Second Semester M. E. Examination

RF AND MICROWAVE CIRCUIT DESIGN

2 ENTC 4

P. Pages : 4

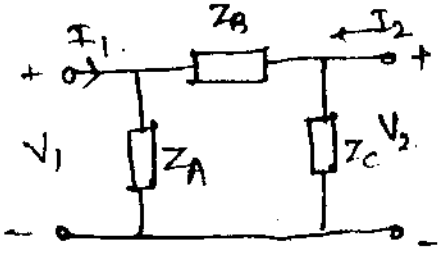
Time : Three Hours] [Max. Marks : 80

Note : (1) Separate answer book must be used for each section in the subject Geology, Engineering material of civil branch and Separate answer book must be used for Section A and B in Pharmacy and Cosmetic Tech.
(2) Answer **Three** questions from Section **A** and **Three** questions from Section B.
(3) Due credit will be given to neatness and adequate dimensions.
(4) Assume suitable data wherever necessary.
(5) Illustrate your answer wherever necessary with the help of neat sketches.
(6) Use pen of Blue/Black ink/refill only for writing the answer book.

SECTION A

1. (a) State and prove unity property of [S] matrix. 7

(b) Compute Z-parameters for the Pi n/w shown in fig.1



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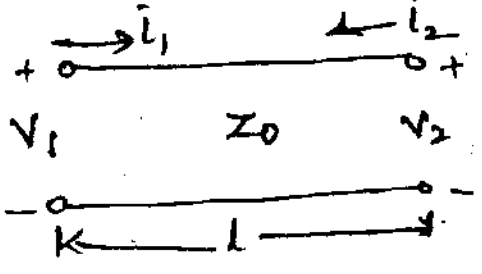
OR

2. (a) Find the [A B C D] matrix for a lossless transmission line of length *l* and characteristic impedance Z_0 as shown below.



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(b) Derive the condition of reciprocal and lossless network for S-parameters. 7

3. (a) Using Smith chart design all possible configuration of discrete two element matching network that match the source impedance $Z_s=(50+j25)\Omega$ to load $Z_L=(25-j50)\Omega$. Assume a characteristic impedance $Z_0=50\,\Omega$ and an operating frequency of 2 GHz. 13

OR

4. (a) Design a T-type matching network that transforms load impedance $Z_L=(60-j30)\Omega$ into $Z_{in}=(10+j20)\Omega$ input impedance that has a maximum nodal quality factor of 3. Compute the values for the matching network components assuming that matching is required at f = 1 GHz. 13

5. (a) Explain the following terms related to RF transistor amplifier.

(i) Tranducer power gain.

(ii) Unilateral power gain.

(iii) Operating power gain. 6

(b) Explain in brief consent VSWR circle. 7

OR

6. (a) Design a 18dB single stage MESFET amplifier operated at 5.7 GHz has follwing S-parameters.

$S_{11}=0.5\angle -60^0$; $S_{12}=0.02\angle 0^0$

$S_{21}=6.5\angle 115^0$; $S_{22}=0.6\angle -35^0$

(a) Determine if the circuit is uncoditionally stable

(b) Find Maximum power gain under optimal choice of reflection coefficient, assuming unilateral design (S_{12} = 0)

(c) Adjust the load coefficient such that the desired gain realized using concept of constant gain circle. 13

SECTION B

7. (a) Explain Negative resistance oscillator circuit in detail. 6

(b) A crystal is characterized by the parameters Lq = 0.1 H, Rq = 25 Ω, Cq = 0.3 PF and Co = 1 PF. Determine series and parallel resonance frequencies. 7

OR

8. (a) Explain single ended mixer design approach. 6

(b) For a 280 MHz oscillation frequency a Colpitts BJT oscillator in CE configuration has to be designed. For a bias point of V_{CE} = 3V and I_C = 3mA, the following circuit parameters are given at room temperature of 25°C.
C_{BC} = 0.1 PF ; V_{BE} = 2 kΩ
V_{CE} = 10 kΩ ; C_{BE} = 100 pf. 7

9. (a) Explain the even and odd mode analysis of coupled microstriplines. 7

(b) Which methods are used for the analysis of microstrip lines ? Explain hybrid mode analysis method. 7

OR

10. (a) A gold parallel strip line has the following parameters :—
Relative dielectric constant of
polyethylene εrd = 2.25
Strip width ω = 25 mm
separation distance d = 5 mm
Calculate :—

(a) Characteristics impedance of strip line.

(b) Strip-line capacitance.

(c) Strip-line inductance.

(d) Phase velocity. 7

(b) Explain the losses in microstriplines. 7

11. (a) Discuss in brief Monolithic Microwave Integrated circuits (MMIC) 7

(b) Explain the following techniques used in fabrication of MMICs.

(i) Diffusion and ion implantation.

(ii) Oxidation and film deposition.

(iii) Epitaxial growth

(iv) Lithography

(v) Etching and photoresist.

(vi) Deposition. 6

OR

12. (a) Explain thin film formation in MMIC. 6

(b) List the basic properties provided by ideal conductor, dielectric and resistive materials used in MMIC. 7