... RF & Microwave Amplifier & Oscillator Design

Con. 2946-07. ND-1846

(REVISED COURSE)

(3 Hours) [Total Marks : 100

N.B. (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions out of the remaining questions.
(3) Use of Smith chart is **compulsory**.
(4) Assume any data wherever **required** but justify the **same**.

1. (a) A certain MESFET is biased for large signal class A operation with the following small-signal s-parameters at 5 GHz. 20

$S_{11} = 0{\cdot}55 \angle -150°$ $S_{21} = 3{\cdot}5 \angle 170°$

$S_{12} = 0{\cdot}04 \angle 20°$ $S_{22} = 0{\cdot}45 \angle -30°$

The large signal forward transmission coefficient S_{21}, is measured to be $S_{21} = 2{\cdot}8 \quad 180°$. Design a large-signal class A amplifier with maximum transducer gain in a 50 Ω system. Assume ± 0·5 dB error in gain is small enough to justify simplifications. What is the high power amplifier gain ?

(b) Define dynamic range, 1dB compression and MDS.

2. A certain GaAs MESFET has following noise figure parameters measured at $V_{ds} = 5$ V, $I_{ds} = 20$ mA with a 50 Ω resistance for frequency of 9 GHz. 20

$F_{run} = 2$dB

$\tau_{opt} = 0{\cdot}485 \angle 155°$

$R_0 = 4\ \Omega$

Plot noise figure circles for given values of F at 2·5, 3·0 and 3·5 dB.

3. (a) Explain optimal loading used in HPA design in detail. 10
(b) Define s-parameters and explain their use in microwave amplifier design in detail. 10

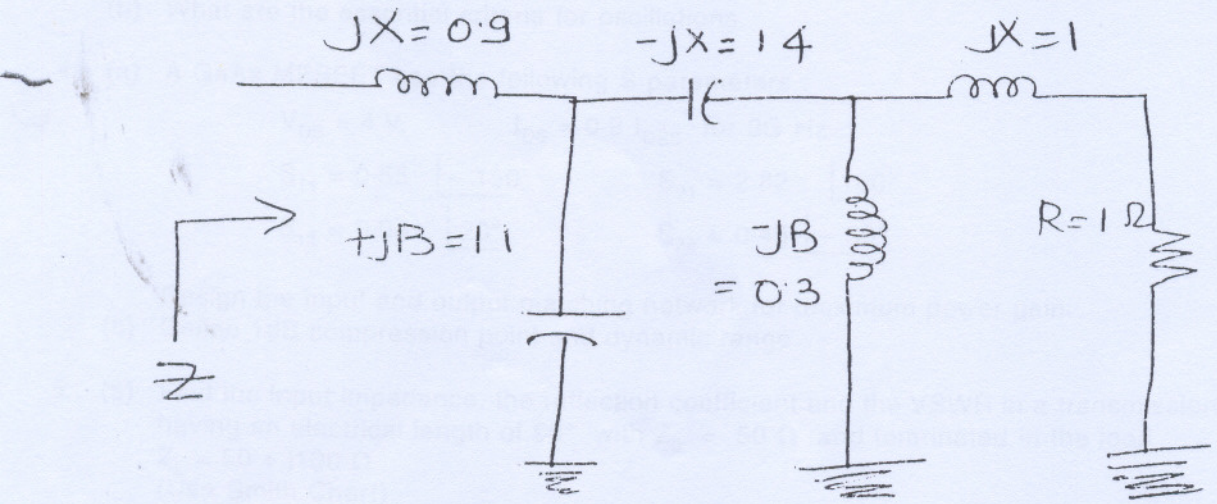
4. (a) Determine the stability of a GaAs FET that has the following s-parameters at 2 GHz in a 50 Ω system both graphically and mathematically. 15

$S_{11} = 0{\cdot}86 \angle -57°$ $S_{21} = 3 \angle 125°$

$S_{12} = 0{\cdot}018 \angle 61{\cdot}5°$ $S_{22} = 0{\cdot}775 \angle -26°$

(b) Explain the various criteria required to determine stability. 5

5. (a) In the **figure** given below, find the impedence looking into the network using Smith Chart. 10



(b) What are Mixers ? Explain any one type of Mixer in detail. 10

6. A GaAs MESFET is measured to have the following s-parameters for a mid range Q-point where $V_{DS} = 5$ V, $T_D = 10$ mA at 10 GHz with 20

$S_{11} = 0{\cdot}53 \angle -152.$ $S_{21} = 2{\cdot}8 \angle 182°$

$S_{12} = 0{\cdot}04 \angle 20°$ $S_{22} = 0{\cdot}47 \angle 28°$

Using this Transistor design a Microwave amplifier for Maximum power gain at 10 GHz.