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10TE64

Sixth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Microwaves and Radar

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART – A

- 1
 - a. Derive transmission – line equations by the methods of distributed circuit theory. (09 Marks)
 - b. Define reflection coefficient and derive an expression for reflection coefficient at load in terms of load impedance. (05 Marks)
 - c. A generator of 1 volt, 1 KHz supplies power to 100 km long line terminated Z_0 . The parameters of the line are $R = 10.4\Omega/\text{km}$, $L = 0.00367\text{H}/\text{km}$, $G = 0.8 \times 10^{-6}\text{S}/\text{km}$ and $C = 0.00835 \times 10^{-6}\text{F}/\text{km}$. Calculate Z_0 , attenuation constant and phase constant. (06 Marks)
- 2
 - a. Using the Helmholtz equation, derive the field equations for TE modes in rectangular waveguides. (10 Marks)
 - b. Briefly explain the following microwave devices :
 - i) Hybrid ring
 - ii) Tow hole directional coupler. (10 Marks)
- 3
 - a. A typical h-type GaAs Gunndiode has the following parameters: Threshold field = $E_{th} = 2800\text{v}/\text{cm}$, Applied field = $E = 3200\text{v}/\text{cm}$, Derive length = $L = 10\mu\text{m}$. Doping concentration = $n_0 = 2 \times 10^{14}\text{cm}^{-3}$, operating frequency = $f = 10\text{GHz}$.
 - i) Compute electron drift velocity
 - ii) Calculate the current density
 - iii) Estimate the negative electron mobility. (04 Marks)
 - b. Explain the principle of operation of read diode with suitable diagrams. (06 Marks)
 - c. Explain the parametric amplifier with equivalence circuit. (10 Marks)
- 4
 - a. For a two-port network, explain the 8-parameters and properties of s-parameters. (10 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. (10 Marks)

PART – B

- 5
 - a. With neat sketch, explain the operation of E – plane tee and also obtain its S – matrix. (10 Marks)
 - b. With neat sketch, explain the operation of magic tee and mention its application. (10 Marks)
- 6
 - a. Explain the construction and field pattern for micro strip line. (08 Marks)
 - b. Show that $Q_d \cong \frac{1}{\text{Tan}\theta}$ for a microstrip line. (04 Marks)
 - c. A Shilded strip line has the following parameters : Dielectric constant of insulator, $t_r = 2.56$; strip width $w = 63.5\text{mm}$; strip thoickness, $t = 35\text{mm}$; shield depth, $d = 180\text{mm}$; compute :
 - i) Characteristics impedance ii) K factor iii) Fringe capacitance. (08 Marks)

- 7 a. Define the following terms related to RADAR :
- i) Range to a RADAR
 - ii) Maximum unambiguous range. (04 Marks)
- b. Derive an expression for simple form of the maximum range of the radar. Comment on the radar range equation. (08 Marks)
- c. A 10 GHz radar has the following characteristics :
Peak transmitted power = $P_t = 250 \text{ kW}$; power gain of antenna = $G = 2500$; Minimum detectable peak signal power by the receiver = $S_{\min} = 10^{-14} \text{ W}$. Radar cross section of the target = 6 m^2 ; cross - sectional area of the radar antenna = $A_c = 10 \text{ m}^2$. Find the maximum range (R_{\max}) possible. (03 Marks)
- d. State and briefly explain applications of RADAR. (05 Marks)
- 8 a. Explain the principle and working of MTI radar, with the help of block diagram. (10 Marks)
- b. Write brief notes on :
- i) Blind speed
 - ii) Delay line canceller. (10 Marks)
