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Total Number of Pages: 2

**B.Tech**  
**PEEC4302**

**5<sup>th</sup> Semester Regular / Back Examination 2016-17**  
**FIBER OPTICS AND OPTOELECTRONICS DEVICES**  
**BRANCH(S): ECE, EE, ETC**

**Time: 3 Hours**

**Max Marks: 70**

**Q.CODE: Y306**

**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) What do you mean by optoelectronics? Write the name of four optoelectronic device.
- b) A student wants to design a single mode optical fiber in microwave and photonic laboratory but he unable to design the same. So, you suggest the specification of core and cladding and help him to develop the same mono mode fiber.
- c) Draw the schematic diagram for optical MUX and DEMUX.
- d) What do you mean by multipath time dispersion? Write supporting expression corresponding to the same.
- e) A p-n photo diode has quantum efficiency of 70% for photons of energy  $1.52 \times 10^{-19}$  J. Calculate the wavelength at which the diode is operating.
- f) Two compatible multimode SI fibers are jointed with a small air gap. The fiber axes and end faces are perfectly aligned. Determine the refractive index of the fiber core, if the joint is showing a loss of 0.47 dB.
- g) A step index fiber has a core and cladding refractive index of 1.50 and 1.46 respectively. What is the value of numerical aperture and acceptance angle of the fiber?
- h) Mention the advantages of graded Index fiber with the help of ray diagram
- i) What EDFA? Write its advantages.
- j) Write the frequencies corresponding to second and third optical communication windows?

- Q2** (a) Describe different type's losses in optical fiber due to both extrinsic and Intrinsic parameters. **(5)**
- (b) Discuss various types of optical connectors. **(5)**

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- Q3 a)** A pin photodiode on average generates one electron-hole pair per two incident photons at first optical communication window. Assuming all the photo-generated electrons are collected, calculate (6)
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- (i) quantum efficiency of the diode
- (ii) the maximum possible band gap energy (in eV) of the semiconductor, assuming the incident wavelength to be a long wavelength cut-off;
- (iii) the mean output photocurrent when the incident optical power is  $10 \mu\text{W}$ .
- b)** Elaborate double crucible method for fabricating optical fiber? (4)
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- Q4 a)** Distinguish between p-n, p-i-n and avalanche photo diode with suitable diagram (5)
- b)** A silicon RAPD, operating wavelength of  $0.80 \mu\text{m}$ , exhibits a quantum efficiency of 95% and multiplication factor of 700 and dark current of 3 nA. Calculate the rate at which photons should be incident on the devices, so that the output current is greater than the dark current (5)
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- Q5 a)** Illustrate the design, structure and principle of solar cell. (5)
- b)** What is acronym for LASER? Elaborate spontaneous, absorption and stimulated emission of radiation. (5)
- Q6 a)** What do you mean by electro-optic effect? Established the supporting mathematical expressions for  $V_{\pi}$  parameter. (5)
- b)** What are the functions of the core and cladding? Why the refractive index of core and cladding are different? Would it possible for the light to be guided without cladding? (5)
- Q7** Derive TE and TM modes for an inhomogeneous medium. (10)
- Q8** Write short answer on following: (2.5 x 4)
- a) Optical switching
- b) ILD
- c) Inter and Intramodal dispersion
- d) Birefringence
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