

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
Seventh Semester B.Tech Degree Examination December 2022 (2019 scheme)

**Course Code: ECT 413**

**Course Name: OPTICAL FIBER COMMUNICATION**

**Max. Marks: 100****Duration: 3 Hours**

**PART A**

*Answer all questions, each carries 3 marks.*

Marks

- 1 Illustrate any six advantages of optical fibre as transmission medium in the communication? (3)
- 2 Consider a multimode silica fibre that has a core refractive index  $n_1=1.47$  and a cladding refractive index  $n_2=1.45$ . Find (a) the acceptance angle in air? (b) the numerical aperture ? (3)
- 3 Write a short note on extrinsic absorption effect on the optical fibre cable? (3)
- 4 List out any six principal requirements of a good connector design in the optical communication system? (3)
- 5 Consider a silicon avalanche photodiode has a quantum efficiency of 70 percent at a wavelength of 950nm. Suppose  $0.5\mu W$  of optical power produces a multiplied photocurrent of  $15\mu A$ . Find (a) the primary photocurrent? (b) the multiplication factor? (3)
- 6 Explain the principle of external modulation in laser diode with a neat block schematic? (3)
- 7 Discuss the working principle of semiconductor laser amplifier ? (3)
- 8 Write a short note on doped fibre amplifiers in the optical communication system? (3)
- 9 Briefly explain the importance of optical splitters in the optical communication networks? (3)
- 10 Discuss the principle of simple passive optical add/drop multiplexer with a neat sketch? (3)

**PART B**

*Answer any one full question from each module, each carries 14 marks.*

**Module I**

- 11 a) Discuss the classification of optical fibre based on modes and refractive index profile with neat sketches? (9)

- b) Write a short note on index-guiding photonic crystal fibre with neat sketches? (5)

**OR**

- 12 a) Write a short note on mode field diameter in the optical fibre communication with neat sketches? (6)

- b) Discuss the importance of cut off wavelength in the optical fibre and explain how can it can be related to the V-number of the optical fibre? Determine the cut-off wavelength for a step index fibre to exhibit single mode operation when the core refractive index and radius are 1.45 and 4  $\mu\text{m}$  respectively, with the relative index difference being 0.20%. (8)

**Module II**

- 13 a) Discuss the importance of intramodal dispersion and material dispersion effect in the optical fibre communication? (10)

- b) Write short note on elastic- tube splicing method in the optical fibre with a neat sketch? (4)

**OR**

- 14 a) Discuss various nonlinear scattering process such as stimulated Raman scattering and stimulated Brillouin scattering in the optical fibre communication? (7)

- b) Write a short note on various bending losses in the fibre optics communication? (7)

**Module III**

- 15 a) Briefly discuss the Fabry Perot type and Distributed feedback type laser diode structure with neat sketches? (14)

**OR**

- 16 a) Discuss the structure and working principle of Avalanche photodiode with neat diagrams? (10)

- b) Write a short note on dark current noise and shot noise of photodiode noise? (4)

**Module IV**

- 17 a) Discuss the working principle of erbium-doped fibre amplifier (EDFA) under three different configurations with neat diagrams? (8)

- b) Consider an EDFA being pumped at 980 nm with a 30-mW pump power. If the gain at 1550 nm is 20 dB, what are the maximum input and output powers? (6)

**OR**

- 18 a) Briefly explain the general applications of three types of optical amplifier? (6)

- b) Explain the Setup and working principle of a typical Raman amplification system with a neat diagram? (8)

**Module V**

- 19 a) Briefly explain the working principle of OTDR with a neat diagram, and explain how the OTDR is used for tracing the various features of optical fibre communication system? (14)

**OR**

- 20 a) Explain the operating principle of wavelength division multiplexing (WDM) with neat diagrams? (10)
- b) Briefly explain the working of passive optical couplers with neat sketches? (4)

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