

Code :R7321005

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III B.Tech II Semester(R07) Regular & Supplementary Examinations, April/May 2011
OPTOELECTRONIC & LASER INSTRUMENTATION
 (Electronics & Instrumentation Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE questions
All questions carry equal marks

1. (a) Briefly explain about the fiber construction details and show a figure for transmission of Light rays and discuss about the refractive index distribution with a graph.
 (b) Write the equations for the total internal reflection of the light rays in a optical fiber and derive the expression for the Numerical Aperture of the fiber.
2. (a) Explain in detail, the structure and operating characteristic of Light sources.
 (b) List and discuss the methods of coupling optical sources into optical fibers.
3. (a) Explain mode locking setup for He- Ne laser.
 (b) Describe the construction and action of carbon dioxide laser.
4. (a) Describe the working of Moire-fringe modulation fiber optic sensor.
 (b) With a neat diagram explain the interferometric method of measurement of length.
5. (a) With the neat sketches explain the operation of Laser Doppler Velocity meter.
 (b) With the neat diagram explain the operation of laser endoscope.
6. (a) Draw the neat sketch for holography microscope and explain its principle of operation. Compare the image resolution of this with that of ordinary conventional microscope.
 (b) With the help of neat sketches explain holographic computer memories.
7. (a) In what way lasers are used for blind man? Explain.
 (b) Explain the treatment of corneal ulcers with lasers.
8. (a) Estimate the power generated internally with in a double hetero-junction LED at a drive current of 60mA and a peak emission wavelength of $1.31 \mu\text{m}$. The radiative and non-radiative recombination life time of the minority carriers in the region are $100\mu\text{s}$. and $60 \mu\text{s}$ respectively.
 (b) What is meant by modulation of a signal? Discuss Raman-Nath acoustic optic modulator.

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1. (a) Explain the historical development of optical fibers with the help of electromagnetic spectrum.
(b) Explain the propagation mechanism in step-index and graded index fibers.
2. (a) Discuss the problem of Fresnel reflection at all types of optical fiber joint.
(b) The Fresnel reflection at a butt joint with an air gap in a multimode step index fiber is 0.46 dB. Determine the refractive index of fiber Core.
(c) Differentiate between the two major categories of fiber-fiber joint.
3. (a) Explain the geometry of He-Ne laser.
(b) Explain double hetero-structure lasers with the help of a neat energy diagram.
4. (a) Draw and explain the construction and working of Faraday's rotation current monitor.
(b) Explain in detail about the fibre optic Gyroscope.
5. With neat diagrams explain:
(a) Lasers in material processing
(b) Lasers in weather monitoring (Lidar).
6. Write short notes on:
(a) Holograms on magnetic tape
(b) Holograms on the thermoplastic films.
7. (a) With neat diagram explain lasers in medicine.
(b) List out various laser instruments used for surgery. Briefly give their working principle.
8. (a) Write about the carrier and optical confinement of Double Heterojunction laser. How is it different from Homo-junction laser? Explain.
(b) What is a Bragg modulator?

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1. (a) What is the Multimode graded index fibre and explain about it with the necessary figures and equations.
(b) Discuss about Attenuation in optical fibers in detail with the necessary figures and graphs.
2. (a) Define the photo detection process.
(b) Explain in detail the working of basic two types of photo detector diodes.
3. (a) Write the importance of Q-switching. Compare mechanical switching with electronic switching.
(b) CO₂ laser is more efficient as compared to other gas lasers-say "True" or "False". Justify your answer comparing the performance.
4. (a) Write in detail about IR sources.
(b) What is modulation zone? Draw the basic optical fiber sensor system and explain.
5. With neat diagram explain:
(a) Lasers tracking
(b) Lasers in velocity measurement.
6. (a) With the help of neat sketches explain reconstruction of hologram with a wave identical to reference wave with a wave conjugate to reference wave.
(b) Explain in detail various recording and reconstruction devices of hologram.
7. With neat sketches explain the following applications of lasers in detail:
(a) Lasers in diagnostics
(b) Lasers in photo medicine.
8. (a) Define and explain the meaning of responsivity and quantum efficiency of photodiode and derive expressions for the same.
(b) An APD generates a current of 100mA when the incident power is 5nW. the operating wavelength is 1.5 μm . Find its responsivity. If the quantum efficiency is 0.7, find the multiplication factor.

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1. (a) Discuss about multimode graded index fibers in detail with the necessary figures and graphs.
(b) Draw a graph showing the refractive index distribution of central core clad optical fiber and explain the plot.
2. (a) Discuss in detail about the various applications of optical fibers for instrumentation with figures.
(b) Discuss about the various applications of optical fibers in detail.
3. (a) Explain the working of Ruby laser.
(b) Find out an expression for critical fluorescence power in a 4 level system.
4. (a) With a neat diagram explain the interferometric method of measurement of length.
(b) Describe the working of Moir-fringe modulation fiber optic sensor.
5. (a) Explain the principle and working of a fiber Gyroscope.
(b) Explain with neat diagrams how lasers are used in the following applications.
 - i. Lasers in surgery
 - ii. Lasers in low power measurement.
6. (a) Explain the terms coherence requirements, resolution in connection with hologram.
(b) With the help of neat sketches explain the recording mechanism of hologram.
7. (a) Explain in detail about laser instruments for surgery in medical applications.
(b) Explain the process of removal tumors of vocal cords.
8. (a) Explain the various noise mechanism in photodiode and derive expression for the signal - to- noise ratio for the case of direct detection using a photodiode.
(b) Obtain expression for the bandwidth of a Bragg acoustic-optic modulator.
