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No.					

DEPARTMENT OF SCIENCES, IV SEMESTER M.Sc (Physics) END SEMESTER EXAMINATIONS, APRIL/MAY 2019

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

Time: 3 Hours

Date:30-04-2019

MAX. MARKS: 50

Note: (i) Answer ALL questions

(ii) Draw diagrams, and write equations wherever necessary

- 1. a) Obtain an expression for nonlinear refraction and explain the phenomena arising from the third order nonlinear process. (7)
 - b) Demonstrate how self-phase modulation could lead to the generation of ultrashort pulses. Use the following data: $n_2=3\times10^{-20}$ m²/W, $\lambda_0=1$ µm, P=5 W, z (distance) =1 km, area= 100 µm² (3)
- 2. a) With necessary derivation explain how one can get phase sensitive amplification and attenuation via second order nonlinear effects. (5)
 - b) Explain the process of the optical parametric oscillator. Find its intermodal frequency, bandwidth, FWHM and threshold power ($n_s = n_i = n_p \approx 2, \lambda_p=0.6 \mu m$, $\lambda_s=1 \mu m$, $\lambda_i=1.5 \mu m$, l=5 cm, $d=3\times10^{-11} \text{ m/V}$, $R_1=R_2=0.98$, $S=1 \text{ mm}^2$, $N(\omega_{so})-N(\omega_i) \approx 0.05$) (5)
- 3. a) Discuss the general considerations on an electrooptic modulator design. (4)
 - b) Obtain an expression for retardation in the case of electrooptic effect in the transverse mode. (3)
 - c) Explain briefly the application of electrooptic effect in Q-switching. Comment on its superiority compared to other techniques. (3)
- 4. a) How do you describe quantum efficiency in the case of an LED, derive an expression for the same. (3)
 - b) Calculate the total output power in case a double heterojunction Ga_{0.70}Al_{0.30}As LED. Assume the non-radiative and radiative lifetimes as 70 ns and 15 ns respectively. The RI of the source material is 3.77 and drive current is 25 mA.
 - c) Explain the working principles avalanche photodiode and semiconductor optical amplifiers with neat diagrams (4)
- 5. a) What are the possible sources of errors optical receiver operation? Obtain an expression for bit-error rate (BER). (3)
 - b) With a block diagram, discuss on the elements of an optical fiber transmission system. (3)
 - c) Explain the process of generation of femtosecond laser pulses via mode locking

(4)

(3)