

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
Seventh Semester B.Tech Degree Supplementary Examination August 2021

**Course Code: EC405**

**Course Name: OPTICAL COMMUNICATION**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) Differentiate Step index fiber with Graded index fiber. How the light is being propagated in each of these? Draw suitable diagrams. (8)
- b) Find the core radius necessary for single mode operation at 1320nm of a step-index fiber with  $n_1=1.48$  and  $n_2=1.478$ . What are the numerical aperture and maximum acceptance angle of this fiber? (7)
- 2 a) What is stimulated emission? Explain the terms slope efficiency and characteristic temperature of a laser. (5)
- b) What is Group Velocity Dispersion in optical fibers? Derive an expression for the pulse spread due to GVD. (10)
- 3 a) Explain the structure and operation of VCSEL. (9)
- b) What is meant by zero dispersion wavelength? What are dispersion shifted and dispersion compensating fibers? (6)

**PART B**

*Answer any two full questions, each carries 15 marks.*

- 4 a) Define quantum efficiency and responsivity of a photo detector. (5)
- b) An InGaAs PIN photo diode has the following parameters at 1550nm;  $I_D=1.0\text{nA}$ ,  $\eta=0.95$  and  $R_L=500\Omega$  with negligible surface leakage current. The incident optical power is 500nW(-33dBm) and the receiver bandwidth is 150MHz find various noise components of the receiver. (10)
- 5 a) Draw the structure and working of an APD photo detector. (5)
- b) A fiber optic communication system operating at 100Mbps with a GaAlAs laser diode having 1mW fiber coupled power at 850nm. A Silicon APD having a sensitivity of -50dBm is used as photodetector. The system uses graded index fiber having attenuation of 3.5dB/km at 850nm. The system uses connectors (10)

having loss 1dB/connector at both ends. Find out the maximum transmission distance of the system. Allow 6dB system margin.

- 6 a) Describe coherent optical receiver with necessary figure. Explain how sensitivity of coherent receiver is enhanced ? (10)
- b) What are solitons? Differentiate bright and dark solitons. (5)

**PART C**

*Answer any two full questions, each carries 20 marks.*

- 7 a) Explain various types of optical amplifiers. Also show that the minimum noise figure of an optical amplifier is 3dB. (8)
- b) Explain the operation of EDFA. (7)
- c) An EDFA being pumped at 980nm with 30nW pump power. If the gain at 1550nm is 20dB, find the maximum input power and corresponding output power. (5)
- 8 a) Describe the following optical devices with figures i) FBG, ii) Tunable filters, and iii) Add drop Multiplexers. (12)
- b) Explain the working of Raman Amplifier. (8)
- 9 a) Briefly explain SONET and the frame structure of STS-1. (7)
- b) Briefly explain i) LiFi, ii) VLC. (6)
- c) With a block diagram explain the operation of OTDR. (7)

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