Code No: R05410403 **R05** **Set No. 2**

IV B.Tech I Semester Examinations,NOVEMBER 2010
OPTICAL COMMUNICATIONS
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Explain the modulation capability and transient response of a fiber optic LED. Discuss the temparature dependence of LED characteristics. [16]

2. (a) Define quantum limit of a fiber optic receiver. What is the effect of detector dark current on quantum limit?
   (b) Describe briefly various sources of noise in a general fiber optic receiver. Identify the PIN receiver noise component that is dominant in receiver SNR computation. [8+8]

3. (a) Derive the wave equation for a step index fiber.
   (b) Calculate the critical angle, maximum entrance angle and NA for a step index fiber having a core index of 1.60 and a cladding index of 1.49. Derive the expressions used. [8+8]

4. (a) What are the basic attenuation mechanisms in the optical fiber communication? Explain in brief on what factor these mechanisms depend.
   (b) Calculate the rayleigh scattering coefficient, the transmission loss factor for 1 Km length fiber and attenuation (dB/Km) for silica fiber at a wavelength of 1.3 μm. For silica, fictive temperature of 1400 K, isothermal compressibility $= 7 \times 10^{-11}$ m^2 N^{-1}, refractive index = 1.46, photo elastic coefficient = 0.286 and Boltzmen constant K $= 1.381 \times 10^{-23}$ JK^{-1}. [8+4+4]

5. (a) Define equilibrium numerical aperture.
   (b) An LED with circular emission region of diameter 200 μm and an axial radiance of 100 W / cm^2- Sr at 100mA drive current is coupled into a step index fiber of 50μm radius and of 0.22 numerical aperture. Compute the power coupled into this step index fiber. Compute the % difference in coupled power if the radius of the fiber is halved.
   (c) Calculate the power coupled from the source specified above into a parabolic index graded-index fiber of 50μm diameter with n_1=1.485 and $\Delta = 0.01$. [3+8+5]

6. Describe the following:
   (a) Estimation of noise margin, best sampling time and timing gitter using eye pattern analysis.
   (b) Quality improvement in signal transmission due to line coding. [8+8]

7. (a) Discuss the system criteria for design of a point-to-point fiber optic link.
   (b) An optical fiber system uses a fiber cable with a loss of 6 dB/Km. Average distributed splice losses is estimated as 1.4 dB/Km. Determine the maximum possible repeater-less transmission distance if the total permitted fiber loss is 36dB. Allocate system safety margin of 5dB. [8+8]

8. (a) Why does material dispersion occur in fiber? Explain in detail.
   (b) A step index multimode fiber has a core of 1.5 and a cladding index of 1.498. Find:
      i. The inter modal dispersion factor for the fiber
      ii. The total dispersion in an 18Km length
      iii. The maximum bit rate allowed assuming dispersion limiting. [8+8]

⋆⋆⋆⋆⋆

Code No: R05410403 **R05** **Set No. 4**

IV B.Tech I Semester Examinations,NOVEMBER 2010
OPTICAL COMMUNICATIONS
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Why does material dispersion occur in fiber? Explain in detail.
   (b) A step index multimode fiber has a core of 1.5 and a cladding index of 1.498. Find:
      i. The inter modal dispersion factor for the fiber
      ii. The total dispersion in an 18Km length
      iii. The maximum bit rate allowed assuming dispersion limiting. [8+8]

2. (a) Discuss the system criteria for design of a point-to-point fiber optic link.
   (b) An optical fiber system uses a fiber cable with a loss of 6 dB/Km. Average distributed splice losses is estimated as 1.4 dB/Km. Determine the maximum possible repeater-less transmission distance if the total permitted fiber loss is 36dB. Allocate system safety margin of 5dB. [8+8]

3. (a) What are the basic attenuation mechanisms in the optical fiber communication? Explain in brief on what factor these mechanisms depend.
   (b) Calculate the rayleigh scattering coefficient, the transmission loss factor for 1 Km length fiber and attenuation (dB/Km) for silica fiber at a wavelength of 1.3 μm. For silica, fictive temperature of 1400 K, isothermal compressibility $= 7 \times 10^{-11}$ m^2 N^{-1}, refractive index = 1.46, photo elastic coefficient = 0.286 and Boltzmen constant K = 1.381×10^{-23} JK^{-1}. [8+4+4]

4. Explain the modulation capability and transient response of a fiber optic LED. Discuss the temparature dependence of LED characteristics. [16]

5. Describe the following:
   (a) Estimation of noise margin, best sampling time and timing gitter using eye pattern analysis.
   (b) Quality improvement in signal transmission due to line coding. [8+8]

6. (a) Derive the wave equation for a step index fiber.
   (b) Calculate the critical angle, maximum entrance angle and NA for a step index fiber having a core index of 1.60 and a cladding index of 1.49. Derive the expressions used. [8+8]

7. (a) Define quantum limit of a fiber optic receiver. What is the effect of detector dark current on quantum limit?

(b) Describe briefly various sources of noise in a general fiber optic receiver. Identify the PIN receiver noise component that is dominant in receiver SNR computation. [8+8]

8. (a) Define equilibrium numerical aperture.

(b) An LED with circular emission region of diameter 200 μm and an axial radiance of 100 W / cm^2- Sr at 100mA drive current is coupled into a step index fiber of 50μm radius and of 0.22 numerical aperture. Compute the power coupled into this step index fiber. Compute the % difference in coupled power if the radius of the fiber is halved.

