PG/IS/ELC-102/13

M.Sc. 1st Semester Examination, 2013

ELECTRONICS

(*Electromagnetic Fields and Plasma Electronics*)

PAPER—ELC-102

(Theory)

Full Marks : 50

Time : 2 hours

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

The figures in the right-hand margin indicate marks

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

1. Answer *all* questions : 2 × 5

(*a*) What is distortionless transmission line ?

(*b*) What is duct propagation in relation with radio wave propagation ?

(*c*) What is a quarter wave plate ? Why it is called an impedance inverter ?

(*d*) A transmission line of characteristic impedance 50 Ω is terminated by a $(100 + j\,100)\ \Omega$ impedance. What is the normalized load impedance ?

(*e*) Compare the radiation pattern of an isotropic antenna with a $\lambda/2$ dipole antenna.

2. (*a*) A load impedance of $40 + j\,70\ \Omega$ terminator a 100 Ω transmission line that is $0{\cdot}3\ \lambda$ long. Find the reflection co-efficient at the load and at the input to the line, the input impedance, the SWR on the line and the return loss with the help of Smith chart.

(*b*) What is single stub matching ? Explain it with the help of admittance diagram. 6 + (1 + 3)

3. (*a*) Find expressions for the characteristic impedance and propagation constant of a transmission line in terms of other line parameters.

(*b*) A transmission line has the following parameters, $R = 2\ \Omega/m$, $L = 8$ nH/m $G = 0{\cdot}5$ m mho/m $C = 2$ pF/m and the operating frequency is 1 GHz. Find characteristic impedance and propagation constant of the line. (3 + 3) + 4

4. (*a*) Define directivity, radiations resistance and effective aperture of an antenna.

(*b*) Find an expression for the effective aperture of an antenna.

(*c*) A transmitting station of 25 kW power is radiating in free space. Find the field strength 30 km away. 3 + 5 + 2

5. (*a*) What are different layers of ionosphere ?

(*b*) Explain terms

(*i*) Virtual height

(*ii*) Skip distance

(*iii*) Maximum usable frequency in terms of ionosphere propagation.

(*c*) Derive an expression of plasma frequency in terms of maximum ionisation density. 3 + 3 + 4

6. (*a*) Find electric and magnetic field (H_ϕ, E_r, E_θ) components which is radiated from a small current element (Hertz dipole).

(*b*) Explain terms involving $\frac{1}{r}, \frac{1}{r^2}$ and $\frac{1}{r^3}$ therein.

(*c*) Predict the radiation pattern of the dipole in θ and ϕ plane. 5 + 3 + 2

[*Internal Assessment* : 10 Marks]