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Azara, Hatkhowapara,
Guwahati - 781017

Roll No. of candidate

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2019

B.Tech. 8th Semester End-Term Examination
OPTICAL COMMUNICATION
(Old Regulation)

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *six* from the rest.

1. Fill in the blanks: (10 × 1 = 10)
- In a fibre, the light is guided through the core due to _____.
 - Refractive index of core is _____ than the refractive index of cladding.
 - Chromatic dispersion is also known as _____ dispersion.
 - The fundamental function of an optical source is to convert _____ energy into _____ energy.
 - For no overlapping of light pulse down on an optical fibre link, the digital bitrate B_T must be _____ than the reciprocal of broadening pulse duration.

[Turn over

- (f) Graded index fibres do not have a _____ refractive index in the core.
- (g) The rays which are transmitted through the fibre without passing through the fibre axis are called _____ rays.
- (h) Disturbance along the fibre such as vibration, discontinuities, etc. results in _____ noise.
- (i) Laser is a beam of radiation which are _____ and coherent.
- (j) Total internal reflection occurs when light travels from _____ medium to _____ medium with angle of incidence _____ than the critical angle.
2. (a) Draw block diagram of fibre optic communication system and describe the function of each components. (7)
- (b) Mention the advantage of optical fibre. (3)
- (c) What is the advantage of multimode fibre over single mode fibre? (3)
- (d) What happens to a light ray when it enters an optical fibre with an angle greater than the acceptance angle of the fibre? (2)
3. (a) Derive the expression for acceptance angle. (5)
- (b) With proper diagram explain the ray transmission in a multimode graded index fibre. (6)
- (c) A graded index fibre with a parabolic refractive index profile core has a refractive index of 1.5 at the core axis and a relative refractive index difference of 1%. Estimate the maximum possible core diameter which allows single mode operation at a wavelength of $13 \mu\text{m}$. (4)

4. (a) What is intramodal dispersion? Derive the expression for pulse delay due to material dispersion. (7)
- (b) A 6 km optical link consists of multimode step index fibre with a core refractive index of 1.5 and a relative refractive index difference of 1%. Estimate-
- The delay distance between the slowest and the fastest mode at the fibre output.
 - The rms pulse broadening due to intermodal dispersion on the link.
 - The maximum bitrate that may be obtained without substantial error on the link.
 - The Bandwidth Length Product. (8)
5. (a) Differentiate between spontaneous and stimulated emission. (5)
- (b) Draw and explain the construction and characteristics of APD. (5)
- (c) The quantum efficiency of a particular silicon APD is 80% for the detection of radiation at a wavelength of $0.9 \mu\text{m}$ when the incident optical power is $0.5 \mu\text{w}$. The output current from the device after avalanche gain is $11 \mu\text{A}$. Determine the multiplication factor of the photodiode. (5)
6. (a) With the help of a suitable diagram explain the steps involved in fusion splicing. What is the drawback of this splicing technique? (6)
- (b) What are receivers? What type of noise may be incorporated in the receiver section? (6)
- (c) What are the criteria of an optical detector? (3)

7. (a) What are optical amplifiers? Describe the RAMAN amplifier. (6)
- (b) An optical signal has lost 55% of its input power after traveling 3.5km of fibre. What is the loss in dB/km of this fiber? (4)
- (c) Explain surface emitter LED with suitable diagram. (5)
8. (a) Describe the different tensing scheme used to improve the source to fibre coupling efficiency. (7)
- (b) Explain the working principle of OADM. (4)
- (c) Calculate numerical aperture of a fiber having $n_1 = 1.6$ and $n_2 = 1.49$ and another fiber having $n_1 = 1.458$ and $n_2 = 1.405$. Which fiber has greater acceptance angle? (4)
9. Write short note (any three) (3 × 5 = 15)
- (a) Population Inversion.
- (b) SONET
- (c) WDM
- (d) Laser Drive Circuit.

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