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Total Number of Pages : 2

AR-17

B.TECH

**B.TECH 5<sup>th</sup> SEMESTER EXAMINATIONS, NOV/DEC 2019**  
**BECPE5041 FIBER OPTICS & OPTOELECTRONICS DEVICES**  
ECE BRANCH

Time : 3 Hours

Maximum : 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

**PART – A: (Multiple Choice Questions) 10 x 2=20 Mark**Q.1. Answer All Questions

- a For the design of fiber Optics, which among the following reasons is/are responsible for an extrinsic absorption? [CO1] [PO1]  
a. Atomic defects in the composition of glass b. Impurity atoms in glass material c. Basic constituent atoms of fiber material d. All of the above
- b In the fiber optic link, power transfer from one fiber to another and from fiber to detector must take place with \_\_\_\_\_ coupling efficiency. [CO1] [PO1]  
a. maximum b. stable c. minimum d. unpredictable
- c The basic principle involved in light transmission through a fiber optic link is : [CO1] [PO1]  
(a) Total internal reflection (b) polarization  
(c) diffraction (d) refraction
- d In spontaneous emission, the light source in an excited state undergoes the transition to a state with a. Higher energy b. Moderate energy c. Lower energy d. All of the above [CO2] [PO1]
- e For a photo-diode with responsivity of 0.50 A/W & optical power of about 12 $\mu$ W, what would be the value of generated photocurrent? [CO2] [PO2]  
a. 3  $\mu$ A b. 6  $\mu$ A c. 9  $\mu$ A d. 12  $\mu$ A
- f Which type of scattering occurs due to interaction of light in a medium with time dependent optical density variations thereby resulting into the change of energy& path? [CO1] [PO1]  
a. Stimulated Brillouin Scattering b. Stimulated Raman Scattering  
c. Mie Scattering d. Rayleigh Scattering
- g The heating of the two prepared fiber ends to their fusing point with the application of required axial pressure between the two optical fibers is called as [CO3] [PO2]  
a) Mechanical splicing b) Fusion splicing c) Melting d) Diffusion
- h Consider the assertions given below. Which is the correct sequential order of process adopted in glass fiber preparation? [CO3] [PO1]  
A. Drawing of fiber B. Production of pure glass  
C. Pulling of fiber D. Conversion of pure glass into preform  
a. C, A, D, B b. A, B, C, D c. B, D, A, C d. D, B, A, C
- i Which kind of dispersion phenomenon gives rise to pulse spreading in single mode fibers? [CO4] [PO1]  
a. Material b. Intermodal c. Group Velocity d. Intramodal
- j If a fiber operates at 1400nm with the diameter of about 10  $\mu$ m,  $n_1 = 1.30$ ,  $\Delta = 0.80\%$ ,  $V = 3.5$ , then how many modes will it have? [CO4] [PO2]  
a. 6 b. 9 c. 13 d. none of the above

**PART – B: (Short Answer Questions) 10X2=20 Marks**Q.2. Answer All questions

- a Calculate the carrier frequency for optical communication systems operating at 0.88  $\mu$ m, 1.3  $\mu$ m, and 1.55 $\mu$ m. What is the photon energy (in eV) in each case? [CO1] [PO3]
- b How bit rate is affected by fiber dispersion? [CO1] [PO2]
- c Difference between coherent & non coherent source [CO4] [PO1]
- d What is stimulated and spontaneous emission? [CO4] [PO2]
- e Write difference between *Photo diode and Photo detector*. [CO3] [PO1]
- f Distinguish between optical source and photo diode [CO3] [PO1]
- g Distinguish between laser and LED. [CO2] [PO1]



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|---|---|-------------|
| h | What is quantum efficiency and responsivity?                    | [CO3] [PO1] |
| i | What is double crucible method                                  | [CO1] [PO2] |
| j | Define the wavelength and frequency of Blue LED light emission. | [CO2] [PO2] |

**PART – C: (Long Answer Questions) 4X15=60 Marks****Answer ALL questions**

- Q.3
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|---|--|----|-------------|
| a | How single mode fiber be categorized? How the number of mode supported by fiber is determined?   | 10 | [CO1] [PO3] |
| b | Discuss the advantage of Fiber optics communication system over traditional communication system | 5  | [CO1] [PO2] |
- OR
- |   |   |    |             |
|---|---|----|-------------|
| c | Define the mode field Diameter in a single mode fiber and discuss how to determine the mode in SIMM and GIMM. | 10 | [CO1] [PO3] |
| d | Discuss T.I.R. with necessary Diagram   | 5  | [CO1] [PO2] |
- Q.4
- |   |   |    |             |
|---|---|----|-------------|
| a | Explain Laser action with the help of 3 and 4 level energy level diagram.                                 | 10 | [CO2] [PO3] |
| b | Describe the types of losses in Optical fibers using a connector. Suggest the minimization of the losses. | 5  | [CO2] [PO2] |
- OR
- |   |  |    |             |
|---|--|----|-------------|
| c | Discuss about different types of dispersion and write how dispersion is managed. | 10 | [CO2] [PO3] |
| d | Briefly explain the Rayleigh scattering Losses                                   | 5  | [CO2] [PO2] |
- Q.5
- |   |   |    |             |
|---|---|----|-------------|
| a | Explain structure and operation of PN and PIN Photo diode   | 10 | [CO3] [PO2] |
| b | With Schematic Diagram discuss about Fabry Parot resonator cavity and derive the expression for resonant frequency of the cavity. | 5  | [CO3] [PO2] |
- OR
- |   |  |    |             |
|---|--|----|-------------|
| c | Write short notes on<br>i. optical connector ii. Splicing Techniques   | 10 | [CO3] [PO2] |
| d | A 32x32 port multimode coupler (fiber transmissive star coupler) has 1 mW of official power launched to a single input port. The average optical power measured for each output port is 14 $\mu$ W. Evaluate the total loss incurred through the device and average insertion loss | 5  | [CO3] [PO2] |
- Q.6
- |   |  |    |             |
|---|--|----|-------------|
| a | Discuss the SOA with neat diagram and write the distinguishing features.   | 10 | [CO4] [PO2] |
| b | A photo diode with quantum efficiency 60%. Calculate the incident optical power to obtain a photocurrent of 2.5 $\mu$ A. | 5  | [CO4] [PO2] |
- OR
- |   |   |   |             |
|---|---|---|-------------|
| c | Describe the use of WDM in Optical fiber communication                | 8 | [CO4] [PO2] |
| d | Write the types of Optical Amplifiers used in OC and categorize them. | 7 | [CO4] [PO2] |

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