Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SIXTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - APRIL / MAY 2017

SUBJECT: OPTICAL FIBER COMMUNICATION (ECE - 4011)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Derive an Eigen value equation for symmetric TE modes supported by symmetric planar waveguide.

1B. The electric field within a planar symmetric waveguide which supports the symmetric TE modes at the lowest order is given by 12 cos (k_0 x) e^{jwt} + 10 Sin (k_1 x) e^{jwt} KV / m at a particular point Z = 0. Propagation constant for symmetric mode = $ß_0$ = 9.41 μm^{-1}. Determine the amount of power carried out by the field. Derive the expression used.

1C. Determine the beat length of a planar symmetric dielectric waveguide which supports TE and TM modes. Let n_g = 1.5, V < π, K_eTE = 0.612, K_eTM = 0.63, d = 3 μm and operating wavelength = 1300nm.

(4+4+2)

2A. Staring from fundamentals, derive an equation for electric and magnetic field components of a cylindrical optical waveguide.

2B. With neat diagrams, derive an expression for pulse broadening due to intra-modal dispersion in an optical fibre.

2C. Assume 5 KM fiber optic cable to be installed. Find the power coupled to transmitter end.
Given: a) Ten sections of cable each of length 500 meters connected through splicing.
a) Attenuation of 1 dB / KM.
b) Connector loss = 1.3dB / connector
c) Receiver sensitivity = - 50dBm
d) System margin = 6dB.
e) Splice loss = 1 dB / splice

(4+4+2)

3A. Discuss degradation in optical fibers due to absorption and bending losses.

3B. With necessary sketches, explain different dispersion compensation methods.

3C. Explain application of optical fibres in optical computing. Discuss its advantages.

(4+4+2)

4A. With the help of schematic and energy level diagram, explain operation of EDFA. Find expression for maximum possible gain.

4B. With necessary diagrams / plots and equations, discuss effect of rise time in digital encoding schemes (RZ and NRZ) used in optical communication system.

4C. EDFA in C band is being pumped at 980 nm with a 30mw pump power. If gain = 20 dB, calculate
   a) Maximum input power in watts
   b) Maximum output power in watts.

(4+4+2)

5A. Describe TDM ,WDM and DWDM techniques used in optical fiber communication

5B. Explain Pockel's effect with regard to wave propagation in an optical communication media.

5C. With block diagram of OTDR, derive an equation for backscattered power detected by the photodetector.

(4+4+2)