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Total Number of Pages: 02

B.Tech.
PEE5J002

5th Semester Regular Examination 2017-18
Optoelectronics Device & Instrumentation

BRANCH: ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.CODE: B364

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

- Q1 Answer the following questions: multiple type or dash fill up type (2 x 10)**
- a) Reflectance is often used for the ratio of the _____ energy per unit area to the _____ flux.
 - b) If the radiation has to build up and sustain in the resonator, one must satisfy $R_1 R_2 e^{2(\gamma - \alpha)l} \underline{\hspace{1cm}} 1$
 - c) The highest energy band in a solids that is completely filled or occupied by electron at 0K is known as _____ band.
 - d) In an intrinsic semiconductor at 0K , the valence band is completely _____ and the conduction band is completely _____ of electrons.
 - e) An optical detector is a device that converts light signals into _____ signals.
 - f) The bandgap energies for silicon _____ ev and for germanium _____ ev.
 - g) Photodectors are made out of _____ junctions.
 - h) The PIN photo diode is normally subjected to a _____ bias.
 - i) Attenuation and dispersion determine _____ spacing in a fiber optic communication.
 - j) Attenuation of an optical beam is usually measured in _____ unit.
- Q2 Answer the following questions: Short answer type (2 x 10)**
- a) Write down the requirements, an optical source should have?
 - b) State the condition for amplification by stimulated emission.
 - c) Calculate the photo current density in a 1 cm length silicon PIN detector, due to a photon flux of $4.37 \times 10^{18} \text{cm}^{-2} \text{s}^{-1}$. The absorption coefficient is 700cm^{-1} .
 - d) Give the condition for complete power transfer from one guide to another in an optical waveguide directional coupler.
 - e) Name any two applications of fiber optic sensor.
 - f) Distinguish between "Monomode" and "Multimode" fiber.
 - g) What is the "Sagnac" effect used in fiber optic sensor
 - h) Explain the principle of "total internal reflection".
 - i) Define electro-optic effect.
 - j) Draw the general block diagram of fiber-optic communication system.
- Q3 a) Describe "Distributed fiber optic sensors. Discuss the method is used to measure pressures and temperatures using optical fiber. Draw suitable diagram to explain your answer (10)**
- b) Write a short note on Numerical Aperture (5)**
- Q4 a) Distinguish between step-index and graded-index optical fibers. Explain the method of ray propagation in step-index fibers. (10)**
- b) What is modulation? Discuss intensity modulation with special reference to fiber optic instrumentations. (5)**

- Q5** a) Explain fiber optic gyroscope (10)
b) With a neat diagram discuss Mach-Zehnder interferometric sensor. (5)
- Q6** a) Explain the construction and principle of operation of semiconductor laser (10)
b) With a neat diagram explain laser oscillation (5)
- Q7** a) Explain the phenomena of constructive interference and destructive interference. Draw suitable diagrams and derive the expressions to explain the above phenomenon. (10)
b) Discuss the various loss that takes place in optical fiber. Draw suitable diagrams to justify your explanation. (5)
- Q8** a) Describe several possible lensing schemes for coupling improvement between an optical source and an optical fiber. (10)
b) A GaAs optical source with a refractive index of 3.6 coupled to a silica fiber that has a refractive index of 1.48. If the fiber end and the source are in close physical contact, calculate the power loss in decibels. (5)
- Q9** a) Explain the working principle of PIN photo diode and APD photodiode (10)
b) Write a short note on Littrow Diffraction Grating (5)