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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; Dec. - 2015

Optical Communication System

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*
ii) Assume missing data, if any, suitably

UNIT - I

1 a. Compare the conventional single mode and multimode step-index and graded index optical fibers. 6

b. Explain the bending losses in optical fibers. 8

c. A typical relative refractive index difference for an optical fiber for long distance transmission is 1%. Estimate the NA and the solid acceptance angle in air for the fiber when core index is 1.46. Further, calculate the critical angle assuming that the concepts of geometric optics hold for the fiber. 6

2 a. Define numerical aperture. Develop an expression for numerical aperture and maximum acceptance angle in case of step-index optical fiber in terms of refractive indices of core and cladding material. 10

b. Explain the plasma-activated chemical vopour deposition (PCVD). 6

c. A guided index fiber has a core with a parabolic refractive index profile which has a diameter of 50 μm. The fiber has a numerical aperture of 0.2. Estimate the total number of guided modes propagating in the fiber when it is operating at a wavelength of 1 μm. 4

UNIT - II

3 a. With neat diagrams, explain the working of (i) Surface emitting LED (ii) Edge emitting LED. 10

b. Explain the nonimaging microsphere lensing scheme used for coupling improvement. 5

c. A DH LED emitting at a peak wavelength of 1310 nm has a radiative and nonradiative recombination times of 30 and 100 ns, respectively. The drive current is 40 mA. Find;
(i) Bulk recombination time (ii) Internal quantum efficiency
(iii)Internal power level (iv) External quantum efficiency
v) Optical power emitted from LED with n = 3.5. 5

4 a. Explain the Fabry-Perot resonator cavity for a laser diode. 7

b. Discuss the advantages of LED over injection laser. 6

c. Discuss the process of Fiber end face preparation. 7

Contd……2

UNIT - III

5 a. With neat diagrams, explain the operation of a pin photo diode. 8

b. An InGa As pin photodiode operating at a wavelength of 1300 nm has I_D = 4 nA,η = 0.90, R_L = 1000 Ω, and the surface leakage current in negligible. The incident optical power is 300 nW(-35dBm), and the receiver bandwidth is 20 MHz. Find; 8

(i) primary photocurrent

(ii) mean-square short noise current

(iii) mean-square dark current

(iv) mean-square thermal noise current.

c. With help of a circuit diagram, describe the working of a trans impedance amplifier. 4

6. a. Explain the working of reach-through avalanche photodiode structure. 6

b. Sketch the photo detector receiver circuit and its equivalent circuit and discuss about the noise sources affecting the SNR. 8

c. With help of a simplifier eye diagram, discuss the eye pattern features. 6

UNIT - IV

7 a. A 2 x 2 biconical tapered fiber coupler has an input optical power level of P_0 = 200 μW. The output powers at the other three ports are P_1 = 90 μW, P_2 = 85 μW, and P_3 = 6.3 nW. Determine the coupling ratio, excess loss, insertion losses, and return loss for this coupler. 5

b. Explain the following : 8

(i) Multichannel AM (ii) Subcarrier multiplexing.

c. Sketch the block diagram of optical analog link and explain the major noise contributors. 7

8 a. Develop an expression for the total rise time of the optical digital link. 8

b. Explain the working principle of a typical WDM network with a neat diagram. 6

c. Discuss about the basic constituents of a generic RF-over fiber link. 6

UNIT - V

9 a. Discuss the EDFA architecture. 6

b. Discuss the bus, ring, star, and the mesh optical fiber network topologies. 8

c. With the neat diagram, explain the general applications of three classes of amplifiers used in optical transmission. 6

10 a. Explain with diagrams the basic structure of an STS-1, SONET frame, STS-N, SONET frame and an STM-N SDH frame. 12

b. Explain the optical add/drop multiplexing. 8

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