

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, DECEMBER 2018

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) Define: (i) Numerical Aperture (ii) Acceptance Cone (4)
Definition with equation – NA – 2 marks; Acceptance Cone – 2 marks
- b) What are the advantages over APD over PIN photo diode? Explain about APD (7)
with neat sketches.
Advantages – 2 marks; APD diagram - 2 marks; Explanation – 3 marks
- c) Determine the cut off wavelength for a step index fiber for single mode operation (4)
with core refractive index of 1.62 and cladding refractive index of 1.58 with core
diameter 0.8.
Cut off wavelength – 4 marks
- $$V = \frac{2\pi a}{\lambda} \sqrt{(n_1^2 - n_2^2)} = \frac{2\pi a}{\lambda} (N.A)$$
- V=2.405 for Single Mode Operation
- 2 a) How optical fiber is produced using Modified Chemical Vapour Deposition (5)
(MCVD)
Diagram – 3 marks; Explanation – 2 marks
- b) Differentiate between Intrinsic and Extrinsic fiber optic sensors. (4)
Diagram – 2 marks; explanation – 2 marks
- c) What is the use of fiber optic gyroscope? Explain its working with neat diagram. (6)
Diagram – 3 marks; Explanation – 3 marks
- 3 a) Explain different source coupling techniques. (5)
Diagram – 2.5 marks; Explanation – 2.5 marks
- b) How attenuation and dispersion are measured? (10)
Attenuation, Dispersion – Diagrams 2x2.5=5 marks; Explanation - 2x2.5=5 marks

PART B

Answer any two full questions, each carries 15 marks.



- 4 a) What are the different variations of the Michelson interferometer? Explain any Interferometric method to test Prism & Lens. (10)
Types – 2 marks; Diagram – 4 marks, Explanation - 4 marks
- b) Summarize your idea on the formation of interference patterns. (5)
Condition for Constructive interference - diagrams – 2 marks; explanation with equations - 3 marks
- 5 a) How an optical spectrum analyser works? Explain with neat block diagram. (8)
OSA diagram – 4 marks; working - 4 marks
- b) Derive Einstein relationship and explain how it helps to evaluate the ratio of rate of spontaneous emission to the rate of stimulated emission. (7)
Einstein's relation – 4 marks; ratio – 3 marks
- 6 a) Derive expression for the threshold optical gain needed for lasing. (6)
Optical cavity diagram – 3 marks; derivation of threshold gain – 3 marks
- b) What is optical pumping? Why it is needed? (4)
Need – 2 marks, explanation – 2 marks
- c) Discuss about any type of Gas Laser. (5)
Diagram - 2 marks; explanation – 3 marks

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Prepare short notes on the application of lasers in (20)
i. Distance Measurement
ii. Monitoring atmospheric pollutants
iii. Anemometry
iv. Scribing of Materials
Each carries 5 marks
- 8 a) List out advantages of using lasers in material processing. (5)
Advantages - 5 marks
- b) Explain about commonly used precise technique for brain surgery with schematic diagram. (10)
Diagram – 4 marks; Explanation – 6 marks
- c) Briefly explain Laser diagnosis. (5)
Diagnosis – 5 marks
- 9 a) Explain how cancer can be treated optically. (10)



Diagram – 3 marks; Explanation – 7 marks

b) Describe different medical applications of lasers.

(10)

Any 4 applications – 4x2.5=10 marks

