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B.Tech
PEEE5301

6th Semester Regular / Back Examination 2015-16
OPTOELECTRONICS DEVICES AND INSTRUMENTATION
BRANCH: AEIE,EEE,EIE,IEE
Time: 3 Hours
Max Marks: 70
Q.CODE: W538
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

   a) Write down four applications of fiber optic gyroscope.

   b) What is evanescent wave?

   c) Find coherence length for an LED operates at 1550 nm for time 10^{-4} ns.

   d) Difference between symmetric and asymmetric TM mode of propagation.

   e) What do you mean by "loss due to transverse misalignment"? Write its supporting equation.

   f) Explain the meaning of dark current.

   g) Write different kind of fiber optic components.

   h) What do you mean by s and p polarization?

   i) Why 1550 nm is suitable for communication purpose?

   j) What would be the effect of magnetic field on a fiber optic gyroscope with regard to phase shifts?

Q2 **a)** Consider a polymer fiber consisting of a core of refractive index of 1.51 and having air refractive index of 1.0 as cladding. What is numerical aperture? What is the maximum angle up to which light can be guided by the fiber? **(5)**

   b) Derive mathematical expression for material dispersion. **(5)**

Q3 **a)** Briefly describe for both sufficient and necessary condition for LASER beam? **(5)**

   b) In photonic research laboratory, it is seen that GaAs laser diode is modulated and refractive index of the cavity changes due to carrier injection. If the fractional change of refractive index is 10^{-6}, find the frequency shift corresponding to the same for wavelength 1550 nm. **(5)**

Q4   Describe Mach-Zehender interfometric sensor including all necessary diagrams and supporting mathematical expression. **(10)**

Q5 **a)** Describe the fabrication of fiber grating? **(5)**

b) Consider a fiber optic directional coupler with an interaction length 5 mm. **(5)**
(a) Obtain the corresponding coupling coefficient.
(b) What should be the value of coupling coefficient, so that a 5 mm long coupler behaves as 3 dB?

Q6 **a)** Discuss optical wavelength division multiplexer and demultiplexer. **(5)**
b) A multimode step index fiber has a refractive index of 2.5. The number of modes propagating at wavelength of 1310 nm is 100. Calculate the diameter of fiber core. **(5)**

Q7 **a)** Briefly describe the concept of RAPD. Mention the schematic diagram for understanding RPAD. **(5)**
b) Silicon RAPD operating at a wavelength of 800 nm, exhibits a quantum efficiency of 90%, a multiplication factor of 880 and a dark current of 2 nA. Calculate the rate at which photons should be incident on the device so that the output current is greater than dark current? **(5)**

Q8   Write short notes on any two: **(5 x 2)**
a) Current sensor
b) Loss mechanisms of optical fiber
c) Modal distribution in step index fiber
d) Optical encoder and decoder