Seventh Semester B.E. Degree Examination, June/July 2013
Optical Fiber Communication

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1   a.   Discuss the advantages and disadvantages of OFC.   (06 Marks)
    b.   Explain Mode Field Diameter (MFD) of a single mode fiber.   (06 Marks)
    c.   Differentiate between glass fiber and plastic fibers. In case of glass fiber, how RI can be varied?   (04 Marks)
    d.   A SI multimode fiber with a NA of 0.20 supports approximately 1000 modes at an 850nm wavelength.
         i)   What is the diameter of its core?
         ii)   How many modes does the fiber support at 1320 nm?
         iii) How many modes does the fiber support at 1550 nm?   (04 Marks)

2   a.   Explain the "pulse dispersion" with suitable diagram and differentiate MMSIF, MMGIF and SMF by their information carrying capacity with reason.   (06 Marks)
    b.   Discuss the following for optical fibers:
         i)   Extrinsic absorption.
         ii)   Material dispersion.   (08 Marks)
    c.   Optical power launched into fiber at transmitter end is 150μw. The power at the end of 10km length of the link working in first window is -38.2 dBm. Another s/m of same length working in second window is 47.5 μw. Same length s/m working in third window has 50% of launched power. Calculate fiber attenuation for each case and mention wavelength of operation.   (06 Marks)

3   a.   A double-hetero junction "InGaAsP" LED emitting at a peak wavelength of 1310 nm has radiative and non radiative recombination times of 25 ns and 90 ns respectively. The drive current is 35 mA.
         i)   Find the internal quantum efficiency and the internal power.
         ii)   If the RI of the light source material is n = 3.5. Find the power emitted from the device.   (06 Marks)
    b.   Describe the following terms relating to LASER:
         i)   External quantum efficiency.
         ii)   Wavelength spacing.   (06 Marks)
    c.   Explain the three factors which affects the response time of a photodiode. (08 Marks)

4   a.   Discuss the different lensing scheme used to improve the source-to-fiber coupling efficiency, with the necessary sketches.   (06 Marks)
    b.   For a surface emitting LED has radiance of 150W/(cm^2.sr) and radius of emitting area is 35μm. Calculate the optical power coupled to the fibers with
         a_1 = 25μm and NA = 0.20, step index
         a_2 = 50μm and NA = 0.20, step index.   (06 Marks)
    c.   Define fiber splicing. Explain different types of splicing with neat sketches. (08 Marks)

PART – B

5 a. Explain the different types of front-end amplifiers in optical receiver. **(06 Marks)**
    b. With a neat sketch, explain how system performance information can be obtained from the eye diagram. **(08 Marks)**
    c. Write a short note on burst-mode receivers. **(06 Marks)**

6 a. Following are the parameters of a point-to-point optical link:
    i)   Optical power launched   : +3dBm
    ii) Sensitivity of detector   : -32dBm
    iii) Source/detector connector loss   : 1dB
    iv) Length of optical cable   : 60 km
    v)   Cable attenuation   : 0.3dB/km
    vi) Jumper cable loss   : 3dB
    vii) Connector loss at each fiber   : 1dB
         joint (two at each transmitter and receiver
         end because of the jumper cables)
    Compute the power margin of the link using spread sheet method. **(06 Marks)**
    b. Explain the basic elements of analog link with different noise contribution. **(09 Marks)**
    c. What is sub carrier multiplexing? Explain. **(05 Marks)**

7 a. Explain the need of isolator in optical network. Give its principle of operation also.
 (06 Marks)
    b. Explain the operational principle and implementation of WDM. **(08 Marks)**
    c. Briefly discuss dielectric thin-film filters. **(06 Marks)**

8 a. Explain the three main optical amplifier types. **(06 Marks)**
    b. Describe:
    i)   SONET/SDH rings.
    ii) SONET/SDH networks.
    iii) Frame format of STS-1 SONET. **(10 Marks)**
    c. An EDFA amplifier produces $P_{s,out}$ = 27dBm for an input $P_{s,in}$ = 2dBm at 1542 nm.
    i)   Find the amplifier gain, G.
    ii) What is the minimum pump power required. **(04 Marks)**

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