M.Sc. 3rd Semester Examination, 2022

ELECTRONICS

(Electromagnetic Theory and Radiating Systems)

PAPER — ELC-301

Full Marks : 50

Time : 2 hours

Answer any **four** questions each from Group-A and Group-B and **two** questions from Group-C

The figures in the right hand margin indicate marks

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

GROUP — A

Answer any **four** questions :　　　　2×4

1. Define primary and secondary constants of a transmission line.　　　　$1 + 1$

2. Differentiate between a good conductor and a good dielectric. 2

3. What is the lowest mode of propagation in guided wave structure ? 2

4. Define poynting vector. 2

5. Why TEM mode of propagation is not possible in a waveguide ? 2

6. What do you mean by skip distance and maximum usable frequency in terms of ionospheric propagation ? 1 + 1

GROUP – B

Answer any **four** questions : 4 × 4

7. What are electrostatic field, induction field and radiation fields of Hertz-dipole radiation ? 1 + 1 + 2

8. An air filled wave guide carries the TM_2 mode. The height of the waveguide is 20 cm. If the phase

velocity of the mode is 1.5c, find the frequency and the guide wavelength of the mode.   2 + 2

9. Find an expression for the loss tangent of a mediaum.   4

10. Find expressions for propagation constant and cut-off frequency of propagation inside a rectangular waveguide for TM mode of propagation.   2 + 2

11. Deduce expressions for the complex dielectric constant of ionosphere.   4

12. Find the condition for which a transmission line becomes distortion less.   4

GROUP – C

Answer any **two** questions :   8 × 2

13. Deduce telegrapher's equation for the two -parallel wire transmission line.   8

14. A 100 Ω transmission line of 0.4 λ long is terminated with a load impedance $Z_L = 80 + 40j$. With the help of Smith chart find the following parameters

    (a) VSWR and return loss.

    (b) Location of minimum and maximum impedances from the load.

    (c) What is the value of input impedance at a distance 0.2 λ from the load?   3 + 3 + 2

15. (a) What are the different layers of ionosphere?

    (b) Derive an expression for plasma frequency in terms of maximum ionisation density.

                                                    3 + 5

16. Define VSWR. What is the value of VSWR of either short-circuited or open circuited transmission line? An uniform plain wave propagating

through a free space. Show that $\vec{E}$ and $\vec{H}$ field components satisfy the relation :

$$\frac{E}{H} = \sqrt{\frac{\mu}{\in}}$$

Also find the orientation between $\vec{E}$ and $\vec{H}$.

$$2 + 2 + 3 + 1$$

[*Internal Assessment* — 10 Marks]

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