Ex : M.SC./P/II/306/20/2018

MASTER OF SCIENCE EXAMINATION, 2018

(2nd Year, 1st Semester)

PHYSICS

Electronics - II

Ppaer : PHY/TE/306

Time : 2 hrs

Full Marks : 40

Answer any ***four*** questions.

1. a) What are the advantages to use optical fiber over metallic cable in communication?

   b) Estimate the numerical aperture of a step index optical fiber having $n_1 = 1{\cdot}50$ and $n_2 = 1.48$. What is the maximum entrance angle of this fiber if the outer medium is air with $n_1 = 1$?

   c) A 6 km optical link consists of multi mode step index fiber with a core refractive index of 1.5 and a relative refractive index difference of 1%. Estimate the delay between the slowest and fastest mode at fiber output. 3+3+4

2. Discuss the different modes propagating in an optical fibre. Estimate the variation of intensity within the core for at least 3 different modes. 5+5

3. a) What do you mean by Pockel's effect?

   b) Describe the variation of incident intensity of light when it passes through an electro optic crystal across which an external voltage is applied.

   c) What is the half wave voltage? 2+6+2

4. a) What are characteristic impedance and propagation constant for a transmission line. Determine their expressions in terms of primary constants of the line.

   b) Calculate the attenuation constant and phase constant of transmission line from if G=0 and R is very small.

   c) Compute characteristic impedance and propagation constant of a transmission line with following specific values.

   R=2 nΩ/m L= 0.1 nH/m G=4.0 m mho/m C=.28 pF/m and operating frequency 2 GHz. 4+3+3

5. a) From the relation of reflection coefficient and load impedance show that constant resistance and constant reactance curves are family of circles on complex reflection coefficient plane.

b) What is VSWR? How it is measured and represented on reflection coefficient plane.

7+3

6. a) Show that in a loss less metallic waveguide

$$\beta_g^2 = \omega^2\mu\varepsilon - k_c^2$$

with usual meaning of the symbols and explain that it behaves like a high pass filter

b) Write down the solution of H_z and E_z for TE and TM mode respectively for a rectangular waveguide and explain about different possible modes for signal propagation.

c) An air filled rectangular waveguide has inside dimension 2.6cm x 1.3cm. Find the range of frequencies for which single mode transmission is possible. How many modes can be excited for a signal frequency 13GHz.

4+3+3