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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

Make-up Examination; July - 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) Use of Smith chart is provided.

UNIT - I

1 a. Derive equation for amplitude and phase of standing wave pattern, sketch and explain the standing wave pattern with related equation. 8

b. In certain lossless microwave transmission line the maximum and minimum impedances were found to be 1333.2 Ω and 120 Ω respectively. If line is terminated in a pure resistance, calculate the reflection coefficient and load resistance. 7

c. A microwave transmission line has a characteristic impedance of $100\angle -53.13^{\circ}\ \Omega$. When it is terminated in unknown load impedance the transmission coefficient is $1.09\angle 35.34^{\circ}$. Find; 5

(i) The reflection coefficient (ii) The terminating load impedance.

2 a. Derive an equation for Line impedance in terms of exponential and hyperbolic function at any point from, (i) Receiver end (ii) Sending end. 8

b. A transmission line 2.413 wave length long is terminated in an impedance of 150+j60 Ω. The line has characteristic impedance of 75 Ω. Find the input impedance. 4

c. A transmission line with characteristic impedance of 400 Ω is connected to a load of 200+j300 Ω operating at 800 MHz. Find the location and length of a single stub nearest to the load to produce an impedance match. 8

UNIT - II

3 a. Dominant mode is propagated through a rectangular wave guide of breadth 10 cm at frequency of 2.5 GHz. Compute; 8

(i) Cut-off wavelength (ii) Phase velocity

(iii) Guide wave length (iv) Wave Impedance and phase constant.

b. Explain the operation of Faraday rotation isolator with neat diagram. 7

c. Discuss the working principle of Directional coupler and define its term, 5

(i) Coupling factor

(ii) Directivity.

4 a. Draw neat schematic diagram and describe the amplification process of helix travelling wave tube. 10

Contd….2

b. A two Cavity Klystron has the following parameters, Beam voltage 20 kV, I_0 = 2 A, f = 8 GHz, $\beta_i = \beta_0 = 1$, $\rho_0 = 10^{-6} C/m^3$, V_1 = 10 V, R_{sh} = 10 kΩ, R = 30 kΩ. Compute; 10

(i) Plasma frequency

(ii) Reduced plasma frequency for R = 0.5

(iii) Induced current and voltage in the output cavity

(iv) Output power delivered to load

(v) Power gain.

UNIT - III

5 a. Develop relationship between [S] and [ABCD] parameters for two-port network shown in Fig. Q5(a). 7

b. Obtain the ABCD matrix for the network shown in Fig. Q5(b). 3

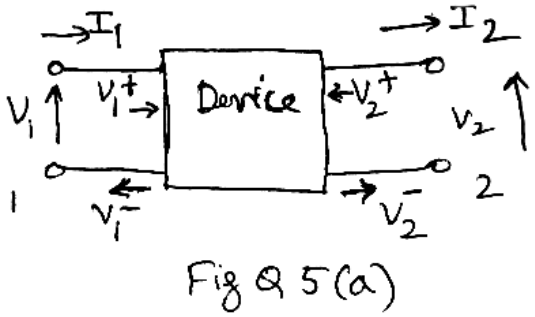

Fig Q 5(a)

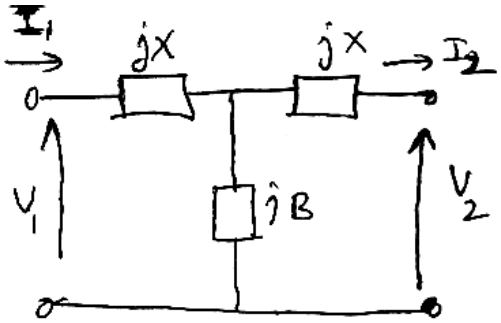

Fig Q 5(b)

c. Discuss the properties of S-parameters for junction of ports having common characteristic impedance. 10

6 a. With a neat diagram discuss the structure of three basic types of co-axial cables. 6

b. Write the function of attenuators in microwave circuits. Explain with figure following types of attenuators : 8

(i) Co-axial line fixed attenuator (ii) Waveguide attenuator.

c. Explain the application of magic-T as balanced mixer. 6

UNIT - IV

7 a. Explain the physical description of READ diode with field distribution and doping profile. 7

b. Explain the concept of RWH theory with relevant figures. 6

c. Discuss with diagram following type of domain modes for the Gunn oscillation mode; 7

(i) Transit-time domain mode (ii) Quenched domain mode.

8 a. Describe the physical structure and principle of operation of BARITT diodes. 8

b. List the differences between tunnel diode and normal p-n junction diode. 6

c. Draw the equivalent circuit of parametric up converter and explain its working. 6

Contd….3

UNIT - V

9 a. Discuss with related equations different types losses in micro-strip line. 8

b. Explain the structure of co-planar strip line with neat schematic diagram. Calculate the characteristic impedance of a coplanar strip line with average power of 200 mW with a peak current of 80 mA. 6

c. A lossless parallel strip line has copper conducting strips each of width 18 mm separated by dielectric of dielectric constant 3.8 having thickness of 2.5 mm. The conductivity of copper is 5.8×10^{7} ℧ /m and that of dielectric is 2×10^{-4} ℧/m. The frequency of operation is 12 GHz. Compute; 6

(i) Characteristic impedance and phase velocity

(ii) Strip line Inductance and capacitance

(iii) Series resistance for both strips

(iv) Shunt conductance of dielectric.

10 a. Explain the accomplishment of circuit definition for MIC using plate through and Etch-back technique. 10

b. Distinguish between Hybrid MIC and MMIC. Discuss their relative advantages and disadvantages. 6

c. Write the steps for the fabrication of sandwich capacitor. 4

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