Code No: **R41041** **R10** **Set No. 1**

IV B.Tech I Semester Regular/Supplementary Examinations, Nov/Dec - 2015

OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) Distinguish the step index fibers & graded index fibers. [8]

b) Define numerical Aperture. How to calculate numerical aperture of a given fiber? Explain. [7]

2 a) A graeded index fiber has a core with parabolic refractive index profile which has a diameter of 50μm. 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 wave length of 1 μm. [5]

b) Define cutoff wave length, Modified diameter and spot size. [10]

3 a) Classify the dispersion present in optical fiber. [7]

b) Explain the working principle of single mode fiber connectors. [8]

4 a) Explain the fusion splicing technique in optical fiber with suitable diagrams. [7]

b) A single-mode fiber has the following parameters:
Normalized frequency (v) = 2.40, Core refractive index (n_1) =1.46
Core diameter (2a) =8 μm, Numerical aperture (NA) =0.1
Estimate the total insertion loss of a fiber joint with a lateral misalignment of 1 μm and an angular misalignment of 1^o. [8]

5 a) A GaAs optical source with a refractive index of 3.6 is coupled to a silica fiber that has a refractive index of 1.48. If the fiber end and the source are in close physical contact, find Fresnel reflection at interface and Power loss (dB). [7]

b) Derive the relation between power launching and wave length. [8]

6 a) Define diffusion length, carrier lifetime and absorption coefficient. [7]

b) Explain the working principle of analog receivers. [8]

7 a) Discuss the parameters to be considered while designing point-point link. [8]

b) Calculate carrier-to-noise ratio in analog link. [7]

8 a) Explain the need of WDM in OC. And explain the function of WDM. [10]

b) Explain working principle of the cut back Technique. [5]

Code No: **R41041** **R10** **Set No. 2**

IV B.Tech I Semester Regular/Supplementary Examinations, Nov/Dec - 2015

OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) With a neat diagram, explain the working principle of analog and digital optical communication systems. [8]

b) Calculate the numerical aperture of a step-index fiber having n_1 =1.48 and n_2=1.46. What is the maximum entrance angle $\theta_{0,max}$ for this fiber if the outer Medium is air with n=1.00? [7]

2 a) Briefly explain the types of losses occur in optical fiber. [8]

b) Two step index fibers exhibit the following parameters:

i) A multimode fiber with a core refractive index of 1.5, a relative refractive index difference of 3 % and an operating wave length of 0.82μm.

ii) An 8μm core diameter single-mode fiber with a core refractive Index the same as (a), a relative refractive index difference of 0.3% and an operating wave length of 1.55μm.

Estimate the critical radius of curvature at which large bending losses occur in both cases. [7]

3 a) Explain the pulse broadening due to inter model dispersion in different types of optical fibers. [7]

b) A 6 km optical link consists of multimode step index fiber with core refractive index of 1.5 and a relative index refractive index difference of 1%. Estimate:

i) The delay difference between the slowest and fastest modes at the fiber output;

ii) The rms pulse broadening due to intermodal dispersion on the link;

iii) The maximum bit rate that may be obtained without substantial errors on the link assuming only intermodal dispersion;

[8]

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4 a) Discuss the different techniques to connect the 2 optical fibers with different lengths and also calculate the Joint losses? [8]
b) Define Lambertion source. Draw and explain radiation pattern from a lambertion source. [7]

5 a) Explain the need of lensing schemes for better coupling between optical source - to-fiber. [8]
b) Explain the equilibrium NA in optical fiber. [7]

6 a) Define responsivity, quantum efficiency and cutoff wavelength of a pin photo detectors. [8]
b) Explain the fundamental digital signal transmission. [7]

7 a) What parameters to be considered while selecting system components? Explain. [8]
b) Discuss how can represent digital data NRZ code. [7]

8 a) Explain the required Test equipment to conduct a measurement. Explain each component. [10]
b) Explain the technique of insertion –loss method to measure attenuation. [5]

Code No: **R41041** **R10** **Set No. 3**

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OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) Light travelling in air strikes a glass plate at an angle $\theta_1 = 33^o$, where θ_1 is measured between the incoming ray and the glass surface. Upon striking the glass ,part of the beam is reflected and part is refracted .If the reflected an reflected beams make an angle of 90^o with each other, What is refractive Index of the glass? What is the critical angle for the glass? [8]

b) Define and explain the linear polarized modes in optical fiber. [7]

2 a) Briefly explain the suitable materials to make a fiber. [10]

b) Define effective refractive index of a fiber. [5]

3 a) Discuss about connector return loss. [7]

b) Explain, Information capacity determination of OF. [8]

4 a) Derive the equation of power coupled in to step indexed optical fiber from the LED as source. [8]

b) Explain the difference between electrical 3 dB point and optical 3 dB point. Discuss about modulation band width of an LED. [7]

5 a) Explain the technique used for power coupling from laser diode to fiber. [7]

b) Explain, why the mechanical Misalignment problem occurs when fibers are joint. [8]

6 a) What type of noise sources may present in optical pulse detection technique? Explain. [7]

b) Explain the working principle of avalanche photodiode. [8]

7 a) Estimate link power budget in optical communication system. [8]

b) Discuss, How can represent digital data in RZ code. [7]

8 Explain in detail, all types of techniques to measure dispersion in optical communication system. [15]

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OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) How many types of rays can propagate in a optical fiber? Explain. [8]

b) Define a mode? Explain mode theory in optical fiber? What is V_{number}? Explain. [7]

2 a) Explain about linear scattering losses in optical fiber. [8]

b) What the mean optical power launched into an 8 km length of fiber is 120μW, the mean optical power at the fiber output is 3μW.
Determine :
i) The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices;
ii) The signal attenuation per kilometer for the fiber.
iii) The overall 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;
iv) The numerical input/output power ratio in (c). [7]

3 a) Explain the intra modal dispersion effect in optical fiber. [8]

b) Explain the need of Expanded Beam Connectors (EBC) and working of EBC. [7]

4 a) Define and Discuss the distributed feedback corrugations in the laser diode. [8]

b) Explain the resonant frequencies of a Laser Diode. [7]

5 a) A laser diode has lateral ($Ø = 0^o$) and transverse ($Ø=90^o$) half-power beam widths of $2\theta = 60^o$ and 30^o, respectively. What are the transverse and lateral power distribution coefficients for the device? [7]

b) Explain quantum efficiency and LED power. [8]

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6 a) In a 100-ns pulse, $6x\ 10^6$ photons at a wavelength of 1300nm fall on an InGaAs Photo detector on the average, 5.4×10^6 electron-hole (e-h) pairs are generated. Find the quantum efficiency. [5]

b) Photons of energy 1.53×10^{-19} j are incident on a photodiode which has a responsivity of 0.65 A/W . If the optical power level is 10 μW , Find the Photocurrent generated. [5]

c) If the photodiode capacitance is 3pF, the amplifier capacitance is 4Pf, The load resistor is 1 kΩ, and the amplifier input resistance is 1 MΩ , then C_T =7Pf and $R_T \approx 1$ KΩ, Find the circuit bandwidth. [5]

7 a) How the rise-time budget is required in optical communication system? And explain the rise-time-budget. [8]

b) Discuss about Block codes and what block codes are suitable to optical communication. [7]

8 Write short notes on

i) Eye patterns ii) attenuation measurement [15]