BE-ExTC   Sem VIII (Rev)
Adv. Microwave Engg.
14/5/15

QP Code : 8038

(3 Hours)   [Total Marks :100

N.B. : (1) Question No.1 is compulsory.
      (2) Make use of complete Smith chart wherever necessary.
      (3) Solve any four questions from remaining six questions.
      (4) Assume suitable data wherever required.

1.(a) Find S-parameters of two port series network with $Z = 100\ \Omega$ and $Z_o = 50\Omega$.   5

  (b) Derive the expression of overall noise figure in three cascaded stages of amplifiers.   5

  (c) Define stability. List the various criteria for stability.   5

  (d) What are the characteristics of power amplifiers ?   5

2. (a) A BJT with $I_c = 30mA$ and $V_{CE} = 10V$ is operated at a frequency of 1.0 GHz in a 50Ω system.   10
Its S-parameters are :
$S_{11} = 0.73 \angle 175°$; $S_{22} = 0.21 \angle -80°$
$S_{12} = 0.0$; $S_{21} = 4.45 \angle 65°$
Determine whether the transistor is unconditionally stable. If yes, calculate the optimum terminations.
Gs, max, GL, max and GTU, max.

  (b) Explain using suitable diagrams two methods of designing broad band amplifier.   10

3. (a) Determine stability of GaAs FET that has the following S-parameters at 2GHz in a 50-Ω system both graphically and mathematically.   10

$$S = \begin{bmatrix} 0.89\angle -60° & 0.02\angle 62° \\ 3.1\angle 123° & 0.78\angle -27° \end{bmatrix}$$

  (b) Derive the transducer power gain as :   10

$$G_T \cdot \frac{P_L}{P_{avg}} = \frac{|s_{21}|^2 \left(1-|\Gamma_s|^2\right)\left(1-|\Gamma_L|^2\right)}{|1-\Gamma_s \Gamma_{in}|^2 |1-S_{22}\Gamma_L|^2}$$

RJ-Con. : 8961-15.   **TURN OVER**

4. Design a transistor oscillator at 6GHz using an FET in CS configuration driving   **10**
a 50 Ω load on drain side. The S parameters at 50 Ω are

$$S = \begin{bmatrix} 0.9\angle150° & 0.2\angle-15° \\ 2.6\angle50° & 0.5\angle105° \end{bmatrix}$$

Calculate and plot output stability circle for

$|\overline{\Gamma_{IN}}|>>1$, choose $\overline{\Gamma_T}$ so that $|\overline{\Gamma_{IN}}|>>1$

Design load and terminating networks.

5. (a) Discuss various mixer topologies. Compare performance of various   **10**
topologies.

  (b) Compare microwave amplifiers with microwave oscillators.   **10**

6. (a) A GaAs FET is biased for minimum noise figure and has following   **15**
S parameters and noise parameters at 4GHz (Zo = 50Ω)

$$S = \begin{bmatrix} 0.6\angle-60° & 0.05\angle26° \\ 1.9\angle81° & 0.5\angle-60° \end{bmatrix}$$

Fmin = 1.6dB, $\overline{\Gamma}_{opt} = 0.62\angle100°$, $R_N = 20\Omega$

Design an amplifier with 2dB noise figure and maximum gain compatible
with this noise figure. Assume device is unilateral.

  (b) prove that scattering matrix is symmetrical and reciprocal.   **5**

7. Write short notes on :
    (a)   Noise figure test equipment   **5**
    (b)   1dB compression point   **5**
    (c)   Amplifier linearization methods   **5**
    (d)   Single ended diode mixer.   **5**

Course: B.E. (SEM.VIII) (ELECTRONICS & TELECOMMUNICATION ENGG.)(prog 758 To 772)

Q.P Code: 8038

Correction:

Q.no.(4)

Read AS: FET in Cg Configuration

Instead of: FET in Cs Configuration

Q.No.(4) is of 20 marks .

Q.No.(3)(b) (chk following img)

Q. 3(b)

Read $\quad G_T \dfrac{P_L}{P_{avg}} \quad$ as $\quad G_T = \dfrac{P_L}{P_{avg}}$

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NOTE: Take printouts & distribute them to concerned students.