PG/IVS/ELC/403A/25

M.Sc. 4th Semester Examination, 2025

ELECTRONICS

(RF amd Microwave System)

PAPER – ELC-403A

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. The S, matrix of a network is given by

$$[S] = \begin{bmatrix} 0.3 & 0.4\angle 30 \\ 0.4\angle -30 & 0 \end{bmatrix}$$

Determine whether the network is matched, reciprocal and lossless ?

2. Design a 50Ω branch line coupler at frequency 2.4 GHz.

3. Write the frequency range represented by C band and W band.

4. Determine the Q-factor of an air filled square resonator having dimension 2cm.

5. Name the device that is used to protect a microwave source from the entry of the reflected wave.

6. What is the mode jumping of magnetron and how it can be overcome ?

GROUP–B

Answer any four questions : 4 × 4

(*Continued*)

7. A lossless T junction has impedance 50Ω. Find the output characteristic impedance so that the energy divides in 2 : 1 ratio. 4

8. A continuous wave rader operating at a frequency of 150 MHz is used to detect a moving target whose relative velocity is 5 m/s. Determine the doppler frequency. 4

9. How velocity modulation is achieved and what is it's importance ? 4

10. Derive Radar range equation. 4

11. How diode with negative resistance can be used as a switch ? 4

12. Show that path loss is inversely proportional to wavelength. Calculate is path loss of Geo-stationary satellite in X-band of operation. 4

GROUP—C

Answer any **two** questions : 8×2

13. Describe how negative resistance is obtained in Zener diode ? Draw the equivalent circuit and find its input impedance. $3 + 2 + 3$

14. Show that a three port network cannot be designed holding properties matched, reciprocal and lossless simultaneously. Hence derive the normalized S-parameter for right hand circulator and left hand circulator. $4 + 4$

15. A 4 port microwave network has the following properties : 8

- It show no reflections when all the ports are matched.
- When some power is applied at port 1, 40% of the input power comes out at port 2 and 40% comes out at port 3.

Also, the signals in port 2 and port 3 are in phase.

- When power is applied at port 4, 40% of the input power goes to port 2 and the signal in port 3 is 180 degrees out of phase with that in port 2.
- The network is symmetrical

Determine the scattering matrix of the network.

16. A radar is operating at 4 GHz and radiates 12kW peak power. Determine the physical area of the radar antenna if the target of $10m^2$ RCS located at 50km away from the radar intercepts 10 mW power. The antenna has an aperture efficiency of 80%. 8

[Internal Assessment — 10 Marks]