Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

PEEC 4302

Fifth Semester Back Examination – 2014

FIBRE OPTICS AND OPTOELECTRONICS DEVICES

BRANCH (S) : EC, ELECTRICAL, ETC

QUESTION CODE : L272

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 ×10

(a) What do you mean by V number ? What is its physical significance ?

(b) Calculate the number of modes of a graded index optical fiber, if its core diameter is 62.5 μm, numerical aperture is 0.275 and its operating wavelength is 1300 nm.

(c) How the dispersion-shifted and dispersion-flattened fibers are manufactured ?

(d) What should be the characteristics of materials used for fabrication of LED ? Give at least two examples of such materials.

(e) What do you mean by total internal reflection ? Explain your answer with proper ray diagram.

(f) The refractive indexes of the core and cladding of a silica fiber are 1.48 and 1.46, respectively. What is the critical propagation angle ?

(g) What are the drawbacks of an APD ?

(h) What do you mean by numerical aperture of an optical fiber ? What is its physical significance ?

(i) What do you mean by direct and indirect band gap semiconductors ? Which type of semiconductors is used for fabrication of LASER Diode ?

(j) What is the physical significance of radiation pattern modulation capability ?

P.T.O.

2. (a) What are the commonly used fiber fabrication methods ? Draw the schematic diagram of the fiber-drawing apparatus. Explain with neat diagram, the modified chemical vapor deposition process. 6

(b) Describe the double crucible method with proper diagram. 4

3. (a) What do you mean by loss in fibers ? Discuss in brief about the different types of signal loss in fibers. 4

(b) Derive the expression for material dispersion. Hence establish a relation between the group delay and material dispersion. 6

4. What do you mean by quantum efficiency of an optical source ? Derive the expression for internal quantum efficiency and external quantum efficiency of LED. 10

5. (a) With neat diagram explain the working of a fiber optic system. 6

(b) Explain with proper block diagram the working of an optical switch. 4

6. (a) Calculate the noise figure of an optical amplifier if the input signal power is 300 μW, the input noise power is 30 nW in a 1-nm bandwidth, the output signal power is 60 mW and the output noise power is 20 μW in a 1-nm bandwidth. 5

(b) Explain the working of a WDM system. 5

7. (a) Consider an Erbium Doped Fiber Amplifier being pumped at 980 nm with a 30 mW pump power. If the gain at 1550 nm is 20 dB, then determine the maximum input and output power. The pump to signal wavelength ratio is 0.63. 4

(b) An InGaAs *pin* photodiode has the following parameters at a wave length of 1300 nm. $I_D = 4$ nA, $\eta = 0.90$, $R_L = 1000\ \Omega$ and the surface leakage current is negligible. The incident optical power is 300 nW and the receiver bandwidth is 20 MHz. Determine the *mean square quantum noise current* and *mean square dark current* for the *pin* photodiode. Symbols are having there usual meaning. 6

8. Write short notes on any **two** of the following : 5 × 2

(a) Wave propagation in a cylindrical wave guide

(b) Schemes for coupling improvement

(c) *pin* photodiode

(d) Schottky barrier cell.