**Q.2** a. Draw the profile of SWR versus reflection coefficient. A transmission line has a characteristic impedance of 50 + j 0.01 Ω and is terminated in a load line impedance of 73-j42.5 Ω. Calculate: (i) The reflection coefficient (ii) the standing wave ratio. **(8)**

**Answer: Refer Figure 3.3.4, Example 3.3.1, Page 75 of Text Book - I**

b. Enlists the significant features of the normalized impedance for a lossless line. **(8)**

**Answer: Refer Article – Normalized Impedance, Page 80 of Text Book - I**

**Q.3** a. For a rectangular waveguide, show that the propagation modes depend on its physical dimensions **(10)**

**Answer: Refer Equation 4.1.54, Pages 107-109 of Text Book - I**

b. An air-filled circular wave guide has a radius of 2 cm and is to carry energy at a frequency of 10 GHz. Find all the $TE_{np}$ and $TM_{np}$ modes for which energy transmission is possible. **(6)**

**Answer: Refer Example 4.2.2, Page 129 of Text Book - I**

**Q.4** a. Derive and explain the significance of S Matrix of a Directional Coupler. **(8)**

**Answer: Refer Article 4.5.2, Pages 151-152 of Text Book - I**

b. Draw the structure of Hybrid Ring. Obtain its S-matrix. Why is it also called Rat-Race circuit? **(8)**

**Answer: Refer Pages 135-136 of Text Book - I**

**Q.5** a. Describe in detail the principles of the following terms: Gunn Effect, Two valley model theory and High Field Domain theory. **(10)**

**Answer: Refer Articles 7.1.2, 7.2.2, 7.2.3 Pages 271, 272, 274, 275, 276 of Text Book - I**

b. An n-type GaAs Gunn diode has the following parameters: **(6)**

$v_d = 2.5 \times 10^5$ m/s

$|\mu_n| = 0.015$ $m^2$/V.s

$\varepsilon_r = 13.1$

Determine the criterion for classifying the modes of operation.

**Answer: Refer Example 7.3.1, Pages 286-287 of Text Book - I**

**Q.6** a. Derive an expression for beam-coupling coefficient of the input cavity gap in Klystron and also draw the profile of beam coupling coefficient versus gap transit angle. **(10)**

**Answer: Refer Figure 9.2.7, Equation 9.2.16, Pages 345-347 of Text Book-I**

b. Explain the Amplification process in helix type travelling-wave tube. **(6)**

**Answer: Refer Article 9.5.2, Pages 388-389 of Text Book - I**

**Q.7** a. Show that the Hartree anode voltage equation is a function of the magnetic flux density and the spacing between the cathode and anode. **(10)**

**Answer: Refer Equation 10.1.54, Pages 439-441 of Text Book - I**

b. An Amplitron has the following operating parameters: **(4)**
$V_0$=15 kV, $I_0$ = 3A, $B_0$ = 0.2 Wb/$m^2$
f = 8 GHz, $Z_0$ = 50 Ω.
Determine: The dc electron-beam velocity, the electron beam phase constant, the cyclotron angular frequency, the cyclotron phase constant and the gain parameter.

**Answer: Refer Example 10.3.1, Pages 460-461 of Text Book - I**

**Q.8** a. Describe the following characteristics of Microstrip Lines - **(10)**
(i) Effective Dielectric Constant.
(ii) Impedance Equation
(iii) Microstrip Lines – Dielectric Losses
(iv) Microstrip Lines – Ohmic Losses

**Answer: Refer Pages 474, 475, 478-481 of Text Book - I**

b. Describe Attenuation Losses taking place in parallel strip lines. **(6)**

**Answer: Refer Article 11.2.3, Page 487 of Text Book - I**

**Q.9** a. List the basic characteristics required for an ideal substrate material. **(8)**

**Answer: Refer Article 12.1.1, Page 498 of Text Book - I**

b. Explain the Etching and photoresist MMIC fabrication technique. **(8)**

**Answer: Refer Article 12.2.1, Pages 503, 504 of Text Book - I**

## TEXT BOOK

I. Microwave Devices and Circuits, Samuel Y. Liao, 3rd Edition, Prentice-Hall of India, New Delhi, 2006