APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Scheme for Valuation/Answer Key
Scheme of evaluation (marks in brackets) and answers of problems/key
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (S), MAY 2019
Course Code: AE409
Course Name: OPTICAL INSTRUMENTATION

Max. Marks: 100   Duration: 3 Hours

PART A
Answer any two full questions, each carries 15 marks.
Marks

1 a) Illustrate the principle behind light propagation through an optical fiber with   (5)
       necessary diagrams.

       Diagram – 2 marks; Explanation – 3 marks

   b) Define Numerical Aperture of an optical fiber. Also derive the expression for   (5)
       numerical aperture.

       Definition – 2 marks; Derivation – 3 marks

   c) Differentiate between step index and graded index fiber.   (5)

       Any 5 comparisons with diagram – 5 marks

2 a) With necessary diagrams explain the operation of a PIN photo diode.   (5)

       Diagram – 2 marks; Explanation – 3 marks

   b) Calculate the V number and number of modes propagating through the fiber   (4)
       having a = 70 μm, n_1 = 1.59, n_2 = 1.52 and λ = 1μm.

       V number – 2 marks; No. of modes – 2 marks

   c) What is splicing? Mention different types. Explain fusion splicing with neat   (6)
       diagram.

       Splicing – 2; types – 1 mark; Fusion splicing diagram – 1; explanation – 2 marks

3 a) How can distance be measured using interferometers?   (7)

       Diagram – 3 marks; Explanation – 4 marks

   b) Give a short note on fiber optic connectors.   (3)

       Explanation with diagram – 3 marks

   c) Explain the measurements of current using fiber optic sensors?   (5)

       Diagram – 2 marks; Explanation – 3 marks

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

4 a) Describe the working of a Fabry- Perot interferometer with a neat diagram.   (7)

Diagram – 3.5 marks; Explanation – 3.5 marks

b) A Fabry- Perot interferometer has a 1 cm spacing and a reflection coefficient of r   (8)
   = 0.9. For a wavelength of 500 nm, Calculate:

   (i)   Mode number

   (ii)   Finesse,

   (iii)   Minimum resolvable wavelength interval and

   (iv)   Resolving power.

   Each part carries 2 marks – 4x2=8marks

5 a) Flatness testing can be done using interferometry. How it is done?   (6)
      Diagram – 3 marks; Explanation – 3 marks
   b) Explain the role of a beam splitter in interferometry with neat diagram.   (4)
      Diagram – 1 mark; Explanation – 3 marks
   c) What are the properties of Laser?   (5)
      Properties with explanation – 5 marks
6 a) Why population inversion is needed for lasing?   (5)
      Definition – 1 marks; Explanation with proper diagrams – 4 marks
   b) Classify laser according different criteria.   (5)
      Depends on output, active medium, level – 5 marks
   c) What is the principle of Q-switching? Mention its advantages.   (5)
      Principle – 2 marks; Advantages – 3 marks

PART C
Answer any two full questions, each carries 20 marks.

7 a) How lasers are being engaged in the detection and estimation of atmospheric   (10)

   pollutants?

   Diagrams – 4 marks; Explanation – 6 marks

   b) Discuss the method for velocity measurement of a fluid using laser.   (6)

   LDA method diagram – 3 marks; explanation – 3 marks

   c) Describe the use of lasers for the trimming of materials.   (4)

   Explanation - 4marks

8 a) How lasers can be utilized for the following applications?   (10)

      i. Heating

      ii. Welding

      Heating – 5 marks; Welding – 5 marks

   b) List different applications of Laser in Dermatology?   (5)

   Applications – 5 marks

   c) Briefly explain Laser diagnosis.   (5)

Explanation – 5 marks

9 a) Explain the interaction between Lasers and Tissues.   (8)

Explanation with proper diagrams - 8 marks

   b) Discuss the application of lasers in Oncology.   (7)

Explanation with proper diagrams - 7 marks

   c) Explain the application of lasers in the removal of tumours of vocal chords.   (5)

Explanation with proper diagrams - 5 marks

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