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Fifth Semester B.E. Degree Examination, December 2010
Microwaves and Radar

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**
2. Smith chart must be provided.
3. Standard notations are used.
4. Draw neat diagrams, wherever necessary.
5. Missing data may be suitably assumed.

PART – A

- 1 a. Define reflection coefficient. Derive the equation for reflection coefficient at the load end and at a distance 'd' from load end, starting from equation for Zl . (10 Marks)
- b. A 300Ω lossless line is terminated in a load of $(600 + j300)\Omega$, operating at 600 MHz. Find SWR on the line. Design a single stub matching section, assuming main line and stub are of the same type (Use Smith chart). (10 Marks)
- 2 a. Briefly explain the following microwave devices :
 i) Hybrid ring
 ii) Two hole directional coupler. (10 Marks)
- b. Write field components of TE_{10} mode inside a rectangular waveguide. Using this, derive the equation for power transmitted through the guide for the dominant mode in Z-direction. (10 Marks)
- 3 a. With the help of drift velocity graph and current waveform, explain the constructional feature and working of n-type GaAs diode. (08 Marks)
- b. Write an explanatory note on read diode. (06 Marks)
- c. An up converter parametric amplifier has the following parameters : Ratio of o/p frequency to signal frequency is 25, figure of merit = 10, factor of merit figure = 0.4, diode temperature = 350 K, $T_0 = 300$ K. Find the power gain in dB, noise figure in dB and band width. (06 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 impedances Z_1 and Z_2 are jointed at plane PP' . Express S parameters in terms of impedances. (08 Marks)
- c. Write relationship of ABCD parameters with S parameters. (04 Marks)

PART – B

- 5 a. Briefly explain the working of a precision rotary phase shifter, with the help of diagram and E – field components. (09 Marks)
- b. A 20 MW power is fed into one collinear port 1 of a lossless H – plane tee junction. Calculate the power delivered through each port, when other ports are terminated in a matched load. (06 Marks)

- c. How the magic tee can be used as an E-H tuner? Explain. (05 Marks)
- 6 a. Briefly explain dielectric losses and radiation losses in microstrip lines. (10 Marks)
- b. Show that $Qd \cong \frac{1}{\tan \theta}$ for a microstrip line. (04 Marks)
- c. A lossless parallel strip line has a conducting strip width of W. The substrate separating the two conducting strips has a relative dielectric constant of 6 and thickness d of 4mm. Calculate :
- i) Required width W of conducting strip, in order to have a characteristic impedance of 50 Ω .
- ii) Strip line capacitance and inductance. (06 Marks)
- 7 a. Derive the simple radar range equation, starting from the power density of isotropic antenna. (08 Marks)
- b. With the help of a neat block diagram, explain the working of pulse radar. (08 Marks)
- c. Name some of the important applications of radar. (04 Marks)
- 8 a. With the help of a neat block diagram, explain power amplifier type MTI radar. (10 Marks)
- b. Write explanatory notes on :
- i) Blind speeds in MTI radar.
- ii) Pulse Doppler radar. (10 Marks)

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