

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018**

**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) How we can classify optical fibers in accordance with refractive index profile? (5)  
Explain with neat diagrams.
- b) What are photonic crystal fibers? Explain the classification of PCF with neat diagrams. (10)
- 2 a) Compare spontaneous emission and stimulated emission of LASER. (5)
- b) Explain the different types of scattering losses. (10)
- 3 a) What is Amplifier Spontaneous Emission Noise? (5)
- b) What is dispersion? Explain the different types of dispersion .Why single mode fiber are used in commercial communication systems? (10)

**PART B**

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

- 4 a) With the help of necessary figures, describe the working of an IMDD system. (5)
- b) Explain the construction and avalanche multiplication of APD with neat diagram and outline the advantages and disadvantages as a detector for optical fibre communications. (10)
- 5 a) Write the concept of link power budget and rise - time budget. (5)
- b) Design an optical fiber link for transmitting 15Mb/s of data for distance of 4 km with BER of  $10^{-9}$ . Assume typical values. (10)
- 6 a) Compare quantum efficiency and responsivity of pin diode. (5)
- b) Write the basic concept of soliton generation, and also write the advantages of soliton based communication system. (10)

**PART C**

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

- 7 a) What are optical Amplifiers? Explain the Working any two with neat diagrams. (8)
- b) What are the advantages of SOA over EDFA? (5)
- c) What is a grating? A plain transmission grating possesses 5000 rulings /cm. What is the angle of second order diffraction produced by the grating for a wave length of 1550 nm? (7)
- 8 a) What is a tunable optical filter? (5)
- b) Explain the working principle of OTDR. How refractive index is calculated using it? (10)
- c) Explain the principle of Raman Amplifier. What are the advantages and disadvantages of Raman amplifier? (5)
- 9 a) Explain add/drop multiplexers. (6)
- b) Explain the working of EDFA with necessary diagrams. (8)
- c) With block diagram explain free space optical communication system. Write the advantages and disadvantages of the system. (6)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019**

**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) Draw the block diagram of a light wave system. Mention the advantages of Optical fiber Communication system. (5)
- b) Explain the working principle of laser action? How a semiconductor diode functions like a laser diode? (10)
- 2 a) Differentiate between spontaneous and stimulated emission. (5)
- b) Explain the mode theory for the propagation of light in optical fiber. (10)
- 3 a) Explain the Modified Chemical Vapor Deposition process in fiber fabrication. (5)
- b) Explain the Numerical Aperture of an optical fiber with neat diagram. Calculate the fractional index change for a given optical fiber if the refractive indices of the core and cladding are 1.563 and 1.498 respectively. Also, calculate (i) numerical aperture (ii) angle of acceptance in air. (10)

**PART B**

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

- 4 a) Briefly explain the different selection criteria for detectors using in optical communication. (5)
- b) Draw the schematics of pin photodiode and APD and explain its working. (10)
- 5 a) What is meant by responsivity? How it is related to quantum efficiency? (5)
- b) A transmitter has an output power of 0.1mW. It is used with a fiber having NA=0.25, attenuation of 6dB/Km and length 0.5 km. The link contains two connectors of 2dB average loss. The receiver has a minimum acceptable power (sensitivity) of -35dBm. The design has allowed a 4dB margin. Calculate the link power budget. (10)

- 6 a) An InGaAs pin photodiode has  $\lambda=1300$  nm,  $I_D = 4$  nA,  $\eta_L = 0.90$ ,  $R_L = 1000 \Omega$ , and the surface leakage current is negligible. The incident optical power is 300nW (-35 dBm) and the receiver bandwidth is 20 MHz. Find the various noise terms of the receiver. (5)
- b) What are the essential components required for establishing a point- to point link. (10)  
What are the various losses associated with it? Explain with neat optical power loss model.

### PART C

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

- 7 a) Explain the Fiber Bragg Grating technology and point two applications. (7)
- b) Explain the working of Semiconductor Optical Amplifier. (7)
- c) Compare the performance of different optical amplifiers. (6)
- 8 a) Explain the working principle of EDFA. Give the advantages of EDFA. (10)
- b) How does an OTDR work? Draw the typical OTDR trace. Name two faults that can be detected by OTDR. (10)
- 9 a) Explain with block diagram the working of optical add/drop multiplexer. Explain why it is required in optical communication system. (7)
- b) Explain the working of TDFA. (7)
- c) What is Li Fi technology? (6)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019**

