**18EID61**

**Hall Ticket Number:**

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| **IV/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION** | | | |
| **April,2023** | **Electronics & Instrumentation Engineering** | | |
| **Eighth Semester** | **Optoelectronics & Laser Instrumentation** | | |
| **Time:** Three Hours | | **Maximum: 5**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (10X1 = 10 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X10=40 Marks) |

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| 1. | a) | Distinguish between meridional rays and skew-rays | CO1(BL2) | |  |
|  | b) | How does dispersion affect the communication link? | CO1(BL1) | |  |
|  | c) | What is meant by cut off wavelength of optical fiber | CO1(BL1) | |  |
|  | d) | Distinguish between Q-switching and mode locking | CO2(BL2) | |  |
|  | e) | Calculate the ratio of the stimulated emission rate to the spontaneous emission rate of a radiative source with temperature ~1000 and=0.5µm. | CO2(BL2) | |  |
|  | f) | List any two bio-medical applications of Lasers | CO2(BL1) | |  |
|  | g) | List the advantages of fiber optic sensors | CO3(BL1) | |  |
|  | h) | Define internal quantum efficiency of LED. | CO3(BL1) | |  |
|  | i) | Define responsivity of photo diode. | CO4(BL1) | |  |
|  | j) | What is meant by electro-optic effect? | CO4(BL1) | |  |
| **Unit - I** | | | | | |
| 2. | a) | What are the functions of the core and cladding in an optical fiber? Why should their refractive indices be different? Would it be possible for the light to be guided without cladding? | CO1(BL1) | **6M** | |
|  | b) | When the mean optical power launched into an 8Km length of fiber is 120µW, the mean optical power at the fiber output is 3µW. Determine  i) The overall signal attenuation or loss in dB through the fiber assuming there are no connectors or splices.  ii)The signal attenuation per kilometre for the fiber.  iii)The overall signal attenuation for a 10Km optical link using the same fiber with splices at 1Km intervals, each giving an attenuation of 1dB.  iv)The numerical input/output power ratio in (iii). | CO1(BL2) | **4M** | |
|  |  | **(OR)** |  |  | |
| 3. | | Classify basic attenuation mechanisms in an optical fiber? Discuss them in detail. | CO1(BL2) | **10M** | |
| **Unit – II** | | | | | |
| 4. | a) | Compare the features of gain-guided lasers, index guided lasers and quantum well lasers. | CO2(BL4) | **6M** | |
|  | b) | Illustrate the operation of laser Doppler velocity meter | CO2(BL3) | **4M** | |
|  |  | **(OR)** |  |  | |
| 5. | a) | Distinguish between the spontaneous and stimulated emissions. Which one is necessary for laser action and why? | CO2(BL2) | **4M** | |
|  | b) | Briefly discuss the role of laser in (a) material processing and (b) Welding | CO2(BL2) | **6M** | |

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| **Unit – III** | | | | |
| 6. | a) | List the major uses of fiber optic liquid level sensors? Discuss the operation of fluorescence liquid level sensor used for continuous level measurement with neat diagram. | CO3(BL1) | **6M** |
|  | b) | Illustrate the operation of Mach-Zehnder interferometric fiber optic sensor used for strain Measurement. | CO3(BL3) | **4M** |
|  |  | **(OR)** |  |  |
| 7. | a) | With neat sketches discuss the construction and operation of Surface emitter LED and Edge emitter LED? | CO3(BL2) | **6M** |
|  | b) | A GaAs LED is forward-biased with a current of 120mA and a voltage of 1.5V. Each emitted photon possess an energy of 1.43eV, and the refractive index of GaAs is 3.7. The configuration of the LED is such that we may neglect back emission and self-absorption within the semiconductor. Assuming the internal quantum efficiency of the LED to be 60%, calculate (a) the internal power efficiency of the device and (b) the external power efficiency of the device. | CO3(BL2) | **4M** |
| **Unit – IV** | | | | |
| 8. | a) | Illustrate the principle and operation of reach through Avalanche photo diode (RAPD). | CO4(BL3) | **6M** |
|  | b) | A p-n photo diode has a quantum efficiency of 70% for photon of energy equal to  1.52 x 10-19 J. Calculate (i) the wavelength at which the diode is operating and (ii) the optical power required to achieve a photocurrent of 3 µA when the wavelength of incident photons is that calculated in part(i). | CO4(BL2) | **4M** |
|  |  | **(OR)** |  |  |
| 9. | | What is the necessity of modulators in fiber optic communication system? With a neat diagram explain the operation of Magneto optic and Electro optic modulators. | CO4(BL2) | **10M** |

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