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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; Dec - 2017 / Jan - 2018

Optical Communication System

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Differentiate between the step index fiber and graded index fiber with regard to construction, performance and applications. 6

b. Calculate the number of modes that can propagate through the fiber which has core radius of 25 micron, core refractive index (n_1) of 1.48 and relative refractive index difference (Δ) of 0.01. Also find out the percentage of optical power flowing in cladding if λ = 1320 nm. 4

c. Derive the necessary condition that the angle of wave incidence (θ) should satisfy in a dielectric slab waveguide for satisfactory light wave propagation. 10

2 a. Draw the schematic diagram of fiber drawing apparatus used in fiber fabrication and explain. 8

b. With neat sketches, describe the two bending losses that occur in optical fibers. 8

c. Explain the Plasma-Activated Chemical Vapour Deposition (PCVD). 4

UNIT - II

3 a. Sketch the cross sectional diagram of a double hetero structure light-emitter diode along with energy based diagram and describe its working. 8

b. With the usual notations, derive the following equation for the number of photos per volume for a laser: 8

$$\phi_s = \frac{\tau_{ph}}{q.d}(\tau - \tau_{th}) + \tau_{ph} R_{sp}.$$

c. A GaAs optical source with refractive index of 3.6 is coupled to a silicon fiber of refractive index of 1.48. Calculate the Fresnel reflection at the interface and the power loss in db. 4

4 a. An LED has a circular emitting area of radius 35 micron and Lambertian emission pattern with 150 W/(cm^2, Sr) axial radiance. Calculate the powers coupled into step index fibers one has a core radius of 25 µm and NA = 0.20, and the other has a core radius of 50 µm and NA = 0.20 and compare them. 6

b. Discuss with the figure the different aspects of fiber-to-fiber joints with respect to modal distributions of optical energy. 8

Contd….2

c. With neat sketches, explain fusion splicing and V-groove splicing. 6

UNIT - III

5 a. Draw the pin photo diode circuit diagram with an applied bias and load resistor, explain its operation. 6

b. For a given silicon avalanche photodiode, the quantum efficiency is 65 percent at a wavelength of 900 nm. If 0.5 micro watt of optical power produces a multiplied photocurrent of 5 microns, calculate the primary photocurrent I_P and multiplication factor M. 6

c. With neat circuit diagrams of high impedance and trans impedance amplifiers, explain its operations. 8

6 a. Explain the fundamental concepts of a coherent light wave system with a neat diagram. 6

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

c. Discuss the eye pattern features with a simplified eye diagram. 6

UNIT - IV

7 a. Draw the block diagram of optical analog link and explain the major noise contributors. 7

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

c. Discuss about the basic principles of radio-over-fiber link. 5

8 a. Discuss the implementation of passive and active components in a typical WDM network containing different optical amplifiers. 8

b. Sketch and explain : 12

i) Multi channel amplitude modulation

ii) Sub-carrier multiplexing.

UNIT - V

9 a. Describe briefly the semiconductor optical amplifier and doped fiber amplifier. 8

b. An EDFA is pumped at 982 nm with 30 mW pump power. If the gain at 1550 nm is 20 db, calculate the maximum input power and maximum output power in watt. 4

c. Describe the applications of three classes of amplifier used in optical communication, with neat diagram. 8

10 a. With neat sketches, explain the basic optical network topologies. 10

b. Draw the two-fiber UPSR and four-fiber BLSR architectures used in SONET and SDH networks and explain. 10

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