

**2011**

**M.Sc.**

**1st Semester Examination**

**ELECTRONICS**

**PAPER—ELC-102**

*Full Marks : 50*

*Time : 2 hours*

*The figures in the right-hand margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

*Illustrate the answers wherever necessary.*

**(Electromagnetic Fields and Plasma Electronics)**

Answer Q. No. 1 and any three questions from the rest.

1. Answer all questions : 2×5
- a) Define V.S.W.R. Give the relation between V.S.W.R. and reflection coefficient.
- b) 'A reflector antenna is called a secondary antenna'. Why?

*(Turn Over)*

- c) What do you mean by cut-off wave length in rectangular wave guide ?
- d) Explain the function of microwave grating.
- e) What is Debye screening distance ?

2. a) Derive an expression for voltage and current in terms of sending and receiving-end variables for a loss-less transmission line of finite length.

b) Find also the expression for input impedance of the line.

c) A 25m long loss-less transmission line is terminated with a load having an equivalent impedance  $40 + 30j$  at 10 MHz. The inductance and capacitance of this line are 310 nH/m and 38 pF/m respectively. Calculate the input impedance at the sending-end and mid-point of the line. 5+2

3. a) Why waveguides are preferred for transmission of microwaves instead of transmission lines ?

b) Mention the factors on which the maximum power handling capacity of a waveguide depends.

c) An air-filled waveguide has dimensions of  $a = 6$  and  $b = 4$  cm. The signal frequency is 3 GHz. Find (i) possible modes, (ii) cut-off frequency and (iii) guide wavelength. 2+2+(2+2)

4. a) To what does the word 'retarded' in the terminology 'retarded magnetic vector potential' refer? Explain.
- b) Why microwave region is called a transition region? Deduce an expression for field distribution across the aperture of a parabolic reflector. (1+2)+(2+5)

5. a) Deduce the expression for the range of line of sight communication of space wave propagation if the transmitter and receiver heights are  $h_t$  and  $h_r$  respectively.

- b) A radio link is set up between two points on the surface of the earth separated by a distance of  $1.2 \times 10^3$  km. Single-hop transmission of the radio wave reflected from the E-layer is used. The height and the electron concentration of the reflecting layer are 110 km and  $1.5 \times 10^5 \text{ cm}^{-3}$  respectively.

Calculate the angle with the horizontal at which the ray is launched at the transmitting point and the frequency of the wave. The radius of the earth is  $6.4 \times 10^3$  km.

$$5+(2\frac{1}{2}+2\frac{1}{2})$$

6. a) Explain quasi-neutrality of plasma. How is maintained ?
- b) Describe with a diagram one of the laboratory methods used for producing plasma.
- c) What is the meaning of cut-off frequency of a plasma  
(2+2)+4

**Internal Assessment — 10**

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