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No.					

DEPARTMENT OF SCIENCES, IV SEMESTER M.Sc. END SEMESTER EXAMINATIONS, MAY 2022

OPTOELECTRONICS-II [PHY6012]

(CHOICE-BASED CREDIT SYSTEM-2020)

Time: 3 Hours

Date: 6-5-2022

MAX. MARKS: 50

Note: (i) Answer ALL questions;

(ii) Draw diagrams, and write equations wherever necessary

(iii) Any missing data may be suitably assumed

Question

Marks

1A	Explain how the electro-optic effect in KDP crystals under longitudinal mode can be used to obtain phase and amplitude modulation.	5
1B	Consider a KDP crystal of length 2 cm, safety factor of 3, electro- optic coefficient of 10.5×10^{-12} m/V, and refractive index of 1.512 (Given $\lambda_0=0.6328$ µm). i) Calculate the minimum value of d (diameter of the beam at the ends of the crystal) and ii) corresponding half wave voltage at $\lambda_0=0.6$ µm in the transverse mode of operation.	3
1C	Write the differences between Raman-Nath and Bragg regime of diffractions.	2
2A	Discuss the theory of sum and difference frequency generation in nonlinear optics.	5
2B	What is phase matching in second harmonic generation and show that phase matching criterion is equal to a refractive index criterion.	3
2C	Explain briefly the phenomenon of nonlinear refraction.	2
3A	With necessary diagrams, Explain the principle and working of Electro-Optic Modulator (EOM). Mention their applications.	5
3B	Explain the principle and working of Raman Fiber Amplifier (RFA).	3
3C	Consider an optical fiber of length 1km with refractive index of the core 1.460 and fractional refractive index change of 1%. What is the pulse duration if the impulse after traversing throughout the fiber broadens?	2
4A	What are the possible sources of errors in optical receiver operation? Obtain an expression for Bit-Error Rate (BER).	5
4B	The mean optical power launched in to a 10 km length of fiber is 160 μ W, the mean optical power at the fiber output is 4 μ W.	3

Determine: i) the overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices. ii) the signal attenuation per kilometer for the fiber. iii) the overall signal attenuation for a 20 km optical link using the same fiber with splices at 1 km intervals, each giving an attenuation of 1dB.

4C	Write a note on rise-time budget analysis of an optical fiber link.	2
5A	Discuss with necessary circuit diagram the V-I characteristics and response characteristics of a phototransistor.	5
5B	With a block diagram explain the working principle of Streak camera as a detector of femtosecond pulses.	3
5C	Explain briefly the optoelectronic method of generation of ultrafast electrical pulses.	2
