Code No: RR422204 **Set No. 1**

IV B.Tech II Semester Regular Examinations, Apr/May 2006
OPTO ELECTRONICS & LASER INSTRUMENTATION
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Briefly explain about the optical fibre 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 fibre cable and derive the expression for the Numerical Aperture of the fibre. [8+8]

2. Explain about the following with the necessary figures.
   (a) Optical fibers for communication.
   (b) Optical fibers for Instrumentation. [8+8]

3. (a) Describe the structure and operation of glass fiber laser.
   (b) Differentiate between three level and four level laser systems. [8+8]

4. (a) Explain how the Moire-Fringe modulation fiber optic sensor helps in eliminating the instability encountered with fiber optic intensity modulated sensor.
   (b) With a neat diagram explain the interferometric method of measurement of length. [8+8]

5. (a) Differentiate between a transducer and a sensor
   (b) Describe the arrangement and working of an optical fiber liquid level detector. [8+8]

6. (a) With a neat sketches explain the operation of Laser Doppler velocity meter.
   (b) With a neat diagram explain the operation of laser endoscope. [8+8]

7. (a) Describe the construction and working of a LED.
   (b) Estimate the power generated internally within a double heterojunction LED at a drive current of 60mA and a peak emission wavelength of 1.31 μm. The radiative and non-radiative recombination life time of the minority carriers in the active region are 100 μs. and 60μs respectively. [8+8]

8. (a) Discuss the advantages of p.i.n. photodiode over p.n. structure in a photodiode.
   (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. [8+8]

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Code No: RR422204 **Set No. 2**

IV B.Tech II Semester Regular Examinations, Apr/May 2006
OPTO ELECTRONICS & LASER INSTRUMENTATION
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the different types of optical fibres, explain about them in detail with the necessary figures, graphs and equations.
   (b) List and explain the reasons for signal distortion in Optical wave guides. [8+8]
2. (a) Give a point - to - point fiber optic communication link block diagram and explain the use of each block in detail.
   (b) Give any three applications of optical fibers for instrumentation and explain them with the necessary figures. [8+8]
3. (a) Obtain an expression for spatial length of pulse in an inhomogenously broadened laser
   (b) Explain mode locking setup for He - Ne laser. [8+8]
4. (a) Describe the working of Moire-fringe modulation fiber optic sensor.
   (b) Write in detail about IR sources. [8+8]
5. (a) What is an Evanescent sensor? Explain.
   (b) List the limitations of the Evanescent sensor? [8+8]
6. With neat diagrams explain:
   (a) Lasers in material processing
   (b) Lasers in medicine. [8+8]
7. (a) Explain with relevant diagrams the basic principle of confinement of carriers optical power in the active region of a double hetrojunction LED.
   (b) Discuss different modulation drive circuits for LEDs and explain their operations. Explain the operations of analog drive circuits designed with Darlington pairs. [8+8]
8. (a) Describe the different mechanisms that limit the frequency response of a photodiode.
   (b) A p.i.n. photodiode has a transit time of 2ns. and a junction capacitance of 3pf. If the load resistor is 50 ohm, find the bandwidth of the diode limited be transit time. [8+8]

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Code No: RR422204 **Set No. 3**

IV B.Tech II Semester Regular Examinations, Apr/May 2006
OPTO ELECTRONICS & LASER INSTRUMENTATION
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Briefly explain about the optical fibre 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 fibre cable and derive the expression for the Numerical Aperture of the fibre. [8+8]

2. (a) Give any three applications of optical fibers for instrumentation and explain them with the necessary figures.
   (b) Draw the block diagram of a typical fiber optic communication system and explain the function of each block in detail. [8+8]

3. (a) Explain the working of a Ruby Laser.
   (b) In a pink ruby laser with a chromium ion density N= 1.58*10^{19} cm^{-3}. its absorption coefficient $\alpha = 0.2cm^{-1}$ at 300K for R_1 line at 6943 ^{0}A , length of the ruby rod = 10cm, cross sectional area = 1 cm^2. Fractional intensity loss per pass=20%, n= 1.78. Calculate peak power and energy of pulse. [8+8]

4. (a) Write in detail about IR detectors.
   (b) Describe the working of Moire-Fringe modulation fiber optic sensor. [8+8]

5. (a) Differentiate between a transducer and a sensor.
   (b) Explain a method for measurement of current by a single mode fiber optic sensor with the help of a diagram.
   (c) How do you estimate the transmission line loss using the above sensor. [5+6+5]

6. With neat diagrams explain:
   (a) Lasers in material processing
   (b) Lasers in medicine. [8+8]

7. (a) With the help of neat sketches explain holographic interferometry?
   (b) With the help of neat sketches explain holographic computer memories? [8+8]

8. (a) Describe the different mechanisms that limit the frequency response of a photodiode.

   (b) A p.i.n. photodiode has a transit time of 2ns. and a junction capacitance of 3pf. If the load resistor is 50 ohm, find the bandwidth of the diode limited be transit time. [8+8]

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Code No: RR422204 **Set No. 4**

IV B.Tech II Semester Regular Examinations, Apr/May 2006
OPTO ELECTRONICS & LASER INSTRUMENTATION
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Briefly explain about the optical fibre 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 fibre cable and derive the expression for the Numerical Aperture of the fibre. [8+8]
2. (a) Compare Optical fiber communication system with Microwave communication system.
   (b) Discuss about the various applications of optical fibers in detail. [8+8]
3. (a) Estimate the number of photons emitted per second from a laser that puts out one watt of power. State clearly the assumptions made.
   (b) Describe the degradation mechanism in injection lasers. [8+8]
4. (a) Compare and contrast double exposure interferometry and real time interferometry.
   (b) Describe the working of Moire-Fringe modulation fiber optic sensor. [8+8]
5. (a) What is an Evanescent sensor? Explain.
   (b) List the limitations of the Evanescent sensor? [8+8]
6. With neat diagrams explain about:
   (a) Laser tracking
   (b) Lasers in weather monitorning (Lidar) [8+8]
7. (a) Describe the construction and working of a LED.
   (b) Estimate the power generated internally within a double heterojunction LED at a drive current of 60mA and a peak emission wavelength of 1.31 μm. The radiative and non-raidiative recombination life time of the minority carriers in the active region are 100 μs. and 60μs respectively. [8+8]
8. (a) What is meant by modulation of a signal? Discuss Raman - Nath acousto-optic modulator.
   (b) Why this modulator has a limited modulation bandwidth. [8+8]

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