

GANPAT UNIVERSITY
M.Tech (EC) Semester -I CBCS Regular Examination, Nov-Dec. 2013
Microwave Engineering (3EC 105)

Max. Time: 3 Hrs.]

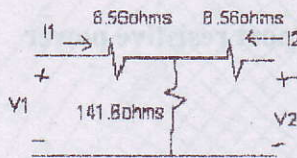
[Max. Marks: 70

Instructions:

1. Attempt **all** questions.
2. Answers to the **two** sections must be written in **separate** answer books.
3. Figures to the **right** indicate full marks.
4. **Assume** suitable data, if necessary.

SECTION-I

Q-1 (A)



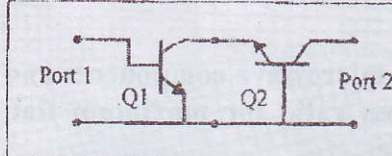
Find S parameter values for given circuit and prove that it is 3-dB attenuator circuit.

- (B) For analysis of a two port network which is lossless, using ABCD parameter prove that $AD - BC = 1$. listout useful properties of Chebyshev polynomials and draw it for first four polynomials.

OR

- Q-1 (A) Suppose given microwave network is 3 port device. For this given network write S parameters and discuss about its properties.

(B)



for given circuit ABCD parameters of two stages are

$$\begin{aligned} A_{Q1} &= 0.086 \angle -26^\circ & A_{Q2} &= 0.094 \angle -151^\circ \\ B_{Q1} &= 10.3 \angle -116^\circ & B_{Q2} &= 11.2 \angle 61^\circ \\ C_{Q1} &= 0.005 \angle -63^\circ & C_{Q2} &= 0.005 \angle 112^\circ \\ D_{Q1} &= 0.339 \angle -73^\circ & D_{Q2} &= 1.01 \angle 18^\circ \end{aligned}$$

Find out resultant ABCD matrix for the same.

- Q-2 (A) Why impedance matching networks are required in RF circuit design? Discuss how single quarter wave transformer is used for same purpose with all required equations.
- (B) Design a single section quarter wave matching transformer to match 20Ω load to 50Ω line at $f_0 = 3 \text{ GHz}$. Calculate fractional bandwidth in percentage for which $\text{SWR} \leq 1.3$.

OR

- Q-2 (A) Discuss the concept of theory of Small reflection and for that prove ,total reflection is dominated by reflection from initial discontinuity and first reflection from second discontinuity.
- (B) What idea Bode – Fano criterion gives for designing a network for impedance matching purpose? Discuss it in detail.

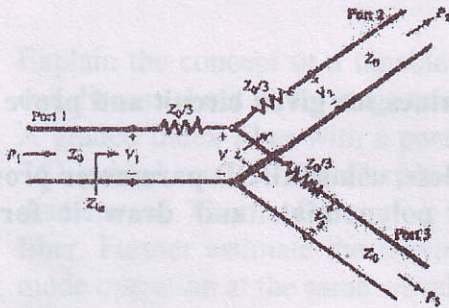
- Q-3 (A) Why S parameters are mainly used for analysis of microwave multiport devices? Discuss its various properties.
- (B) What is Transmission matrix? And derive same for two port 3 stage cascaded circuit. Also discuss its advantages.
- (C) Match a load impedance of $Z_L = 100 + j80 \Omega$ to a 50Ω line using a single series open –circuit stub. Assuming that the load is matched at $2, \text{ GHz}$ and that the load consists of a resistor and inductor in series.

SECTION - II

- Q-4 (A) A lossless T junction has source impedance $Z_0=50 \Omega$. Find output characteristic impedance so that power is divided in 2:1 ratio. Also calculate reflection coefficients while looking in to output ports. 6
- (B) Define coupling, directivity and isolation terms for directional coupler. With help of its S matrix discuss working of directional coupler. 6

OR

- Q-4 (A) Prove for the network as shown below that it is an equal-split three port resistive power divider. 6



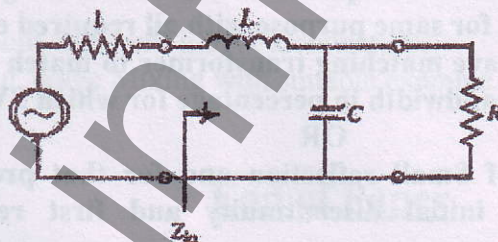
divider.

- (B) Prove that 3 port circulator is non reciprocal, lossless and matched at all its port device. 6

- Q-5 (A) What is importance of K- β diagrams and wave velocities for microwave components and transmission lines design? Discuss the concept of power loss ratio for maximum flat, Equal ripple, Elliptic and linear phase practical filter responses. 6
- (B) Why amplitude and frequency scaling is required in filter design procedure? Discuss Richard's transformations and Kuroda's identities. 5

OR

- Q-5 (A) As shown in following circuit For $N=2$, maximally flat low-pass filter prototype prove that $L=C=\sqrt{2}$. 6



- (B) Discuss about various types of filter transformations used in practical filter design. 5

- Q-6 (A) Write short note on Microwave Resonators. 4
- (B) What do you mean by loaded and unloaded Q in resonant circuits? Derive equations of input impedance Z_{in} , ω_0 and Q for series resonator circuit. 4
- (C) Write short note on Wilkinson power divider. 4

The Smith Chart

