Student Exam No:_____

GANPAT UNIVERSITY

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

REGULAR EXAMINATION DEC.-2013/ JAN.-2014

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)	A 30 km optical fiber link uses fiber with a loss of 1.3 dB/km. The fiber is joined every kilometer with connector which gives an attenuation of 0.5 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 0.5μw at the detector.	06
	(B)	What is single mode Laser? Discuss about vertical-cavity surface emitting laser.	06
		OR	
Q-1	(A)	An InGaAs p-i-n photodiode has the following parameters at a wavelength of 1300 nm : I_D = 3 nA, η = 0.85 , R_L = 2000 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.	06
	(B)	Explain Laser diode modes and derive threshold condition for Lasing.	06
Q-2	(A)	Consider a commercially available 32 x 32 single – mode coupler made from a cascade of 3-dB fused – fiber 2 x 2 couplers, where 10 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
	(B)	Derive the expression of delay difference for inter-modal dispersion.	05
		OR	
Q-2	(A)	A 2x2 biconical tapered fiber coupler has an input optical power level of Po = 500 μW . The output powers at the other three ports are P1 = 230 μW, P2 = 90 μW , and P3 = 9.2 nW . Find out coupling ratio, Excess loss, Insertion loss and crosstalk.	06
	(B)	Give the difference between Stimulated Raman Scattering and Stimulated Brillouin Scattering in silica glass fibers.	05
Q-3	(A)	Why different materials are used for different wavelength light sources? Discuss about the different materials used for 800 – 900 nm wavelength and 1-1.7 μm.	06
	(B)	Discuss about self phase modulation and cross phase modulation.	06

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SECTION-II

Q-4 (A) Discuss about a four channel wavelength multiplexer using three 2 x 2 MZI elements. **06**

(B) A K_2o-Sio_2 glass core optical fiber has an attenuation resulting from Rayleigh scattering of 0.46 dB/km at a wavelength of 1 μm. The glass has an estimated fictive temperature of 758 ^{0}K, isothermal compressibility of 8.4×10^{-11} $m^2 N^{-1}$, and a photo elastic coefficient of 0.245. Determine from theoretical considerations the refractive index of the glass. **06**

OR

Q-4 (A) Explain the concept of a tunable multi-electrode asymmetric directional coupler and discuss about three- stage tunable MZI filter. **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-5 (A) Define WDM concept and discuss about WDM network containing various types of optical amplifiers. **06**

(B) What is optical circulator ? How to add and drop N different wavelength with multiple tunable fiber gratings used in conjunction with two optical circulators ? **05**

OR

Q-5 (A) What is the difference in mechanism of LASER and Optical amplifier? Describe the amplification mechanism of Erbium – doped fiber amplifier. **06**

(B) Discuss the architecture of a four-fiber bidirectional line switched ring and discuss about the reconfiguration under fiber cable failure. **05**

Q-6 (A) Discuss about different EDFA architectures. **06**

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

End of Paper