

MS-107 ELECTRONIC AND OPTO-ELECTRONIC MATERIALS

M Tech (Materials Science and Engineering), Ist Year, IInd Semester
End Semester Examination May 2007

Time: 3 Hrs

M Marks: 45

Note: Attempt all the questions. Answers should be to the point.

1. a) How does population inversion take place in the case of semiconductor lasers? Is this mechanism different from population inversion of a gas laser. Draw qualitative differences.
b) Explain the operating principle of a double heterostructure laser with diagrams for layer structure, energy band diagram and the refractive index profile. How does the active layer confine charge carriers and the optical power.
 2. a) Draw a typical energy diagram to explain the basic principle of confinement of carriers and optical power in the active region of a double heterojunction light emitting diode (LED).
b) Define impurity levels in semiconductor LED materials. What are the key parameter considerations while designing a semiconductor material as an LED for an efficient power source in optical communication. Which compound semiconductors are possesses higher efficiency. Explain.
 3. a) Explain the optical detection process in a p-i-n photodiode. Give the necessary reasons for the absorption of a material used in photodetection. Discuss various optical processes associated in this phenomena.
b) Name and discuss an important experimental technique for the purification of a semiconductor to be used in opto- electronic devices. How is this different from a conventional technique.
 4. a) Describe the variation of the refractive index of an optical material as a function of electric field. Where does optical process in Kerr effect deviate from the Pockel's criteria. Justify on the basis of material as well as physical considerations.
b) Draw a typical twisted nematic liquid crystal display (TNLCD) structure. What is the use of polarizers in this device. Under what criteria can it be extended to a thin film transistor (TFT) based TN LCD
c) What are the advantages of using liquid crystal display (LCD) over light emitting diode(LED) display for an alphanumeric system. Draw your inferences on the basis of material characteristics and display parameters.
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