Total number of printed pages=4

53 (EC 601) MCWE

2019

MICROWAVE ENGINEERING

Paper : EC 601

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions :* 5×20=100

1. A 6 *GHz* electromagnetic wave propagates in a rectangular waveguide, the spacing between the vertical planes being 3*cm*. Determine the cut-off wavelength of the dominant mode, the guide wavelength of the dominant mode, the corresponding group as well as phase velocities and the characteristic wave impedance. Deduce the equations used. 20

Contd.

2. 10+7+3

(a) Derive the expression for the electric field inside a rectangular cavity ($a \times b \times l$) made of a rectangular waveguide with inner dimension ($a \times b$) in TE_{101} mode.

(b) Explain with neat sketches including field distributions of the mode TE_{101} in a rectangular cavity made of a rectangular waveguide carrying dominant mode and closed at two ends by shorting plates.

(c) Discuss how you can determine the 'Q' factor of the cavity.

3. 2+18

(a) What are the different properties of Scattering matrix parameters (S-parameter) ?

(b) Deriving the necessary equations, discuss each of them.

4. 8+4+8

(a) Describe the principle of an ideal two-hole directional coupler. Define 'Coupling' and 'Directivity' in the context of a directional coupler.

(b) Mention the principal shortcomings of such a directional coupler. Discuss how these shortcomings can be overcome.

(c) Explain the working principle of a precision type attenuator and derive its scattering matrix.

5. 7+6+7

(a) Explain the working principle of a reflex klystron oscillator.

(b) Explain what is meant by 'velocity modulation' and how this phenomenon is used in the operation of a klystron tube.

(c) Draw the power *vs* repeller voltage and frequency *vs* repeller voltage characteristics of a reflex klystron. Explain qualitatively.

6. 10+(2+8)

(a) With a neat sketch, explain the RF structure of a magnetron and explain how does the oscillation mechanism takes place in such structure.

(b) What is 'Hull cut-off' magnetic field and voltage in connection with magnetron oscillator ? Derive the expressions for 'Hull cut-off' magnetic field and voltage.

7. Write short notes on : ***(any four)*** 5×4=20

(a) Magic Tee

(b) Absorption type wavemeter

(c) Faraday Isolator

(d) Limitations of Conventional tube

(e) Circulators

(f) Attenuation in rectangular waveguide.