17633

Seat No.

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) Attempt any THREE of the following :   **12**

(i) List out any four advantages of optical fiber communication over conventional electrical communication.

(ii) Justify for lower bandwidth applications multimode fiber are commonly used instead of single mode fiber.

(iii) Sketch constructional diagram of LED and write its operating principle.

(iv) Compare LASER and LED on the basis of spectral width, efficiency, operating principle and application.

Marks

b) Attempt any <u>ONE</u> of the following :   **6**

    (i) State the condition at which fiber splicing is required. List and compare different types of fiber splicing.

    (ii) Define following terms –

        (1) Reflection

        (2) Refraction

        (3) Absorption

        (4) Radiation

        (5) Scattering

        (6) Disperson

2.   Attempt any <u>FOUR</u> of the following :   **16**

a) State the effect of spontaneous emission and stimulated emission. Give examples for each effect.

b) Compare fusion splice and mechanical splice. (Any four factors)

c) A optical fiber has a core refractive index of 1.50 and cladding refractive index of 1.47. Calculate critical angle at the core-cladding interface and numerical aperture (NA) for the fiber.

d) Sketch constructional diagram for surface emitting LED and edge emitting LED and label it.

e) State working principle of core interactive and surface interaction type fiber couplers.

f) Sketch block diagram of optical time domain reflectometer and list out its any four specifications.

Marks

3. **Attempt any FOUR of the following :** 16

   a) Sketch block diagram of optical fiber communication system and state the importance of each block.

   b) Define the term intermodal dispersion why multimode graded index show less intermodal dispersion as compare to multimode step index fiber.

   c) State type of connector which can give insertion loss and state their features –

   (i)   1.00 to 1.5 – 0 dB

   (ii) 0.20 to 0 – 70 dB

   d) List out SOWET signal hierarchy from STS-1 to STS-12 with line rate in M bit/sec.

   e) Sketch block diagram of digital optical system and state functions of each block.

4. a) **Attempt any THREE of the following :** 12

   (i)   List out types of fiber as per index profile and mode profile.

   (ii) State advantages of PIN diode and advantages of photo diode.

   (iii) A graded index fiber has a paraholic refractive index profile ($\alpha = 2$) and a core diameter of 50 μm. Calculate insertion loss due to a 3 μm lateral misalignment at a fiber joint when there is a index matching. Assume uniform illumination of all guided mode.

   (iv) Sketch block diagram and state features of hybrid multichannel analog and digital optical system.

   b) **Attempt any ONE of the following :** 6

   (i)   When the mean optical power launched into a 8 km length of fiber is 120 μw the mean optical power at the fiber output is 3 μw. Calculate the overall signal attenuation in decibel, signal attenuation per kilometer for the fiber, the over all signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals each giving an attenuation of 1 dB.

Marks

    (ii)   For photodetector, illustrate the term responsivity, photodetector noise, dark current.

          Calculate responsivity of the photo diode at 0-85 μm, when $3 \times 10''$ photons each with wavelength of 0.85 μm are incident on a photo diode, on average $1.2 \times 10''$ electrons are collected at the terminals of the device.

5.   **Attempt any <u>FOUR</u> of the following :**   **16**

    a) List out two standards used for optical fiber communication component testing. List out band designation used in OFC. (Any two)

    b) State the process to calculate bending loss in fiber optic cable.

    c) Justify angular misalignment give joint loss. Hence state factors for this type of loss.

    d) With neat diagram state working principle of RV by LASER.

    e) With neat diagram, illustrate wavelength division multiplexing.

    f) Differentiate between analog and digital optical system. (Any four factors)

6.   **Attempt any <u>FOUR</u> of the following :**   **16**

    a) List out characterstics of GaAs injection LASER and YAG LASER. (Two each).

    b) State the process of light emission in gas LASER.

    c) Sketch constructional diagram and state functions of each element of optical fiber.

    d) State working principle and advantages of avalanche photo diode.

    e) List out any four features of SONET standard.

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