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

Total Number of Pages: 2 **M.Tech**
ETPE204

2nd Semester Back Examination 2016-17
OPTICAL COMMUNICATION
BRANCH: COMMUNICATION ENGG, COMMUNICATION SYSTEMS, ELECTRONIC & COMM. ENGG, ELECTRONIC AND TELECOMMUNICATION ENGG, SIGNAL PROCESSING

Time: 3 Hours
Max Marks: 70
Q.CODE: Z1171

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 is total internal reflection and what is its significance in optical communication?
b) What is(are) the difference(s) between step-index and graded-index optical fiber?
c) Define numerical aperture of a step-index fiber. What is its significance?
d) What are the two causes of intermodal dispersion?
e) What type of material is used as light source materials?
f) What are the three processes involved in laser action?
g) Define quantum efficiency. In a 100ns pulse, 6×10^6 photons at a wavelength of 1300nm found on an InGaAs photodetector. On the average 3.0×10^6 electron-hole pairs are generated. What is the quantum efficiency?
h) What is the meaning of coherent in optical fiber communication and how does it defer from coherent detection in radio communication?
i) What is linewidth in optical communication? For a Fabry-Perot laser operating at 1300 nm and 3 nm spectral width, what is the linewidth?
j) What are the basic applications of optical amplifiers?

Q2 **a)** With schematic diagrams explain the various types of optical fibers. **(5)**
b) Represent and explain about skew ray and Meridional ray propagation in optical fiber. **(8)**

Q3 **a)** Derive the wave equations for step-indexed fibers. **(6)**
b) What are the modes available in step-indexed fibers? Represent the schematics of the transverse electric field pattern for the lowest order modes. **(4)**

Q4 **a)** Represent the double-heterostructure LED configuration and explain its working principle. **(5)**

b) Draw the energy band diagram of a pin photodiode and explain its operation. **(5)**

Q5 **a)** Explain the structure of Fabry-Perot resonator cavity and distributed-feedback laser diode. **(6)**

b) Derive the expression for the frequency spacing between two resonant frequencies in laser diode. **(5)**

Q6 **a)** A given silicon avalanche photodiode has a quantum efficiency of 65% at a wavelength of 900nm. If 0.5μW of optical power produces a multiplied photocurrent of 10μW, what is the primary photocurrent and what is the multiplication factor? **(5)**

b) Explain the bending losses in optical fiber. **(5)**

Q7 **a)** Explain the fundamental concept of coherent lightwave system and also explain the homodyne and heterodyne detection. **(6)**

b) What are the three fundamental ways by which information can be sent in a coherent optical transmission system? Explain the OOK homodyne system. **(4)**

Q8 **Write short answer on any TWO:** **(5 x 2)**

a) Avalanche photodiode

b) Heterodyne detection schemes

c) Wavelength division multiplexing