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Question Paper Code : 91421

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Seventh Semester

Electronics and Communication Engineering

EC 2403/EC 73/10144 EC 703 — RF AND MICROWAVE ENGINEERING

(Regulation 2008/2010)

(Common to PTEC 2403 – RF and Microwave Engineering for B.E. (Part-Time) Sixth Semester Electronics and Communication Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Smith chart is to be provided.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the high frequency limitations of conventional tubes?

2. Given $[y]=\begin{bmatrix} 3.2 & 1 \\ 1 & 3.2 \end{bmatrix}$ find S parameters.

3. Define unilateral power gain.

4. State the significance of microstrip matching networks.

5. A 6dB attenuator is specified as having VSWR of 1.2. Assuming that the device is reciprocal, find the S parameters.

6. Mention the application of Gyrator and Isolator.

7. Write the necessary conditions for Gunn effect.

8. A Si Mw transistor has a maximum electric field intensity Em of $3\times10^5\ {}^{V}/_{Cm}$ and its carrier has a drift velocity of $4\times10^6\ {}^{Cm}/_{S}$. The emitter collector length is $4\mu m$. Find maximum possible transit time cut off frequency.

9. Compare two cavity klystron and traveling wave tube.

10. What is the significance of VSWR measurement?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss the importance of low frequency and high frequency parameters of RF two port networks. (6)

(ii) The two port devices represented by the following matrices are cascaded. Find the scattering matrix of the resulting device. Determine its properties (symmetry, reciprocity, losses and match).

(1) $\begin{bmatrix} 0.1 & 0.8 \\ 0.8 & 0.1 \end{bmatrix}$ (5)

(2) $\begin{bmatrix} 0.4 & 0.6 \\ 0.6 & 0.4 \end{bmatrix}$ (5)

Or

(b) Verify the lossless and reciprocity properties of any two port network using scattering matrix. (16)

12. (a) (i) With reference to RF transitor amplifier, discuss the considerations for stability and gain. (8)

(ii) Show that the noise figure of a three stage amplifier is $F = F_1 + \frac{F_2 - 1}{GA_1} + \frac{F_3 - 1}{GA_2}$ where F_1, F_2 and F_3 are noise figures and GA_1 and GA_2 are power gains. (8)

Or

(b) (i) Explain in detail the concept of T and Microstripline matching networks. (10)

(ii) Describe the Smith chart. How can it be used to determine an unknown impedence? (6)

13. (a) (i) Explain the concept of N port scattering matrix representation. (6)

(ii) Discuss the properties of scattering matrix. Determine the scattering matrix representation of E plane Tee Junction. (10)

Or

(b) (i) Explain the operating principle of a microwave circulator with neat schematic diagram. (8)

(ii) An air filled rectangular cavity resonator has dimensions of a = 5 cm, b = 2 cm and d = 15 cm. Compute the resonant frequency of the dominant mode for an air filled cavity. The resonant frequency of the dominant mode for a dielectric filled cavity of $\varepsilon_r = 2.56$. (8)

14. (a) With neat diagram, explain the construction and characteristics of tunnel diode. Compare tunnel diode and Gunndiode.

Or

(b) (i) Discuss the working principles of parametric amplifier. (8)

(ii) Explain merits, demerits and application of parametric device. (8)

15. (a) Derive the equation of velocity modulated wave and discuss the concept of bunching effect in two cavity klystron.

Or

(b) (i) An X band pulsed cylinderical magnetron has the following operating parameters :

Anode voltage $V_0 = 26$ kV

Beam current $I_0 = 27$ A

Magnetic flux density $B_0 = 0.336$ Wb/m^2

Radius of cathode cylinder a = 5 cm

Radius of vane edge to center b = 10 cm.

Determine cyclotron angular frequency, cut off voltage for a fixed B_0 and cut off magnetic flux density for a fixed V_0. (10)

(ii) Explain SWR measurement with neat block diagram. (6)