Code No: K0421 **R07** **Set No. 1**

IV B.Tech. II Semester Regular/Supplementary Examinations, April, 2012

OPTICAL COMMUNICATIONs

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. a) Draw the electromagnetic spectrum, Explain different ranges and their wavelengths. Clearly show the range of wavelengths used for optical fiber communication.
   b) What are the advantages of optical fibers over conventional transmission lines? [8+8]

2. a) Discuss the different absorption in SiO_2 fiber at 850 nm, 1300 nm and 1550nm.
   b) What are the basic attenuation mechanisms in the optical fiber communication? Explain in brief on what factor these mechanisms depend. [8+8]

3. a) Derive the expression for the wave guide dispersion also find the relationship between V and β.
   b) A single mode fiber operating at the wavelength of 1.3μm is found to have a total material dispersion of 2.81ns, and a total wave guide dispersion of 0.495ns. Determine the received pulse width and approximate bit- rate of the fiber if the transmitted pulse has a width of 0.5ns. [8+8]

4. a) With the help of expressions, Explain internal quantum efficiency and modulation capability of LED.
   b) Obtain the expression for the 3dB modulation bandwidth of LED and discuss the importance of radiative recombination life time. [8+8]

5. a) Describe lensing mechanisms to improve coupling efficiency between a source and a fiber.
   b) Derive an expression for power coupled from a Lambertian surface emitting LED into a smaller step-index fiber. [8+8]

Code No: K0421 **R07** **Set No. 1**

6. a) Differentiate between the photo diode parameters, 'Quantum limit' and 'Dark current'.
   b) The quantum efficiency of an InGaAs PIN diode is 80% in the wave length range between 1300nm and 1600nm. Compute the range of responsivity of the PIN diode in the specified wavelength range. [8+8]

7. a) Give an example of fiber optic link power budget with an example.
   b) List the factors involved in launching optical power from a light source to a filter. [8+8]

8. a) How is WBDM accomplished
   b) What are all the possibilities for WDM systems.
   c) What is DWDM [6+6+4]

Code No: K0421 **R07** **Set No. 2**

IV B.Tech. II Semester Regular/Supplementary Examinations, April, 2012

OPTICAL COMMUNICATIONs

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. a) Compare the advantages and disadvantages of guided optical communication lines with that of microwave systems.
   b) What are the various elements of an optical communication system. Explain each element in brief. [8+8]

2. a) Explain group delay and mode delay factor with reference to single mode fibers showing the relevant graph.
   b) A multimode step index fiber has a relative refractive index difference of 1% and core refractive index of 1.5. The number of modes operating at a wavelength of 1.3μ meter is 1100. Estimate the diameter of the fiber core? [8+8]

3. a) Explain dispersions in the single mode step index ,multimode step index and multimode graded index fibers with necessary equations.
   b) The wave guide dispersion paramenter is 0.2, n_2 =1.48, λ= 900nm and =0.02 and $_\lambda$=1nm calculate the rms pulse broadening per km due to wave guide dispersion. [10+6]

4. a) With respect to LED why hetero- junction devices are suitable for optical fiber communication systems?
   b) Briefly describe the direct and indirect band gap semiconductor material.
   c) Explain the factors, which reduces the lifetime and internal quantum efficiency of the source. [8+4+4]

Code No: K0421 **R07** **Set No. 2**

5. a) Draw the schematic of Fabry Perot Resonator Cavity for a laser diode and explain how the optical radiations are generated?
   b) Draw the LASER diode characteristics. [10+6]

6. a) What are the requirements of photo detector and why photo diode is preferred in fiber optic communication systems.
   b) Out line the reasons for the adoption of the material and devises used for photo detection in optical fiber communications. [8+8]

7. a) Discuss system considerations in point to point optical link.
   b) Compare the advantages and disadvantages of using WDM in an optical fiber communication system. [8+8]

8. a) Describe with a diagram to explain the operation of an unidirectional WDM system.
   b) Discuss about a bidirectional WDM system. [10+6]

Code No: K0421 **R07** **Set No. 3**

IV B.Tech. II Semester Regular/Supplementary Examinations, April, 2012

OPTICAL COMMUNICATIONs

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. a) Give the block diagram of a digital optical fiber communication. System and explain the functions of each block.
   b) With respect to bandwidth explain how optical fibers are advantageous over coaxial cables. [8+8]

2. a) Discuss briefly about radiative losses in the optical fiber
   b) Explain the core and cladding losses in the optical fiber and also derive the expression for those losses. [8+8]

3. a) Explain material dispersion, wave guide dispersion and find an expression for material and waveguide dispersions using electromagnetic field theory.
   b) An LED operating at850mm has a spectral width of 45nm, What is the pulse spreading in ns/km due to material dispersion? [8+8]

4. a) Why power band width is an important parameter in optical communication system.
   b) Explain in detail the various factor which effects the performance of optical source. [6+10]

Code No: K0421 **R07** **Set No. 3**

5. a) Describe all the factors giving rise to losses while coupling optical power between any two devices of a optic link.
   b) What is a pig-tailed device? List out the advantages and disadvantages of pig-tailing either a fiber optic source or a fiber optic detector.
   c) Write expression for power coupling form an LED into a step index fiber for larger and smaller active area relative to the area of the fiber. [5+5+6]

6. a) Calculate the minimum optical power required to maintain the bit error (BER) at 10^{-7} of a photodiode detector whose responsivity is 0.5 AW^{-1}.
   b) Explain various errors that occur in the detection mechanism. [8+8]

7. a) Discuss about the point to point fiber optic link and its characteristics with an example.
   b) Explain about the frequency chirping and its effects. [8+8]

8. a) Explain about an optical attenuation meter.
   b) i) Convert the optical signal powers of 5mW and 20µW to dBm
   ii) Convert the optical signal powers of 0.3mW and 80nW to dBµ [8+8]

Code No: K0421 **R07** **Set No. 4**

IV B.Tech. II Semester Regular/Supplementary Examinations, April, 2012

OPTICAL COMMUNICATIONs

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Explain in detail elliptical and circular propagation of light.
   b) Describe the quantum nature of light. Explain basic optical laws in detail with relevant expressions [8+8]

2. a) What are the three important mechanisms that are responsible for absorption losses in signal through an optical fiber? Explain in brief the curve for wave length versus attenuation for different ranges of the signal.
   b) Write short notes on plastic optical fibers. [8+8]

3. a) Compare the optical parameters of free space with dispersive and non dispersive mediums.
   b) List the differences between intra modal and intra dispersions. [8+8]

4. a) Give the block diagram of a Fiber optic receiver showing different types of noise generated giving the expression for each type of noise.
   b) What is a bit period? The bit frequency of the link is 10^7Hz. On the average if one error is encountered in a second, find the value of BER (Bit Error Rate). [8+8]

5. Write short notes on the following:
   a) Power coupling from a Vertical Cavity Surface Emitting Laser (VCSEL) diode to a single mode fiber.
   b) Radiation patterns in axial and vertical planes from surface emitting LED and edge emitting LED. [8+8]

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6. a) Give the block diagram of a fiber optic receiver showing different types of noise generated giving the expression for each types of noise.
   b) What is a bit period? The bit frequency of the link is 10^7 Hz. On the average if one error is encountered in a second, find the value of bit error rate). [8+8]

7. Write down and explain the link design equations in point to point communication link, based on power budget and rise time budget considerations [16]

8. a) What are the underlying principles of the WDM technique? What are its various advantages? How is it different from FDM technique?
   b) Discuss the effect of RZ and NRZ coding on bit rate. [10+6]