Registration no: | | | | | | | | | | |

Total Number of Pages: 2 **B.TECH**
PEEC4302

5th Semester Regular / Back Examination 2015-16
FIBER OPTICS AND OPTOELECTRONICS DEVICES
BRANCH: EC,ELECTRICAL,ETC
Time: 3 Hours
Max marks: 70
Q.CODE: T603

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) Differentiate between a step index and a graded index fiber.
b) What is chromatic dispersion?
c) What is a bending loss in optical fiber?
d) Differentiate between a PIN photo detector and APD photo detector.
e) Write an expression for the numerical aperture of a graded index fiber.
f) Differentiate between an electrical bandwidth and optical bandwidth.
g) Write down some of the properties of a good optical fiber connector.
h) Differentiate briefly between thermal noise and shot noise.
i) What are the low loss windows that are used in the fiber optics communication?
j) What are the characteristics of a high purity silica Fiber?

Q2 a) If photons of energy 1.53 x 10^{-19} J are incident on a photodiode which has a responsivity of 0.65 A/W. If the optical power level is 10 micro watt, then what is the photocurrent generated in a photo diode. **(5)**

b) A silicon avalanche photodiode has a quantum efficiency of 65 percent at a wavelength of 900 nm. Suppose 0.50 micro watt of optical power produces a multiplied photocurrent of 10 mico ampere. Find the multiplication factor M. **(5)**

Q3 a) Explain different types of fiber splicing techniques. **(5)**

b) The end faces of two optical fibers with core refractive indices of 1.50 are perfectly aligned and have a small gap between them. If this gap is filled with a gel having a refractive index of 1.30, find the optical loss in decibels at this joint. **(5)**

Q4 A silica glass optical fiber has a core refractive index of 1.5 and the cladding refractive index of 1.45. Calculate **(10)**

a) the critical angle for the core-cladding interface.
b) The acceptance angle α in air for the fiber.
c) The numerical aperture (NA) of the fiber and
d) The percentage of light collected by the fiber with respect to the incident light (it is given that the core diameter of the fiber is greater than the diameter of the light source).

Q5 **a)** Explain total dispersion in a single mode fiber. **(5)**

b) A single mode fiber operating at the wavelength of 1.3 μm is found to have a total material dispersion of 2.81 ns, and a total waveguide dispersion of 0.495 ns. Determine the received pulse width and approximate bit rate of the fiber if the transmitted pulse has a width of 0.5 ns. Inter modal dispersion does not occur in a single mode fiber. **(5)**

Q6 **a)** Explain birefringence.A single mode optical fiber has a beat length of 8 cm at 1300 nm. Find out the modal birefringence. **(5)**

b) Explain a typical semiconductor laser amplifier with schematic diagram. **(5)**

Q7 **a)** Differentiate between stimulated emission and spontaneous emission in a laser. **(5)**

b) What are the requirements in selecting materials for optical fibers. **(5)**

Q8 Write short notes on any two: **(5 x 2)**

a) Optical isolator

b) Dispersion shifted fiber

c) 4 x 4 photonic switch

d) Responsivity