

[Total No. of Questions - 8] [Total No. of Printed Pages - 3]
(2064)

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M. Tech 2nd Semester Examination

Design of Optical Networks

EC-201

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions. All questions carry equal marks

1. (a) Give the principle of working of SOA (Semiconductor Optical Amplifier)? How it is different from EDFA's. Also give the types of crosstalk in SOA's. Explain them? (10)
(b) Calculate the gain of a travelling wave semiconductor amplifier if maximum gain coefficient $g=106$ (1/cm), $\alpha=14$ (1/cm) and $n=0.8$. (10)
2. (a) Discuss amplification occurs in EDFA (Erbium-Doped Fiber Amplifiers) with energy level diagram. (10)
(b) Calculate the gain of an erbium-doped fiber if the light input power is $300\mu\text{W}$ and the output power is $60\mu\text{W}$. Also calculate gain of EDFA given if $P_{\text{ASE}}=30\mu\text{W}$. (10)
3. (a) Explain the four-wave mixing (FWM) phenomenon, why is FWM so important in today's optical network? (12)
(b) Explain how chirped-fiber Bragg grating works-as a dispersion compensating device. (8)
4. (a) Discuss the major considerations in the design of digital drive circuits for:
(i) an LED source;
(ii) an injection laser source. (10)

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- (b) The sampling rate of each speech channel on the 30 channel PCM system is 8kHz and each sample is encoded into eight lists. Determine transmission or list rate for the system; and the duration of a time slot. Also find the duration of a frame and multiframe. (10)
5. (a) A silicon p-i-n photodiode has a quantum efficiency of 65% at a wavelength of $0.8\mu\text{m}$. Determine:
- (i) the mean photocurrent when the detector is illuminated at a wavelength of $0.8\mu\text{m}$ with $5\mu\text{W}$ of optical power.
 - (ii) the μs quantum noise current in a post detection bandwidth of 20MHz.
 - (iii) the SNR in dB, when the mean photocurrent is the signal. (10)
- (b) Briefly explain what is meant by the following terms when they are used in relation to injection lasers:
- (i) relaxation oscillations.
 - (ii) frequency chirp.
 - (iii) partition noise.
 - (iv) mode hopping. (10)
6. (a) Give the major reasons which have led to the development of optical amplifiers, outlining the attributes and application areas for these devices. Describe the two main SLA types and indicate their distinguishing features. (10)
- (b) (i) Briefly explain the difference between the self phase modulation (SPM) and cross phase modulation (XPM) phenomenon.

- (ii) What is a soliton? Also Explain Schrodinger Equation. (10)
7. (a) Write short notes on:
- (i) Storage area networks.
 - (ii) Gigabit and 10-Gigabit Ethernet. (8)
- (b) Briefly discuss maximum load dimensioning models network architecture. (6)
- (c) Explain how IP runs over ATM and ATM runs over SONET networks? (6)
8. (a) Explain why a WDM (MUX/DEMUX) is such an important component of WDM system? (7)
- (b) What are the basic characteristics of a filter? Why do we need tunable filters? What major parameters are used to characterize tunable filters? (7)
- (c) What measures are usually taken in transmitter design to facilitate the trouble shooting of a fiber optic communications link? (6)