B.Tech 8th Semester [illegible]

MICROWAVE ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* of the following : 2×7=14

(a) Write the limitations of conventional tubes at UHF and microwave frequencies.

(b) List different methods of impedance measurement at microwave frequency.

(c) What are the problems associated to conventional tubes at microwave frequencies?

(d) What is *S*-matrix? What are the properties of *S*-matrix?

(e) Define the following terms :

(i) VSWR

(ii) Characteristic impedance

(f) Explain the terms electromagnetic interference and electromagnetic compatibility.

(g) What is the importance of impedance matching?

(h) Why are scattering parameters used for higher frequencies?

(i) Explain the advantages and applications of microwaves.

(j) Write a short note on two-cavity klystron.

2. Answer the following : 7+7=14

(a) Explain the coupling factor and directivity of the four-port directional coupler. Also derive the *S*-matrix for completely matched four-port directional coupler.

(b) Explain the basic principle of IMPATT and TRAPATT diodes.

3. Answer the following : 7+7=14

(a) What do you mean by E-plane Tee and H-plane Tee? Compare their propagation characteristics.

(b) What is attenuation? Name various types of attenuators. Discuss any one of them.

4. Answer the following : 7+7=14

(a) Discuss the condition for sustained oscillation in reflex klystron. How is frequency of oscillation varied in this device?

(b) How does amplification take place in TWT? What is the use of slow wave structure in TWT?

5. Answer the following : 7+7=14

(a) Explain the working of multicavity klystron with necessary diagram and waveforms.

(b) Discuss various methods for measuring low microwave power. Comment on the accuracy of the measurement in the particular method.

6. Answer the following : 7+7=14

(a) How can the microwave power be taped from the waveguide for coupling using directional coupler?

(b) With necessary equation, explain the working of a parametric amplifier.

7. Answer the following : 7+7=14

(a) Explain the operation of 'magic tee' with necessary equations and sketch. Mention its applications.

(b) Discuss volt-amp characteristics of 'tunnel diode' and explain how tunnel diode can be used as an oscillator.

8. Answer the following : 7+7=14

(a) Explain the operation of 'varactor diode'. Discuss its constructional details and mention its applications.

(b) Explain spectrum analyzer. Also explain how the spectrum of microwave frequency can be measured using spectrum analyzer.

9. Answer the following : 7×2=14

(a) Explain basic principle of 'RADAR' and derive the basic RADAR range equations.

(b) List out microwave antenna and explain any one in detail.

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