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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester, B.E. – Electronics and Communication Engineering

Semester End Examination; June - 2016

Microwave Devices and Integrated Circuits

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each Unit.*
ii) Assume missing data suitably.

UNIT - I

1 a. Define the term reflection coefficient and transmission coefficient for a transmission line and derive equation $T^2 = \frac{Z_l}{Z_o}\left(1-\tau_l^2\right)$. 8

b. Define standing waves. Obtain the equation for maximum and minimum amplitude and phase of standing wave. Sketch the pattern of standing wave in lossy and lossless line. 8

c. A transmission line has the following parameters :

R = 2 Ω/m, G = 0.5 m mho/m, f = 1 GHz, L = 8 nH/m, C = 0.23 pF. 4

Calculate : i) Characteristic impedance ii) Propagation constant.

2 a. Derive equation for line impedance at any point on the line from the receiving end in terms of Z_l and Z_0. 6

b. What are the applications of smith chart? Explain briefly. 6

c. A lossless line of characteristic impedance $R_0 = 50\ \Omega$ is to be matched to a load :

$Z_l = 50/[2 + j(2 + \sqrt{3})]\ \Omega$ by means of a lossless short-circuited stud. The characteristic impedance of the stub is 100 Ω. Find the stub position and length so that a match is obtained. 8

UNIT - II

3 a. Derive the relevant equations for the propagation of TE waves in a rectangular waveguide and explain how the dominant mode is obtained. 12

b. Explain Faraday rotation isolator with a neat sketch. 8

4 a. Derive an expression for output power and output current of two-cavity klystron. 8

b. List the differences between travelling wave tube and klystron. 4

c. A reflex klystron-operates under the following conditions :

$V_0 = 600\,V, \quad L = 1\,mm, \quad R_{sh} = 15\,k\Omega, \quad \frac{e}{m} = 1.759x10^{11}, \quad f_r = 9\,GHz$

The tube is oscillating at f, at the peak of the n = 2 mode or 1¾ mode. Assume that the transit time through the gap and beam loading can be neglected. 8

Contd….2

i) Find the value of the repeller voltage.

ii) Find the direct current to give a microwave gap voltage of 200 V.

iii) What is the electronic efficiency under this condition?

UNIT - III

5	a.	What are the different properties of scattering parameters? Explain briefly.	8
	b.	With necessary conditions write the scattering matrix representation of multiport network.	7
	c.	Explain the salient features of co-axial connectors and adaptors, with diagrams.	5
6	a.	Explain with neat diagram the working principle of non-reciprocal phase shifter.	6
	b.	Explain the characteristics of magic tee passive device, with a schematic diagram. Also obtain the S matrix representation of the magic-tee.	8
	c.	With neat diagram of a microwave attenuator explain the operation of the same.	6

UNIT - IV

7	a.	Explain the principles of operation of the gunn diode with formation of Gunn domain. Also explain the modes of operation of the Gunn diode with Gunn-oscillation mode.	10
	b.	Explain the construction and working of PIN diode and IMPATT diode.	10
8	a.	Explain the operation of the Schottky-barrier diode with its structure. Also explain the fabrication technique with sputtering of aluminium on silicon wafers. Draw the characteristics of Schotty-barrier diode and write its symbol.	10
	b.	Write a note on : i) TRAPATT diode ii) READ diode.	10

UNIT - V

9	a.	Explain the construction, field pattern and losses in micro strip line.	8
	b.	With neat diagram, explain the operation of parallel strip line and write the expressions for distributed parameters of parallel strip lines, characteristic impedance and attenuation of the same.	8
	c.	Define the different losses taking place in micro strip line.	4
10	a.	Briefly explain MIC fabrication techniques.	10
	b.	Explain the accomplishment of circuit definition by means of, (i) Plate through technique (ii) Etch-back technique	10

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