Registration Number :

B.E. / B.TECH. (FULL TIME) ARREAR EXAMINATION – MAY 2012

ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH

SEVENTH SEMESTER – (REGULATIONS R 2008)

EC 9402 – OPTICAL COMMUNICATION

Duration : 3 Hours Max. Marks = 100

Answer **ALL** the questions.

PART- A (10 x 2 = 20 marks)

1. Briefly explain the principle of total internal reflection.
2. What are the transmission parameters that determine the performance of Unguided optical communication systems.
3. Consider an optical link consisting of a 5 Km long step index fiber with core index n_1 = 1.49 and relative index difference Δ = 1 %. Find the delay difference at the fiber end between the slowest and the fastest modes.
4. What are the two broad classification of fiber non-linearities ?
5. Differentiate between direct and indirect band gap materials.
6. Explain the necessity to go for Single mode laser design.
7. What are the factors to be considered for budgeting the rise time.
8. Define Quantum limit and highlight its importance.
9. What is the function of an Optical isolator. Where is it used.
10. Draw the format of the SONET STS-1 frame.

PART – B (5 x 16 = 80 marks)

11. i) Derive an expression for the Signal to Noise Ratio for the APD and explain the significance of optimum APD Gain. (8)

(ii) A 1550 nm single - mode digital fiber optic link needs to operate at 622 Mbps over 80 Km without amplifiers. A single – mode InGaAsP laser launches an average optical power of 13 dBm into the fiber. The fiber has a loss of 0. 35 dB / Km, and there is a splice with a loss of 0.1 dB every kilometer. The coupling loss at the receiver is 0. 5 dB, and the receiver uses an InGaAs APD with a sensitivity of - 39 dBm. Excess-noise penalties are predicted to be 1. 5 dB. Set up an optical power budget for this link and find the system margin. (8)

P.T.O

12a. i) What is the necessity to go for Graded Index configuration in MultiMode fibers ? Compare the refractive index profiles of a Step Index Fiber and a Graded Index Fiber with suitable mathematical expressions and profile diagrams. (8)

ii) Consider a graded index fiber having a parabolic refractive index profile, 25 μm core radius, $n_1 = 1.48$ and $n_2 = 1.46$. If $\lambda = 1320$ nm, what is the value of V and how many modes propagate in the fiber ? Compare this with the number of modes for a Step Index configuration. What percent of optical power flows in the cladding for the step index fiber ? (8)

'OR'

12b. Discuss the mechanisms that give rise to attenuation in glass optical fibers. Draw the attenuation characteristics of Silica fibers and mark the transmission windows.

13a. Explain in detail the signal dispersion mechanisms affecting the information carrying capacity of Standard Single Mode Fibers.

'OR'

13b. Compare the dispersion characteristics of Standard Single Mode Fiber, Dispersion Shifted Fiber and Dispersion Flattened Fiber using the Dispersion vs. wavelength curve. What are their applications. Also explain Polarization Mode Dispersion and the condition under which it becomes significant.

14a. Compare the Spectrum of the LASER diode emissions with that of the LED and explain the reasons for the same with suitable diagrams.

'OR'

14b. Explain the principle of operation of a Laser diode and derive an expression for the lasing threshold current density.

15a. Discuss with suitable energy band diagrams, the mechanism by which amplification of multiple wavelengths happens in an EDFA and the different EDFA architectures.

'OR'

15b. What factors make Dense WDM possible in optical fibers ? Discuss the different architectures that may be employed for implementing WDM networks with suitable diagrams and explain their pros and cons.

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