PG/IIIS/ELC-301/18

M.Sc. 3rd Semester Examination, 2018

ELECTRONICS

(*Advance Electromagnetic Theory and Radiating Systems*)

PAPER – ELC-301

Full Marks : 50

Time : 2 hours

Answer **Q. No. 1** and any **three** questions 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

Illustrate the answers wherever necessary

1. Answer any *five* questions : 2 × 5

(*a*) Why a waveguide behaves like a high pass filter ?

(*b*) A transmission line is terminated with matched load. Find its VSWR and RL in dB.

(*c*) What are lumped parameters and distributed parameters ?

(*d*) Two lossless cables of characteristic impedance 50 Ω and 80 Ω are to be joined for reflection less transmission. Find suitable matching transformer.

(*e*) Draw the equivalent circuit of two parallel wire transmission line and show its different primary constants.

(*f*) A 50 Ω loss less transmission line has the velocity of voltage wave 2×10^8 m/sec. Find the length of the line to use it as series resonant circuit at 1 GHz when

(*i*) line is open circuited

(*ii*) line is short circuited.

2. (*a*) Find an expression for the input impedance of a two parallel wire loss less transmission line of chact impedance z_0 and terminated by an impedance z_L.

(*b*) Show that :

(*i*) the input impedance repeats at every $\lambda/2$ distance.

(*ii*) normalised impedance inverts at $\lambda/4$.

(*iii*) the impedance at any point is equal to chact impedance when it is terminated with the chact impedance. 4 + 2 + 2 + 2

3. (*a*) Find expressions for propagation const, cut-off frequency and phase velocity of propagation inside a rectangular waveguide for TM mode of propagation.

(*b*) What are dominant mode and degenerate mode of propagation ?

(*c*) What are the dominant modes for TE and TM mode of propagation inside a rectangular waveguide ? 6 + 2 + 2

4. (*a*) Find total power radiated by Hertz-dipole, given avg power radiated by the dipole is

$$\text{pav} = \frac{1}{2}\left(\frac{i_0 dl \sin\theta}{4\pi r}\right)\frac{\beta^3}{w\epsilon}\hat{r}.$$

(*b*) Find the radiation resistance of Hertz dipole.

(*c*) Define :

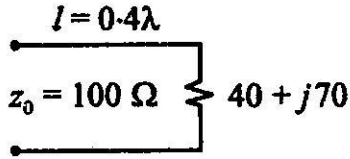
(*i*) Half power beam width

(*ii*) Side lobe level

(*iii*) Directivity

(*iv*) Antenna gain. 4 + 2 + 4

5. A 100 Ω transmission line is terminated by load impedance of $40 + j70$ as shown in figure below :



The line is 0·4 λ long. Use the Smith chart to find the following :

(*i*) Input impedance of the line

(*ii*) Load admittance

(*iii*) The SWR on the line

(*iv*) Reflection co-efficient at load

(*v*) RL in dB

(*vi*) Position of first voltage maxima and minima.

$1 + 1 + (4 \times 2)$

6. (*a*) Find expressions for attenuation const (α) propagation const (β) and phase velocity (v_p) for propagation of wave inside good dielectric and good conductor.

(*b*) What is dissipation factor ? $8 + 2$

[*Internal Assessment* : 10 Marks]