

Part C

Answer all questions.

Each question carries weight of 4.

17. (a) What are heterojunction high-intensity LEDs ? Explain the advantages of double heterostructure in LED efficiency.

Or

- (b) Describe the different factors affecting attenuation in optical fibers.

18. (a) Discuss laser diode characteristics and derive laser diode equation.

Or

- (b) Explain the theory of mode locking in lasers.

19. (a) With the help of a neat diagram, explain the principle and I-V characteristic? of a photovoltaic solar cell.

Or

- (b) Explain the working of a phototransistor and compare it with a photodiode.

20. (a) Explain the principle and working of acousto optic modulator.

Or

- (b) Explain the concept of phase matching in nonlinear optical interactions.

(4 × 4 = 16)

