B.E.(FULL-TIME) DEGREE ARREAR EXAMINATIONS, APRIL / MAY 2011

ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH

SEVENTH SEMESTER

EC 473 – OPTICAL COMMUNICATION AND NETWORKING

(REGULATION 2005)

Time: 1 Hour Max.Marks: 100

Answer ALL Questions

PART-A (10x2=20 Marks)

1. Compare with mathematical expressions, the refractive index profiles n (r) of the two optical fiber structures.
2. Determine the percentage optical power that flows in the cladding at 820 nm of a step-index fiber having 25 μm core radius, $n_1 = 1.48$ and $n_2 = 1.46$.
3. What is the significance of $\alpha_{optimum}$ in the case of Graded Index fibers.
4. What is meant by non-linear refraction.
5. What type of materials are used for optical sources. Why?
6. Compare the light-current characteristics of the two types of optical sources.
7. Why response time of photo diode due to fast carriers differ from that of slow carriers?
8. What are the advantages of coherent detection.
9. How WDM becomes possible in optical networks.
10. What are the applications of optical amplifiers.

PART-B (5x16=80 Marks)

11.(i) With necessary diagrams, explain any one type of silica optical fiber fabrication technique that uses CVD process. **(8)**

(ii) Explain the mechanisms that cause light signal attenuation in optical fibers. **(8)**

12.(a)(i) Discuss the dispersion characteristics in the three types of single mode fibers. **(6)**

(ii) Define "Mode Field Diameter" and "Beat Length" of single mode fibers. **(4)**

(iii) Compare the dispersion characteristics of multimode Step Index and Graded Index fibers. **(6)**

OR

12.(b)(i) Discuss the need for compensating fiber dispersion and how the dispersion compensation techniques are implemented in optical communication systems. **(8)**

(ii) Discuss the Soliton propagation through single mode optical fibers. **(8)**

13.(a) (i) Explain the use of Double Heterostructure in optical sources. Compare the characteristics of the surface emitting and edge emitting structures of LED. **(8)**

(ii) Given radiative and non-radiative recombination life times, refractive index of the active region material and the drive current, discuss the steps in determining the optical power internally generated and emitted from the device; and electrical and optical 3dB modulation bandwidths. **(8)**

OR

13.(b)(i) Derive the threshold condition in a Fabry Perot Resonator Cavity Laser diode and hence the resonant frequencies and the wavelength spacing $\Delta \lambda$ between the longitudinal modes. **(10)**

(ii) Briefly explain how longitudinal mode control is achieved in DFB laser diodes. **(6)**

14.(a)(i) Briefly discuss the various noises possible in optical receivers and hence derive an expression for the Signal to Noise Ratio of an analog receiver. **(10)**

(ii) With an equivalent circuit, discuss the features of trans impedance pre-amplifiers. **(6)**

OR

14.(b)(i) Explain the concept of coherent detection with a schematic diagram. **(8)**

(ii) With the definitions, obtain the relationship between quantum efficiency and responsivity of phot detectors. **(4)**

(iii) Mathematically represent the effects of the four basic elements that significantly limit the system speed (rise time) and hence the bit rate of a multimode optical link. **(4)**

15.(a)(i) Discuss the amplification mechanism in Erbium Doped Fiber Amplifiers and the possible architectures of EDFA. **(10)**

(ii) With reference to a 2 x 2 fiber coupler, define the four parameters that are used in the performance analysis of an optical coupler. **(6)**

OR

15.(b)(i) With the fundamental SONET frame structure, obtain the transmission bit rate of the basic SONET signal. **(4)**

(ii) With suitable diagrams, explain the configuration of SONET /SDH networks. **(8)**

(iii) Briefly explain the function of optical isolators. **(4)**
