Exam No:_____

GANPAT UNIVERSITY

M.TECH. SEM. - I ELECTRONICS & COMMUNICATION ENGINEERING
REGULAR EXAMINATION NOV- DEC 2015
3EC104 OPTICAL COMMUNICATION SYSTEMS

MAX. TIME: 3 HRS | MAX. MARKS: 60

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)	Derive threshold condition of Lasing with the plot of injection current vs. normalized optical output power plot.	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.	04
		OR	
Q-1	(A)	Give the details of distributed feedback LASER. Discuss different designing parameters of single mode LASER .	06
	(B)	A graded index fiber with a parabolic index profile core has a refractive index at the core axis of 1.5 and a relative index difference of 1%. Estimate the maximum possible core diameter which allows single-mode operation at a wavelength of 1.3 μm.	04
Q-2	(A)	Why single mode fiber is used in long distance optical communication system? What is the role of EDFA in optical link?	06
	(B)	What is rise-time budget for optical fiber link? Discuss in detail about rise-time budget.	04
		OR	
Q-2	(A)	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
	(B)	Why four wave mixing is important to consider in WDM optical communication system?	04
Q-3	(A)	Design 8x8 star coupler with 2x2 star couplers. Express Excess loss and splitting loss.	05
	(B)	How dispersion and non-linearity is controlled with optical phase conjugation (OPC)? Discuss in detail.	05

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SECTION-II

Q-4 (A) Discuss different photo detector noises in detail and define signal to noise ratio (SNR) at the output of an optical receiver. **04**

(B) Define various noise terms of optical receiver. **06**
An InGaAs p-i-n photodiode has the following parameters at a wavelength of 1310 nm : I_D = 2 nA, η = 0.80 , R_L = 1500 Ω and the surface leakage current is negligible. The incident optical power is 350 nW and the receiver bandwidth is 35 MHz. Find the various noise terms of the receiver.

OR

Q-4 (A) What is the utility of optical amplifier in highly attenuated long distance optical communication system ? Discuss about different applications of optical amplifier. **04**

(B) A double – heterojunction InGaAsP LED emitting at a peak wavelength of 1550 nm has radiative and non – radiative recombination times of 20 ns and 120 ns respectly. The drive current is 30 mA. Find out bulk recombination lifetime, internal quantum efficiency and internal power. **06**

Q-5 (A) Describe phase-diversity homodyne receiver. Derive expression for in-phase and quadrature-phase current components. **05**

(B) Design and discuss 16 channel WDM optical system set-up in pre-compensation configuration. **05**

OR

Q-5 (A) Design and discuss 8 channel WDM optical system set-up in post-compensation configuration. **05**

(B) Explain phase and polarization-diversity homodyne receiver. Derive expression for x and y polarization components. **05**

Q-6 (A) What is chirp fiber bragg grating ? Discuss dispersion compensation with Fiber Bragg Grating (FBG). **05**

(B) Design 4 channel WDM optical system with the use of DSP at the receiver side. Discuss this WDM optical system in detail. **05**

End of Paper