Register Number: ………………

M.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

COMMUNICATION SYSTEM

COM 508: RF System Design

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. A coaxial cable that is assumed lossless has a wavelength of electrical and magnetic fields of λ=20 cm at 960MHz. Find relative constant of the insulation.
2. A typical PCB substrate consists of Al_2O_3 with a relative dielectric constant of 10 and a loss tangent of 0.0004 at 10GHz. Find the conductivity of the substrate.
3. What are the generic steps involved in smith chart computation?
4. What is forward power gain (S – parameters)?
5. What is insertion loss, return loss?
6. With respect to RF Filters define internal and external quality factors.
7. What are the advantages of mesa processing technology over conventional planar Construction?
8. What is the stable and unstable region of the transistor?
9. Define
   (a) available power gain
   (b) operating power gain
10. What is the single balanced mixer and double balanced mixer?

PART B (5 x 16 = 80 Marks)

11. a) (i) What are the intrinsic wave impedance, phase velocity and wave length of EM wave in free space. (6)
    (ii) For generic T-network, find the impedance and admittance matrices. (10)

(OR)

b) (i) An unknown load impedance is connected to a 0.3λ long, 50 Ω lossless transmission line. The SWR and phase of the reflection coefficient measured at the input of the line are 2.0 and -20^{o}, respectively. Using the Smith Chart, determine the input and load impedances. (4)
   (ii) With design equation explains how RF capacitor and inductor are made. (12)

12. a) Design a low –pass filter whose input and output are matched to a 50 Ω impedance and that meets the following specification : cut –off frequency of 3 GHz ; equi-ripple of 0.5dB; and rejection of at least 40dB at approximately twice the cut-off frequency. Assume a dielectric material that result in a phase velocity of 60% of the speed of light.

(OR)

b) (i) What is image impedance? (4)

(ii) What are the four major steps involved in practical micro stripline filter realization?(12)

13. a)(i) What is junction capacitance? Why it is so important parameter for RF devices, explain? (6)

(ii) Find the transducer loss of a forward and reverse biased PIN diode in series connection (Z_g = Z_L = Z_o=50Ω). Assume the junction resistance R_j under forward bias range between 1 and 20 Ω. Further –more, assume that the reverse bias operating condition result in the junction capacitance being C_j = 0.1, 0.3,0.6,1.3,0.6,10.3 and 205pF, and the frequency range of interest extends from 10MHz to 50GHz. (10)

(OR)

b) (i) Explain various classes of amplifier operations (6)

(ii) What are the different diodes that are most commonly used in RF and MW circuit? Briefly explain their characteristic with equivalent circuit.(At least for 2 devices) (10)

14. a) (i) What is operating power gain? (2)

(ii) A FET has the following parameters: S11=0.8<-140o, S12=0.2<30^o, S21=2.8<60^o, S22=0.2<150^o. Design an amplifier using this FET with GP= 10.79dB. Assuming we can tolerate an input mismatch of VSWRin =1.6, find a suitable load and source reflection coefficients. Also work out the effectivepower gain of the amplifier. (14)

(OR)

b) (i) Explain the Analytical or graphical procedure to design a power Amplifier for minimum noise figure and constant gain. (8)

15. a) (i) what is a feedback oscillator and derive the condition for oscillation? (8)

(ii) A typical varactor diode has an equivalent series resistance of 45 and a capacitance ranging from 10pF to 30pF for reverse voltages between 30V and 2V. Design a voltage controlled Clapp-Type oscillators with the transconductance of the transistor is constant and equal to g_m=115mS (8)

(OR)

b) (i) What are the basic characteristic of mixers .derive the equations necessary for proving a FET is less prone to generate undesired higher- order intermodular products compare to diodes and BJTs. (8)

(ii) Explain with equation the design of detector and demodulator circuits. (8)

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