**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) | Explain the mode theory for propagation of light in optical fiber?   | (9) |
|   | b) | Draw and explain the Outside vapour-phase deposition process in fiber fabrication?   | (6) |
| 2 | a) | Write the working principle of LASER and compare it with LED using neat diagrams.  | (9) |
|   | b) | A graded index fiber with parabolic refractive index has $n_1=1.48$ and $n_2=1.46$ if core radius is $20\mu\text{m}$ . Find the number of modes at $1300\text{nm}$ and $1550\text{nm}$ ? | (6) |
| 3 | a) | Explain different types of intramodal dispersion and derive the expression for pulse spread and dispersion factor for each case.   | (8) |
|   | b) | Explain different types of bending losses in optical fibers?   | (4) |
|   | c) | What is meant by Surface emitting LEDs?  | (3) |

**PART B**

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

- |   |    |  |     |
|---|----|--|-----|
| 4 | a) | Derive an expression for receiver sensitivity and also explain quantum limit .   | (8) |
|   | b) | Explain the physical principles of PIN photodetector?  | (7) |
| 5 | a) | Discuss the rise-time budget analysis in an optical fiber link and write about its advantages.   | (9) |
|   | b) | A given APD has a quantum efficiency of 65 % at a wavelength of $900\text{nm}$ . If $0.5\mu\text{W}$ of optical power produces a multiplied photocurrent of $10\mu\text{A}$ . Find the multiplication factor $M$ ? | (6) |
| 6 | a) | Briefly discuss the fundamental receiver operation in optical communication.   | (6) |
|   | b) | Write the advantages of Soliton based communication and explain the generation of soliton wave.  | (5) |

- c) A photodiode is constructed of GaAs, which has band gap energy of 1.43 eV at 300 K. What is the cutoff wavelength of this device? (4)

### PART C

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

- 7 a) Explain the operational principle of an OTDR and write the important performance parameters. (7)
- b) Compare the working between FP-SOAs and TW-SOAs. (8)
- c) Write a short note on Tunable optical filters? (5)
- 8 a) Explain the operation of Erbium-Doped fiber Amplifier. List out the different advantages. (12)
- b) What is meant by Fiber Bragg Grating? Write any one application in detail. (8)
- 9 a) What are the differences between fused fiber coupler and waveguide coupler? (8)
- b) Write the general characteristics and working principle of Raman Amplifier. (8)
- c) Why reconfigurable OADMs are more preferred in metro networks? (4)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Seventh semester B.Tech examinations (S), September 2020

**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) Define macroscopic and microscopic bending losses. (5)  
b) Explain Outside Vapor Phase Oxidation fabrication process with neat diagram. (10)  
Compare it with MCVD process.
- 2 a) Explain different types of materials used for making optical fibers. (5)  
b) Define attenuation constant. Explain the different attenuation mechanisms in optical fibers. (10)
- 3 a) Explain the following i) total internal reflection ii) axial numerical aperture in a graded index fiber. (5)  
b) Explain the working of surface emitting LED with neat diagram. Also explain its emission pattern. (10)

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

- 4 a) Explain receiver sensitivity and quantum limit of detection of optical receiver. (5)  
b) In a coherent optical communication system operating on the basis of homodyne detection, the received optical power is 2 nW and the signal bandwidth is 1 GHz. Taking the quantum efficiency of the detection to be 0.8 and the wavelength as 1500 nm find the SNR in case of shot noise limited performance. (10)
- 5 a) With the help of necessary figures, describe the working of an IMDD system. (5)  
b) Explain the working of APD. What do you mean by reach through effect? (10)
- 6 a) A photo detector generates a photo current of  $0.25\mu\text{A}$  for an incident optical power of  $0.8\mu\text{W}$  at operating wavelength of  $0.87\mu\text{m}$ . Estimate the quantum efficiency of photo detector at this wave length. (5)  
b) Derive the expressions for rise time and power budget analysis. (10)

**PART C**

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

- 7 a) What are the different components used in WDM system? Explain any two. (8)  
b) Compare different parameters of any four optical amplifiers. (8)  
c) What is Li-Fi technology? (4)
- 8 a) What are the advantages of free space optical communication? (4)  
b) Explain the working of EDFA. What are the advantages of EDFA? (10)  
c) What do you mean by fiber bragg grating? (6)
- 9 a) How a fault is detected in an optical fiber? Explain the principle with necessary equations. (5)  
b) What is TDFA? Explain the working of TDFA. (10)  
c) What is tunable optical filter? (5)

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