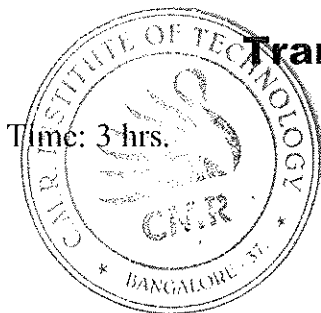


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Fifth Semester B.E. Degree Examination, June/July 2016



Time: 3 hrs.

Max. Marks: 100

Transmission Lines and Waveguides

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

PART – A

- 1
 - a. Derive the expression for general solution of a transmission line at any point along the line of any length with uniformly distributed constants. (12 Marks)
 - b. Derive equations for filter elements of a low pass constant K filter with symmetrical T-section. (08 Marks)

- 2
 - a. A generator of 1V, 1 kHz supplies power to a 100 km line terminated by Z_0 and has $R = 10.4 \Omega/\text{km}$, $L = 0.00367 \text{ H/km}$, $G = 0.8 \times 10^{-6} \text{ mho/km}$ and $C = 0.00835 \mu\text{F/km}$. Calculate Z_0 , attenuation constant α , phase constant β , wavelength λ , velocity v , received current, voltage and power. (06 Marks)
 - b. Explain the various distortions that occur when a wave propagates through transmission line. (04 Marks)
 - c. Derive the equation for voltage and current for a high frequency dissipationless line. Draw the voltage and current waveforms for open and short circuit conditions. (10 Marks)

- 3
 - a. Derive the relationship between standing wave ratio and reflection coefficient. (06 Marks)
 - b. Derive the equations for length and location of single stub matching device in terms of reflection coefficient. (10 Marks)
 - c. What is Smith chart? Discuss the applications and properties of Smith chart. (04 Marks)

- 4
 - a. Derive the equations for short circuit and open circuit impedances for quarter wave lines and half wave lines of small dissipation. (10 Marks)
 - b. A load of admittance $\frac{Y_R}{G_0} = 1.25 + j0.25$ is connected to the transmission line. Find the length and location of single stub tuner short circuited connected to line. (10 Marks)

PART – B

- 5
 - a. Explain S-matrix representation of multiport network. (04 Marks)
 - b. State and explain the properties of S-matrix. (06 Marks)
 - c. Two transmission lines of characteristic impedances Z_1 and Z_2 are joined at plane PP^1 . Express s-parameters in terms of impedances. (10 Marks)

- 6
 - a. Describe the properties and characteristics of wave guides. (06 Marks)
 - b. What are microwave cavities? Also show that cavity resonator has only one frequency of resonance for a given mode. (10 Marks)
 - c. Define the following terms with necessary equations:
 - i) Cutoff frequency of waveguide
 - ii) Cutoff wavelength of waveguide
 - iii) Group velocity
 - iv) Guide wavelength (04 Marks)

- 7 a. Starting from Maxwell's equation derive expression for various field components inside circular waveguide for TE_{mn} wave propagation. (10 Marks)
- b. A rectangular air filled copper waveguide has dimensions of $4\text{ cm} \times 2.2\text{ cm}$ and length 8 cm . It operates at 8 GHz with dominant TE_{10} mode. Determine:
- i) Cut off frequency
 - ii) Guide wavelength
 - iii) Phase velocity
 - iv) characteristic wave impedance
 - v) Total attenuation in dB.
- Assume $\sigma = 8.57 \times 10^7$ mho/m for copper. (10 Marks)
- 8 a. With neat sketches, explain working of Gunn diode and its modes of operation. (10 Marks)
- b. With relevant diagrams, explain IMPATT diode operation and mechanism of oscillation. (10 Marks)

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