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DEPARTMENT OF SCIENCES, IV SEMESTER M.Sc (Physics) END SEMESTER EXAMINATIONS, JUNE 2021

SUBJECT [CODE PHY 5011] (REVISED CREDIT SYSTEM-2017)

Time: 2 Hours

Date:14-06-2021

MAX. MARKS: 40

Note: (i) Answer **any four full** questions

(ii) Draw diagrams, and use equations wherever necessary

- 1. a) Derive the wave equation for a wave propagating in a nonlinear media. Give the wave equations in case of second harmonic generation (5)
 - b) Briefly explain the various phenomena arising from third order nonlinear process. Explain how self-phase modulation affects the propagation of light? Consider the case of an optical fiber of length 20 km. Give an application of this phenomena. (Use this data: P=1 W, $n_2=3.2 \times 10^{-20} \text{ m}^2/\text{W}$) (5)
- 2. a) Obtain an expression for the power generated at second harmonic in case of low efficiencies and explain how perfect phase matching affects the efficiency? (7)
 - b) Explain open aperture z-scan. What are the advantages of z-scan? (3)
- 3. a) Discuss the electro optic effect in longitudinal mode in KDP. What are the disadvantages of this mode? (6)
 - b) Discuss on the transit time limitations while designing an electrooptic modulator (4)
- 4. a) Explain the general working principle of a photodetector along with the essential requirements. An InGaAs pin photodiode operating at 1300 nm (efficiency, $\eta = 0.90$) is being operated at an incident optical power of 300 nW, what is the primary photocurrent? (4)
 - b) How waveguide devices are advantageous over the conventional devices. Briefly explain the fabrication of working of Mach-Zender interferometer modulator and switch. (6)
- 5. a) Give the key requirements needed in analyzing a simple point-to-pint link. Explain power budget and time budget. (6)
 - b) Discuss the different error sources in an optical fiber communication (OFC) system. Obtain an expression for bit error rate. (4)
- 6. a) What do you mean by multiplexing in an OFC system? Explain wavelength-division multiplexing along with its advantages (5)
 - b) Discuss the need for femtosecond pulses. Give its general properties. (5)