

6E6062

Roll No. _____

Total No of Pages: 4

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B. Tech. VI Sem. (Main & Back) Exam., April/May-2016
Electronic Inst. & Control Engineering
6EI2A Fiber Optics & Instrumentation

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks (Main & Back): 26

Instructions to Candidates:-

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

UNIT-I

- Q.1 (a) Discuss absorption losses in optical fibers, comparing and contrasting the intrinsic and extrinsic absorption mechanisms. A 15km optical fiber link uses fiber with a loss of 1.5dB km^{-1} . The fiber is jointed every kilometer with connectors, which given an attenuation of 0.8 dB each. Determine the minimum mean optical power that must be launched into the fiber in order to maintain a mean power level of $0.3\mu\text{W}$ at the detector. **rtuonline.com** [4+4=8]
- (b) What are the materials required for manufacturing the optical fiber? Describe the Plasma activated chemical vapor deposition (PCVD) method for preparation of optical fiber. [3+5=8]

- Q.2 (a) Using simple ray theory, describe the mechanism for the transmission of light within an optical fiber. Briefly discuss with the aid of a suitable diagram what is meant by the acceptance angle for an optical fiber. Show how this is related to the fiber numerical aperture and the refractive indices for the fiber core and cladding. [4+2+2=8]
- (b) What is Dispersion? Explain dispersion shifted and dispersion flattened optical fiber cables [2+4+2=8]

UNIT-II

- Q.3 (a) Describe the following characteristics of injection LASER; [2×4=8]
- (i) Frequency chirp
 - (ii) Noise
 - (iii) Reliability
 - (iv) Threshold current temperature dependence.
- (b) Write short notes on Q – switching. [8]

OR

- Q.2 (a) A ruby laser contains a crystal length 4cm with a refractive index of 1.78. The peak emission wavelength from the device is $0.55\mu\text{m}$. Determine the number of longitudinal modes and their frequency separation. [4+4=8]
- (b) Describe the optical characteristics of LED with neat sketch. [8]

UNIT-III

- Q.3 (a) GaAs has a bandgap energy of 1.43eV at a 300K. Determine the wavelength above which an intrinsic photo detector fabricated from this material will cease to operate. [8]
- (b) What is the difference between splices and connector? Explain different types of splices with neat diagram. [2+6=8]

OR

- Q.3 (a) Explain the structure features and working principle of a PIN photodiode. What is the functional significance of the intrinsic layer inserted in between the P and N layer? [2+2+4=8]
- (b) A Four port multimode fiber FBT coupler has $60\mu\text{W}$ optical power launched into port 1. The measured output power at port 2, 3 and 4 are 0.004, 26.0 and $27.5\mu\text{W}$ respectively. Determine the excess loss, the Insertion losses between the input and the output ports, the crosstalk and the split ratio for the device. [2+2+2+2=8]

UNIT-IV

- Q.4 (a) A 2Km length of multimode fiber is attached to apparatus for spectral loss measurement. The measured output voltage from the photo receiver using the full 2km length is 2.1 volt at a wavelength of $0.85\mu\text{m}$. when the fiber is then cut back to leave a 2 m length the output voltage increases to 10.7 volt. Determine the attenuation per kilometer for the fiber at a wavelength of $0.85\mu\text{m}$ and estimate the accuracy of the result. Also explain the experimental method for measurement of spectral loss. [8]
- (b) What is the working principle of optical time domain reflectometry (OTDR)? Explain the process of fault location identification through OTDR infield. [4+4=8]

OR

- Q.4 (a) Explain the time domain technique for measurement of dispersion with neat diagram. [8]
- (b) Explain the Laser based system for measurement of distance with neat diagram. [8]

UNIT-V

Q.5 (a) What is the need of optical amplifiers? Explain Fiber Raman Amplifier (FRA) with neat diagram. [4+4=8]

(b) Write short note on fiber optic Mach – Zehnder Interferometric sensor. [8]

OR

Q.5 (a) Write down the applications of optical fiber instrumentation in daily life. Also gives its advantages and drawbacks with clarifications. [4+4=8]

(b) Write short note on tunable sources and tunable filters. [4+4=8]
