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Fifth Semester B.E. Degree Examination, June/July 2013

Microwaves and Radar

Time: 3 hrs.

Max. Marks:100

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

PART – A

- 1
 - a. Derive equation for voltage and current at any point on a transmission line. (10 Marks)
 - b. A telephone line has $R = 6$ ohms/km, $L = 2.2$ mh/km, $C = 0.005$ μ F/km and $G = 0.05$ μ mho/km. Determine Z_o , α , β at 1 kHz. If the line length is 100 km, determine the attenuation and phase shift of the signal. Calculate the phase velocity of the signal. (06 Marks)
 - c. Define reflection co-efficient and derive relationship between SWR and reflection coefficient. (04 Marks)

- 2
 - a. Briefly explain the working of precision rotary phase shifter with the help of diagram and E field components. (07 Marks)
 - b. Derive electric and magnetic field equations in rectangular waveguides for TE_{mn} mode. (07 Marks)
 - c. An air filled rectangular waveguide of inside dimension $a = 7$ cm, $b = 3.5$ cm operates in the dominant TE_{10} mode.
 - i) Find the cut off frequency.
 - ii) Determine phase velocity of the wave in the guide at a frequency of 3.5 GHz.
 - iii) Determine the guide wavelength at the same frequency. (06 Marks)

- 3
 - a. With the help of drift velocity graph and current waveform, explain the constructional features and working of n-type GaAs diode. (08 Marks)
 - b. An IMPATT diode operates 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 the pulse width of 0.5 Ps. (08 Marks)
 - c. Define reflection loss and attenuation loss in transmission lines. (04 Marks)

- 4
 - a. Starting from the impedance matrix equation, prove the symmetry property of a reciprocal network. (08 Marks)
 - b. Two transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane PP^1 express 'S' parameters in terms of impedances. (Assume the circuit diagram) (08 Marks)
 - c. Explain S matrix representation of 'n' port network. (04 Marks)

PART – B

- 5
 - a. Explain the characteristics of magic tee with diagram. Also obtain the 'S' matrix representation of the magic tee. (08 Marks)
 - b. With schematic diagram, explain Bethe Hole directional coupler. (08 Marks)
 - c. Define coupling factor and directivity of directional coupler. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 6 a. Explain the construction and field pattern for microstripline. (08 Marks)
b. With necessary equations, explain radiation loss and dielectric loss. (06 Marks)
c. A shielded strip line has the following parameters dielectric constant of the insulator $E_r = 2.56$, strip width, $W = 25$ mils, strip thickness, $t = 14$ mils and shield depth, $d = 70$ mils. Calculate: i) The K factor
ii) The Fringe capacitance
iii) The characteristic impedance of the line. (06 Marks)
- 7 a. Derive an expression for the basic Radar equation. (08 Marks)
b. With a neat block diagram, explain the pulse Doppler Radar. (08 Marks)
c. Name important applications of Radar. (04 Marks)
- 8 a. With the help of neat block diagram, explain MTI Radar. (10 Marks)
b. Write explanatory notes on:
i) Moving Target Detector
ii) Delay line cancellers. (10 Marks)

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