

EX/SC/INSC/PG/CORE/TH/MI303/2024

M. Sc. INSTRUMENTATION EXAMINATION, 2024

(2nd Year, 1st Semester)

OPTO-ELECTRONICS AND LASER (MI-303)

PAPER : PG/CORE/TH/MI303

Time : Four Hours

Full Marks : 80

(Use separate answer sheet for Part-I and Part-II)

PART—I (40 Marks)

Answer *any four* questions :

1. What is meant by Optoelectronic devices? What are the traditional technologies for producing light? What is the fourth lighting technology? Describe the advantages and disadvantages of the fourth lighting technology. [2+4+2+2]
2. Describe Michelson-Morley experiment with special reference to Michelson interferometer. [10]
3. Describe luminescence, phosphorescence and fluorescence with band diagram and common materials used for these. [3+3+3+1]
4. Describe a photomultiplier tube to be used as a detector. What are dynodes and what materials are used to coat the dynodes? [6+4]

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[Turn Over]

(2)

5. Define photometric and radiometric units used for measuring light intensity. Define Lambert's law and Beer's law. What are the wavelength ranges for UV, visible and infrared radiations? [4+4+2]
6. Describe a single beam spectrophotometer with reference to the different components used. What modifications are needed to convert the above to a double-beam one? [6+4]
7. What is meant by the active component and passive component in an electronic device? Describe in details of the above with special reference to different components generally used. [4+6]
8. What is thermionic effect? Define work function of a metal. Define work function and electron affinity of a semiconductor material with requisite band diagram. [4+6]

PART—II (40 Marks)

Answer *any* **four** questions :

1. What is metastable state and why is it necessary for lasing action? What are the pumping methods used for lasing action? Write a short note on Excimer laser. (3+2+5)
2. Explain the construction and operation of He-Ne laser with a neat diagram. Why is He-Ne laser superior to ruby laser? Name the material used for the construction of ruby laser. (6+2+2)

(3)

3. Describe the construction and working of a Nd-YAG laser with necessary diagram. Mention the common materials used for the active regions of semiconductor laser. What are the applications of CO₂ laser? (6+2+2)
4. What is Holography? Describe the recording of a hologram and reconstruction of the image. How is holography different from ordinary photography? (2+6+2)
5. Describe step index and graded index fiber with neat diagram. (5+5)
6. Compare single mode and multimode optical fibers. Derive the expression for acceptance angle and numerical aperture. (4+6)

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