JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2023

B.Tech-VII Semester (ALL)

COURSE CODE(CREDITS): 18B1WPH732 (3) MAX. MARKS: 25

COURSE NAME: OPTICAL FIBER NETWORK DESIGN

COURSE INSTRUCTORS: SKK MAX. TIME: 1.5 Hrs

Note: (a) All questions are compulsory and Marks are indicated against each question

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) For reference, some equations are hand written on the back of the question paper

1. Write the equation for refractive index and numeric aperture of a graded index fiber. Under what conditions, they are converted for step index fiber. [3]

2. Using geometric model, derive relation for model dispersion of optical fiber [3]

3. What is the use of Couplers in a ring or linear network? Explain with diagrams [3]

4. (a) it is predicted that a certain diode laser will have its power decreased to 90% of its initial value in 3 years, How many years will be required to the power to decrease to 10% of its initial power.

   (b) Consider a laser with a predicted life time of 20 years at an operating current of 100mA. Assuming n=1.75, what would be its lifetime if the current were doubled? [3+2]

5. (a) Calculate the coupling efficiency for a 50/125 SI fiber if the longitudinal displacement is 10% and NA=0.2

   (b) What are different coding systems used for communication in optical fibers? How is MC more efficient with respect to others [2+3]

6. (a) Consider a star network with connector loss of 1.5 dB per pair and insertion loss of 0.75 dB per channel, calculate the system losses for N=3 and N=50 stations on the fiber ignoring fiber loss and system margin.

   (b) Consider a data bus that taps 10% of light into the arms of a Tee couplers in use. The insertion loss per tee is 0.5 dB, calculate the system losses for N=3 and N-100 stations on the fiber ignoring fiber loss and system margin. [3+3]

Equations

1) $$\frac{P(\theta)}{P_0} = \cos^n \theta$$

2) $$\eta = \frac{P_{out}}{V_f I_f}$$

3) $$\frac{P_{out}}{P_i} = e^{-t/t_m}$$

4) $$t \propto e^{E/eT}$$

5) $$t \propto J^{-n}$$

6) $$\eta = \frac{P_f}{P_s}$$

7) $$\eta = NA(0)^2 \left(\frac{a}{r_s}\right)^2 \left(\frac{g}{g+2}\right)$$

8) $$R = \frac{I_{out}}{P_{in}}$$

9) $$L_M = P_T\,(dBm) - P_R(dBm) - \alpha L - L_T - n l_s - l_R - l_A$$

10) $$D_R = 10\log P_{R2,1} - 10\log R_{RN,1}$$

11) $$\eta_{SI} = \frac{2}{\pi} \cos^{-1}\left(\frac{d}{a}\right) - \frac{d}{\pi a}\sqrt{1 - \left(\frac{d}{2a}\right)^2}$$

12) $$\eta_{gI} \simeq 1 - \left(\frac{2d}{\pi a}\right)\left(\frac{g+2}{g+1}\right)$$

13) $$\eta_{S1} = \left(\frac{1}{1 + (S/a)\tan\theta_c}\right)^2$$