Old Exam Questions on Amplifier Design – EE4011 – (this section from EE4005).

4. Discuss the theory and application of *stability circles* in small-signal microwave amplifier design.

A GaAs MESFET has the following noise-figure parameters measured at V_{ds}=5V, I_{ds}=20 mA with 50Ω resistance at 9 Ghz.

$$F_0=1.6\text{dB},\ \Gamma_0=0.45\angle 145°\ ,\ R_n=5\Omega.$$

Determine the centre point and radius of the noise-figure circle for F_i=3dB.

5. Outline the design procedure used when designing a microwave amplifier for maximum gain.

A microwave junction transistor has the following characteristics (at 5 GHz with 50 ohm reference);

$$S_{11} = 0.5\ \angle -145°$$
$$S_{12} = 0.05\ \angle\ 25°$$
$$S_{21} = 2.75\ \angle\ 190°$$
$$S_{22} = 0.5\ \angle -40°$$

Check the stability of the device and design input and output matching networks for maximum power gain.

(b) A GaAs MESFET has the following noise-figure parameters measured at V_{ds}= 5 V, I_{ds} = 20 mA with 50 Ω resistance at 8 GHz.

$$F_0 = 1.6\text{ dB},\ \Gamma_0 = 0.45\angle 145°\ ,\ R_n = 5\ \Omega.$$

Determine the centre point and radius of the noise-figure circle for F_i = 2.5 dB.

5. Outline the design procedure used when designing a microwave amplifier for maximum gain.

A microwave junction transistor has the following characteristics (at 2.5 GHz with 50 ohm reference);

$$S_{11} = 0.5\ 6\angle -140°$$
$$S_{12} = 0.15\ \angle\ 48°$$
$$S_{21} = 1.74\ \angle\ 32°$$
$$S_{22} = 0.41\ \angle -92°$$

Check the stability of the device and design input and output matching networks for maximum power gain.

(b) A microwave transistor has the following *s*-parameters at 3GHz

S_{11} = 0.707 ∠-155° S_{12} = 0
S_{21} = 4 ∠180° S_{22} = 0.51 ∠-20°

Design a 3GHz amplifier with maximum possible gain.

[*10 marks*]