(c) Calculate the power coupled from the source specified above into a parabolic index graded-index fiber of 50μm diameter with n_1=1.485 and Δ = 0.01. [3+8+5]

⋆⋆⋆⋆⋆

Code No: R05410403 **R05** **Set No. 1**

IV B.Tech I Semester Examinations,NOVEMBER 2010
OPTICAL COMMUNICATIONS
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define equilibrium numerical aperture.
   (b) An LED with circular emission region of diameter 200 μm and an axial radiance of 100 W / cm^2- Sr at 100mA drive current is coupled into a step index fiber of 50μm radius and of 0.22 numerical aperture. Compute the power coupled into this step index fiber. Compute the % difference in coupled power if the radius of the fiber is halved.
   (c) Calculate the power coupled from the source specified above into a parabolic index graded-index fiber of 50μm diameter with n_1=1.485 and Δ = 0.01. [3+8+5]

2. Describe the following:
   (a) Estimation of noise margin, best sampling time and timing gitter using eye pattern analysis.
   (b) Quality improvement in signal transmission due to line coding. [8+8]

3. (a) Discuss the system criteria for design of a point-to-point fiber optic link.
   (b) An optical fiber system uses a fiber cable with a loss of 6 dB/Km. Average distributed splice losses is estimated as 1.4 dB/Km. Determine the maximum possible repeater-less transmission distance if the total permitted fiber loss is 36dB. Allocate system safety margin of 5dB. [8+8]

4. (a) Why does material dispersion occur in fiber? Explain in detail.
   (b) A step index multimode fiber has a core of 1.5 and a cladding index of 1.498. Find:
      i. The inter modal dispersion factor for the fiber
      ii. The total dispersion in an 18Km length
      iii. The maximum bit rate allowed assuming dispersion limiting. [8+8]

5. Explain the modulation capability and transient response of a fiber optic LED. Discuss the temparature dependence of LED characteristics. [16]

6. (a) What are the basic attenuation mechanisms in the optical fiber communication? Explain in brief on what factor these mechanisms depend.

(b) Calculate the rayleigh scattering coefficient, the transmission loss factor for 1 Km length fiber and attenuation (dB/Km) for silica fiber at a wavelength of 1.3 μm. For silica, fictive temperature of 1400 K, isothermal compressibility $= 7 \times 10^{-11}$ m^2 N^{-1}, refractive index = 1.46, photo elastic coefficient = 0.286 and Boltzmen constant K = 1.381×10^{-23} JK^{-1}. [8+4+4]

7. (a) Derive the wave equation for a step index fiber.

(b) Calculate the critical angle, maximum entrance angle and NA for a step index fiber having a core index of 1.60 and a cladding index of 1.49. Derive the expressions used. [8+8]

8. (a) Define quantum limit of a fiber optic receiver. What is the effect of detector dark current on quantum limit?

(b) Describe briefly various sources of noise in a general fiber optic receiver. Identify the PIN receiver noise component that is dominant in receiver SNR computation. [8+8]

⋆⋆⋆⋆⋆

Code No: R05410403 **R05** **Set No. 3**

IV B.Tech I Semester Examinations,NOVEMBER 2010
OPTICAL COMMUNICATIONS
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Describe the following:
   (a) Estimation of noise margin, best sampling time and timing gitter using eye pattern analysis.
   (b) Quality improvement in signal transmission due to line coding. [8+8]

2. (a) Derive the wave equation for a step index fiber.
   (b) Calculate the critical angle, maximum entrance angle and NA for a step index fiber having a core index of 1.60 and a cladding index of 1.49. Derive the expressions used. [8+8]

3. (a) What are the basic attenuation mechanisms in the optical fiber communication? Explain in brief on what factor these mechanisms depend.
   (b) Calculate the rayleigh scattering coefficient, the transmission loss factor for 1 Km length fiber and attenuation (dB/Km) for silica fiber at a wavelength of 1.3 μm. For silica, fictive temperature of 1400 K, isothermal compressibility $= 7 \times 10^{-11}$ m^2 N^{-1}, refractive index = 1.46, photo elastic coefficient = 0.286 and Boltzmen constant K $= 1.381 \times 10^{-23}$ JK^{-1}. [8+4+4]

4. (a) Define quantum limit of a fiber optic receiver. What is the effect of detector dark current on quantum limit?
   (b) Describe briefly various sources of noise in a general fiber optic receiver. Identify the PIN receiver noise component that is dominant in receiver SNR computation. [8+8]

5. Explain the modulation capability and transient response of a fiber optic LED. Discuss the temparature dependence of LED characteristics. [16]

6. (a) Discuss the system criteria for design of a point-to-point fiber optic link.
   (b) An optical fiber system uses a fiber cable with a loss of 6 dB/Km. Average distributed splice losses is estimated as 1.4 dB/Km. Determine the maximum possible repeater-less transmission distance if the total permitted fiber loss is 36dB. Allocate system safety margin of 5dB. [8+8]

7. (a) Why does material dispersion occur in fiber? Explain in detail.
   (b) A step index multimode fiber has a core of 1.5 and a cladding index of 1.498. Find:

i. The inter modal dispersion factor for the fiber
ii. The total dispersion in an 18Km length
iii. The maximum bit rate allowed assuming dispersion limiting. [8+8]

8. (a) Define equilibrium numerical aperture.
   (b) An LED with circular emission region of diameter 200 μm and an axial radiance of 100 W / cm^2- Sr at 100mA drive current is coupled into a step index fiber of 50μm radius and of 0.22 numerical aperture. Compute the power coupled into this step index fiber. Compute the % difference in coupled power if the radius of the fiber is halved.
   (c) Calculate the power coupled from the source specified above into a parabolic index graded-index fiber of 50μm diameter with n_1=1.485 and Δ = 0.01. [3+8+5]

⋆ ⋆ ⋆ ⋆ ⋆