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06EC54

Fifth Semester B.E. Degree Examination, May/June 2010
Microwaves and Radar

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Derive an expression for reflection coefficient and transmission coefficient in the transmission line. **(08 Marks)**

b. What are the applications of Smith chart? Explain briefly. **(06 Marks)**

c. A transmission line having a length of 25 KM is terminated in its characteristic impedance. At a specified frequency, the voltage at a distance of 1 KM from the line is 10% below that of the sending end voltage. Compute the value of the load-end voltage, if the sending end voltage is 40 V. **(06 Marks)**

2 a. With a schematic diagram, explain the directional coupler. Derive an expression and give scattering matrix representation of the directional coupler. **(08 Marks)**

b. With a neat diagram, explain the operation of ferrite rotation isolator. **(06 Marks)**

c. A rectangular – waveguide cavity filled with a dielectric of constant $\in_r = 4$ has a breadth of 4 cm and height of 2 cm. Find the length of the cavity to procedure resonance at 4 GHz. Assume $TE_{|0|}$ mode. **(06 Marks)**

3 a. Explain the principles of operation of the Gunn diode with formation of Gunn domain. And also briefly, explain the modes of operation of the Gunn diode with Gunn-oscillation modes. **(08 Marks)**

b. 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. **(06 Marks)**

c. An Impatt diode operates at 150 V delivering 1A of current at 8% efficiency. Calculate the output power and duty cycle, if the device is operated in pulsed mode at 20 GHz with a pulse width of 0.5 ps. **(06 Marks)**

4 a. What are the different properties of Scattering parameters? Explain briefly. **(08 Marks)**

b. With necessary conditions write the Scattering matrix representation of multiport network generally. **(07 Marks)**

c. Express S – parameters in terms of impedance when two transmission lines are joined with characteristic impedances Z_1 and Z_2. **(05 Marks)**

PART – B

5 a. Explain the salient features of co-axial connectors and adaptors, with diagrams. **(06 Marks)**

b. Explain the characteristics of magic tee passive device, with a schematic diagram. Also obtain the S matrix representation of the magic-tee. **(08 Marks)**

c. With neat diagram of a microwave attenuator, explain the operation of the same. **(06 Marks)**

6 a. Explain the operation of microstriplines with its structure and Quasi TEM mode field distribution. **(07 Marks)**

b. With neat diagram, explain the operation of parallel strip line. And also write the expressions for distributed parameters of parallel strip line, characteristic impedance and attenuation of the same. **(07 Marks)**

c. A certain shielded stripline has W = 63.5 mm, t = 35 mm and d = 180 mm. It has a permittivity of 2.56. Compute its characteristic impedance, K factor and fringe capacitance. **(06 Marks)**

7 a. Derive an expression for the basic form of radar – range equation and hence explain the factors influencing the maximum range of radar. **(08 Marks)**

b. Calculate the maximum range of radar which operates at a frequency of 10 GHz, peak pulse power of 600 kW, if the antenna effective area is $5m^2$ and the area of target is 20 m^2. Minimum receivable power is 10^{-13} watt. **(06 Marks)**

c. What are the applications of radar? Explain each application briefly. **(06 Marks)**

8 a. With block diagram approach, explain the operation of the moving – target indicator (MSI) radar. **(07 Marks)**

b. Explain the basic principles of continuous – wave Doppler radar with block-diagram approach. Also mention the advantages and disadvantages of CW Doppler radar. What are the applications of CW Doppler radar? **(07 Marks)**

c. A moving target indicator radar uses a PRF (pulse repitation frequency) of 1000 Hz at 4 GHz. Compute the lowest blind speed of the radar. Also calculate the second and third lowest blind speeds of the radar. **(06 Marks)**

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