SARDAR PATEL UNIVERSITY
M.Sc. (Electronics) IV Semester Examination
PS04CELE22 (Fiber optics and its applications)
Wednesday– 20th March,2019
Time: 02.00 .m. to 5.00 p.m.
2.00 –TO 5.00 PM

Total Marks - 70

N.B: 1. Figure to the right indicate maximum marks for the quotations.

Q.1 Multiple Choice Questions: (8x1=8)

1. Refractive index is the comparison of the speed of light in material with that of
   (i) Vacuum
   (ii) water
   (iii) glass
   (iv) air

2. The mechanical splice is best suited for
   (i) situations in which cost of equipments is not a factor
   (ii) minimum attenuation losses
   (iii) field services conditions
   (iv) quicker installation under ideal conditions.

3. Which of the following is not used as a flame heating source in fusion splicing?
   (i) Microprocessor torches
   (ii) Ox hydric burners
   (iii) Electric arc
   (iv) Gas burner

4. Which of the following is an advantage to using fiber optics data transmission?
   (i) Resistance to data theft
   (ii) Fast data transmission line
   (iii) low noise level
   (d) all of the above

5. In Lambertian output pattern of LED, the source is -------------- bright from all directions
   (i)   less
   (ii)   equally
   (iii) more
   (iv)   unpredictably

(P.T.O.)

6. Which among the following is/are responsible for generating attenuation of an optical power in fiber?
   (i) Absorption
   (ii) Scattering
   (iii) Waveguide effect
   (iv) All of the above

7. A distributed data processing configuration in which all activities must pass through a centrally located computer is called a
   (i) ring network
   (ii) spider network
   (iii) hierarchical network
   (iv) data control network

8. The operation of a photo-diode involves
   (i) photo-conductive effect
   (ii) photo-voltaic effect
   (iii) photo-emissive effect
   (iv) photo-multiplicative effect

Q.2 Short questions: (any seven)   (7X2=14)
   (a) Why laser emission shows high degree of coherence ?
   (b) Define Bit Error Rate.
   (c) Give the significance of Numerical Aperture.
   (d) What is the eye pattern? What is the significance of the size of the opening?
   (e) Explain the difference between transmissive and reflective optical coupler.
   (f) What are the important features of a long –haul communication system?
   (g) What do you mean by intersymbol interference?
   (h) Why LED radiates as a Lambertian source ?
   (i) Can a LASER be used for both digital and Analog transmission? Explain.

Q3.(a) Using simple ray theory concepts, discuss the transmission of light through the fiber. Explain what is meant by a graded index optical fiber, giving an expression for the possible refractive index profile. Indicate the major advantage of this type of fiber with regard to multimode propagation.   (6)

(b) A graded index fiber has a core with a parabolic refractive index profile which has a diameter of 50 μm. 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 wavelength of 1μm.   (6)

OR

(b) A multimode step index fiber has a relative refractive index difference of 1% and a core refractive index of 1.5. The number of modes propagating at a wavelength of 1.3 μm is 1100. Calculate the diameter of the fiber core.   (6)

②

Q-4(a) Discuss the mechanism of optical feedback to provide oscillation and hence amplification within the LASER. **(6)**

(b) A lens coupled surface emitting LED launches 190 μm of optical power (P_{out}) into a multimode step index fiber when a forward current of 25 mA is flowing **(6)** through the device. Determine the overall power conversion efficiency (η) when the corresponding forward voltage across the diode is 1.5V.

OR

(b) Define the quantum efficiency and the responsivity of a photo detector. **(6)** GaAs has a bandgap energy of 1.43 eV at 300K. Determine the wavelength above which an intrinsic photodetector fabricated from this material will cease to operate.

Q-5(a) Explain how Wave Length Division multiplexing would help in transmission of data in computer network? **(6)**

(b) A 10x10 star coupler is used in a fiber optic distribution system to connect the **(6)** signal from one computer to ten terminals. The power at input fiber to star coupler is 1.6mW and excess loss of the coupler is 3.9dB. Determine the power at each output fiber.

OR

(b) . Briefly describe the mechanical properties of fiber. Also, describe any method of **(6)** preform fabrication technique. Indicate starting material and fabrication technique used to make preform .

Q-6(a) Give the general relation among bandwidth, data rate and rise time **(6)**

(b) What are the dominant sources of noise in a fiber optic communication system? **(6)** With too large a rise time (for a particular data rate), intersymbol interference may occur. What does this mean?

OR

(b) Discuss how the fiber optic technology can be used for the measurement of distance **(6)** and phase sensor?