Student Exam No:_____

GANPAT UNIVERSITY

M.TECH. SEM. - I ELECTRONICS & COMMUNICATION ENGINEERING

REGULAR EXAMINATION - JAN 2013

3EC104 FIBER OPTICS DEVICES

TIME: 3 HOURS **TOTAL MARKS: 70**

INSTRUCTIONS:

1. Attempt all questions.
2. Answers to the two sections must be written in separate answer books.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

SECTION-I

Q-1 **(A)** What is single mode Laser? Discuss about vertical-cavity surface emitting laser. **06**

(B) Define various noise terms of optical receiver. **06**
An InGaAs p-i-n photodiode has the following parameters at a wavelength of 1550 nm : I_D = 4 nA, η = 0.90 , R_L = 1000 Ω and the surface leakage current is negligible. The incident optical power is 300 nW and the receiver bandwidth is 40 MHz. Find the various noise terms of the receiver.

OR

Q-1 **(A)** Explain Laser diode modes and derive threshold condition for Lasing. **06**

(B) A graded index fiber with a parabolic index profile supports the propagation of 742 guided modes. The fiber has a numerical aperture in air of 0.3 and a core diameter of 70 μm. Determine the wavelength of the light propagating in the fiber. Further estimate the maximum diameter of the fiber which gives single-mode operation at the same wavelength. **06**

Q-2 **(A)** Define skew ray and derive the expression of Numerical aperture for skew rays. **06**

(B) Give the difference between Stimulated Raman Scattering and Stimulated Brillouin Scattering in silica glass fibers. **05**

OR

Q-2 **(A)** What is LP mode in cylindrical fiber? Give the necessary details of different LP modes in fiber with drawing. **06**

(B) Give the difference between Rayleigh Scattering and Mie Scattering in silica glass fibers. **05**

Q-3 **(A)** Discuss about the difference between the intramodal and inter-modal dispersion. Derive the expression of delay difference for inter-modal dispersion. **06**

(B) Define Four Wave Mixing with suitable example. **06**

SECTION-II

Q-4	(A)	Discuss about a four channel wavelength multiplexer using three 2 x 2 MZI elements.	06
	(B)	Consider a commercially available 32 x 32 single – mode coupler made from a cascade of 3-dB fused fiber 2 x 2 couplers, where 5 percent of the power is lost in each element. Find out excess loss and splitting loss. Also discuss about 2 x 2 fiber coupler .	06

OR

Q-4	(A)	Discuss the architecture of a four-fiber bidirectional line switched ring and discuss about the reconfiguration under fiber cable failure.	06
	(B)	A 2x2 biconical tapered fiber coupler has an input optical power level of Po = 400 μW . The output powers at the other three ports are P1 = 130 μW, P2 = 90 μW , and P3 = 6.3 nW . Find out coupling ratio, Excess loss, Insertion loss and crosstalk.	06
Q-5	(A)	Describe the amplification mechanism of Erbium – doped fiber amplifiers and also discuss about dual pumping scheme of EDFA architecture.	06
	(B)	Explain the concept of a tunable multielectrode asymmetric directional coupler and discuss about three- stage tunable MZI filter.	05

OR

Q-5	(A)	Give the idea about functional concept of an add/drop multiplexer for SONET applications.	04
	(B)	How to add and drop N different wavelength with multiple tunable fiber gratings used in conjunction with two optical circulators?	04
	(C)	An optical transmission system is constrained to have 500 GHz channel spacings. How many wavelength channels can be utilized in the 1536 to 1556 nm spectral band?	03
Q-6	(A)	Define WDM concept and discuss about WDM network containing various types of optical amplifiers.	06
	(B)	A 15 km optical fiber link uses fiber with a loss of 1.5 dB/km. The fiber is joined every kilometer with connector which gives an attenuation of 0.8 dB each. Determine the minimum mean optical power which must be launched into the fiber in order to maintain a mean optical power level of 0.3μw at the detector.	06

End of Paper