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Total Number of Pages : 02

B.Tech
PEI5J003

5th Semester Regular / Back Examination 2018-19
OPTOELECTRONICS DEVICES & INSTRUMENTATION

BRANCH : AEIE, EIE, IEE

Time : 3 Hours

Max Marks : 100

Q.CODE : E494

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 Short Answer Type Questions (Answer All-10) (2 x 10)

- Write various blocks of optical fiber communication system.
- Enlist various applications of step Index fiber and Graded Index fibers.
- Explain Numerical Aperture (NA) for Graded index fiber.
- Compare a multimode optical fiber with single mode optical fiber from application point of view.
- A Step index fiber has a core and cladding refractive index of 1.50 and 1.46 respectively. What is the value of critical angle, numerical aperture and acceptance angle of fiber?
- What do you mean by RAPD type optical detector?
- What is GVD?
- Differentiate between SLED & ELED.
- What are the major criteria of semiconductor material selection for optical sources?
- A photodiode has a quantum efficiency of 55% when photons of energy 1.5×10^{-19} J are incident upon it. Find the operating wavelength of the photodiode?

Part- II

Q2 Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Explain the importance of optoelectronic devices for instrumentation application.
- Define Responsivity, Quantum efficiency and Absorption coefficient for optical detectors.
- Discuss the requirement for population inversion in order that stimulated emission may dominate over spontaneous emission.
- Briefly explain the structure of planar type LED with optical output power characteristics with neat diagrams.
- Define isotype and anisotype heterojunction in optical sources.
- How carrier recombination take place in direct and indirect band-gap semiconductors?
- With a schematic sketch compare the different fiber types based on the following points (i) index profile (ii) fiber cross section and ray paths (iii) typical dimensions.
- Indicate the distinction between the fiber Splices and fiber couplers with suitable diagrams.
- With a schematic diagram explain the structure of Fabry-Perot resonator cavity. Define resonant frequency of the cavity.
- How is the normalized frequency (V) parameter is related to the radius of the core in optical fiber? What is the value for a single mode to exist?

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- k) Explain the detection process in the p–n photodiode. Compare this device with the p–i–n photodiode.
- l) What are the factors responsible for optical power loss on fiber optic communication?

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Part-III

Long Answer Type Questions (Answer Any Two out of Four)

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- Q3** Write the concept of absorption and emission of radiation of laser Diode with suitable diagrams. **(16)**
Discuss the working principle of PIN photo detector with physical structure, equivalent circuit, field distribution and energy diagram.
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- Q4** Discuss the operation of APD with neat sketch, describing how it differs from p-i-n photodiode. **(16)**
Enlist the drawbacks and advantages of APD.
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- Q5** What are double heterojunction LEDs? Explain their layer structure and energy band diagrams with suitable figures. **(16)**
Explain the structure of surface emitter LEDs using neat schematics.
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- Q6** Write short notes on : **(16)**
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- a) OTDR
- b) Fiber optic gyroscope