Exam.Code:969
Sub. Code: 7337

1129

M.E. (Electronics and Communication Engineering)
First Semester
ECE-1102: Fiber-Optics Communication Systems

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. Use of non programmable calculator is allowed.

x-x-x

I. Attempt the following:-

a) Optical fiber transmission systems offer near zero loss and almost infinite bandwidth. Justify the statement.
b) Define the term 'group velocity' in optical wave guiding. Give relation between group velocity and group index for optical waveguide.
c) Explain the role of dispersion compensating fibers in fiber optic communication systems.
d) Draw schematic comprising the major components of a digital optical receiver.
e) Enlist various types of optical amplifiers used in managing OFC networks.

(5x2)

UNIT – I

II. a) Define the terms Acceptance angle and numerical aperture for optical fibers. Establish the relation between two.

b) Differentiate between step-index and graded index fibers on basis of refractive index profile and ray transmission. Draw possible fiber refractive index profiles for different values of 'α' in case of graded index fibers. (2x5)

III. a) Define the term "Mode" in optical waveguides. Draw electric field distribution for dominant modes propagating along the axis of optical waveguide when coupled to a light source.

b) The mean optical power launched into a 10 km length of fiber is 120 μW. The mean output power received at the fiber output is 2.5 μW. Determine: (i) The overall loss in decibels through the fiber, assuming that there is no connectors or splice loss; (ii) Overall signal loss in the link assuming the same fiber with splices at 1 km interval each with an attenuation of 1 dB.

c) Describe various types of intrinsic absorptions in optical fibers. How the effect of such absorption may be minimized in optical fibers.

(4,3,3)

P.T.O.

IV. a) Illustrate with schematic how optical feedback is achieved in lasers. Give the conditions for resonance of the laser cavity.

b) A planar LED is fabricated from GaAs material has internal quantum efficiency of 62%. Determine the power internally generated within the device when the peak emission wavelength is 840 nm at a drive current of 40 mA.

c) Highlight the important features of DFB lasers used in modem OFC systems. (4,3,3)

UNIT – II

V. a) Describe with neat sketch the principle of operation of a P-I-N photodiode. Enlist the limitations of front illuminated PIN photodiode as compared to side illuminated device.

b) A silicon RAPD shows a quantum efficiency of 80% for the detection of radiations at wavelength of 850 nm. When the incident optical power is 0.8 μW, the output current from the device is 12 μA. Determine the multiplication factor of the photodiode. (6,4)

VI. a) Explain the purpose of 'rise time budget' in OFC link design. List various elements which contribute to the rise time of the signal in the link.

b) Draw the schematic of balanced coherent receiver showing various sources of noise.

c) Differentiate between WDM and DWDM fiber optic communication systems. (4,4,3)

VII. a) Describe with schematic the working principle of fiber amplifiers. Why fiber amplifiers are preferred over the semiconductor optical amplifiers in OFC links.

b) Sketch the structure of four port fiber fused biconical taper coupler. List various loss parameters associated with a four port coupler. (6,4)

x-x-x