[70]

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar
M.Sc. (3rd Sem) Examination - 2012 [CBCS]
7th December, 2012 (Friday)
2:30 pm - 5:30 pm
PS03EINS02 (Instrumentation)
Optoelectronics

Maximum Marks: 70

Que 1   Each question below gives a multiple choice of answers. Choose the most appropriate   [08]
one.

1   The Rise Time of an LED is specified to be 24 ns. Its Optical Bandwidth is _____ MHz.
    i.   0.1458   ii.   1.558
    iii.   14.58   iv.   None of the above

2   _____: The photocurrent divided by the input optical power.
    i.   Photocurrent   ii.   Responsivity
    iii.   Quantum efficiency   iv.   None of the above

3   A fiber with core index of 1.45 is spliced allowing an air gap between the fiber ends. Total
    loss because of Fresnel reflections is _____ dB.
    i.   0.3   ii.   0.0337
    iii.   0.15   iv.   None of the above

4   Digital Systems are analyzed on the basis of
    i.   Rise time   ii.   Bandwidth
    iii.   Both i) and ii)   iv.   None of the above

5   Large line width ($\Delta\lambda$) results in
    i.   Large dispersion   ii.   Lower bandwidth
    iii.   Lower data rate   iv.   All of the above

6   _____: The number of incident photons times the photon energy per second.
    i.   Noise - equivalent power   ii.   Responsivity
    iii.   Quantum efficiency   iv.   None of the above

7   _____ misalignment: The distance between the center lines of the two fiber edges.
    i.   Lateral   ii.   Angular
    iii.   Edge separation   iv.   None of the above

8   _____ is/are not of major importance of the LAN system.
    i.   Dispersion (ns/km)   ii.   Loss (dB/km)
    iii.   Both i) and ii)   iv.   None of the above

Que 2   Short Questions (Attempt any SEVEN)

[14]

1   A Lambertian light source, with a total power output of 1.15 mW is coupled to a fiber.
    Assume the active light source is smaller than the fiber core. Find the power coupled to the
    fiber with N.A. = 0.4.

2   What is meant by Responsivity?
    A photodetector has quantum efficiency of 70% and is operating with λ of 0.82 µm. Find the
    Responsivity.

3   A fiber of 100 m length has $P_{IN} = 10\mu W$ and $P_{OUT} = 9\ \mu W$. Find the loss in dB/km.

4   For what is the monitor photodiode is used?

5   Find the emitted power P_{OUT} for a LED with η_{PT} = 1.0%, I_0 = 50mA (Diode Current), and V_F = 1.6 V (Diode Voltage Drop).

6   Define Quantum efficiency of a Photodetector.
    Calculate η_Q for a detector with R = 0.7 A/W operating at λ of 1.5 µm.

7   What do you mean by Angular misalignment?
    A fiber with N.A. of 0.2 and n_{core} of 1.45 is connected with an angular misalignment of 5^0. Find the loss.

8   Explain in brief Intensity - Modulated Sensor.

9   What are the important characteristics of a communication light source?

Que 3 [A] Enlist the common LED structures for optical fiber communications. Disucss Planar   [06]
            LED and Dome LED with necessary diagram.

       [B] Briefly outline the advantages and drawbacks of the LED in comparison with the   [06]
            injection laser for use as a source in optical fiber communications. Explain Digital LED
            Drivers.

                                        OR

       [B] Discuss LED Characteristics in detail.

Que 4 [A] Explain the basic detection process in a photoconductive detector.   [06]

       [B] Enlist the features of Photodetector. Explain what is meant by the long wavelength   [06]
            cuttoff point for an intrinsic photodetector.
            GaAs has a bandgap energy of 1.43 eV at 300 K. determine the wavelength above
            which an intrinsic photodetector fabricated from this material will cease to operate.

                                        OR

       [B] Describe the detection process in the p - n photodiode. Compare this device with the
            p - i - n photodiode. What is meant by Noise - Equivalent Power (NEP)?

Que 5 [A] What do you mean by Splicing? Discuss fusion splicing of optical fiber.   [06]

       [B] When the mean optical power launched into an 8 km length of fiber is 120 µW, the   [06]
            mean optical power at the fiber output is 3 µW. Determine:
            a) The overall signal attenuation in dB through the fiber assuming there are no
               connectors or splices;
            b) The signal attenuation per kilometre for the fiber.
            c) The overall signal attenuation for a 10 km optcal link using the same fiber with
               splices at 1 km intervals, each giving an attenuation of 1 dB.

                                        OR

       [B] Give an account of Fiber alignment and Joint loss.

Que 6 [A] Give an account of LAN (as an application of Optical Fiber Communication   [06]
            Technology).

       [B] Discuss with the aid of a suitable diagram the cut - back technique used for the   [06]
            measurement of the total attenuation in an optical fiber.

                                        OR

       [B] Give an account of Long - Haul Communication (as an application of Optical Fiber
            Communication Technology).

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