2014

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 propagation constant, attenuation constant and phase constant. Write an equation relating them.

(b) Why TEM mode of propagation is not possible in a rectangular waveguide ?

(c) An airfilled rectangular waveguide has dimensions of a = 6 cm, b = 4 cm. The signal frequency is 3 GHz. Find the cut off frequency for TE_{11} mode.

(d) A dipole antenna has a length of $\frac{\lambda}{8}$ m. What is its radiation resistance ?

(e) What is Scant law ? Find the maximum usable frequency for the earth surface.

2. (a) Derive an expression for the line impedance at any point of a transmission line in terms of load impedance and characteristic impedance.

(b) Show that this value is periodic is i.e. it repeats avery $\frac{\lambda}{g/2}$.

(c) What is the minimum impedance that can exist at any point of the line when the load end is open circuited ? Explain. 5+3+2

3. Find an expression for the electric field at far field due to two dimensional array and explain how field patterns are dependent on interelement spacing, phase difference and relative current distribution. Consider each array element is isotropic. 4+2+2+2

4. (a) Deduce an expression for dielectric constant of the ionosphere.

(b) Explain critical frequency and skip distance.

(c) Why sky wave and surface wave communications are complementary to each other? 5+3+2

5. (a) What is Poynting vector? Starting from Poynting theorem derive expression for the power transmitted through the cross section of a rectangular wave guide. 5

(b) A rectangular air-filled waveguide of dimension 2.25 cm × 1.0 cm us carrying e-m waves of frequency 10 GHz by TE_{10} mode. If breakdown electric field for air is 30 kv/cm, calculate the maximum average power that can be carried by the guide. 5

6. (a) A copper made rectangular cavity resonator is operated at the dominant mode TE_{101}. If dimension of the resonator is a = 5 cm, b = 2.5 cm and d = 15 cm and the surface conducting of copper is 5.76×10^7 s/m, then calculate :

(i) resonant frequency for airfilled cavity ;

(ii) quality factor ;

(iii) resonant frequency ;

when the cavity is filled with a material of dielectric constant 2.56. 5

(b) A dipole antenna of length 50 cm is situated in free space. The antenna is fed by a signal of frequency 10 MHz with maximum current 25A. Calculate :

(i) the electric and magnetic fields in the far zone ;

(ii) the average power density ;

(iii) the radiation resistance. 5

Internal Assessment — 10 Marks

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