Register Number……………………

M.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Third Semester

COMMUNICATION SYSTEMS

P07CME01 RF System Design

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

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. What is skin effect and what are the parameters decide the skin depth?

2. Draw the equivalent circuit representation for a high frequency inductance and indicate how it is formed?

3.What are the generic steps involved in smith chart computation?

4.Under what condition are S – parameters recorded?

5. What is insertion loss, ripple with respect to RF Filters?

6. Give the Schottky diode equation and briefly explain.

7. What are the major issues when dealing with RF transmitter?

8. Define

(a) available power gain

(b) operating power gain

9. What is the strategy of designing an RF amplifier?

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. (8)

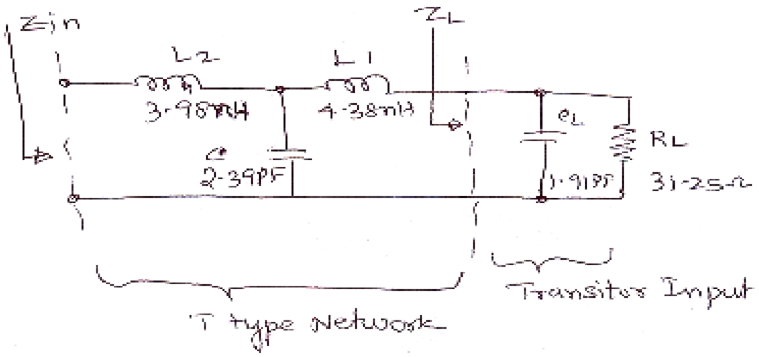
(ii) A transmission line has the following parameters at the frequency of 1 GHz.

R = 2Ω/m, G = 0.5 X 10^{-3} mho/m; L = 8 n H/m C = 0.23 pf/m

Calculate characteristic impedance of the line propagation constant. (8)

(OR)

(b) Compute the input impedance of the T Network shown below for a center frequency F = 2 GHz. The transmitter is modeded as a parallel RC network as indicated. Assume a characteristic impedance of $Z_o = 50\ \Omega$ (use smith chart) (16)



Problem 11.(b)

12. (a) Series RLC band pass filter is having a value $Z_o = 50\Omega$, $Z_G = Z_L = Z_0$, R = 10Ω, L = 50nA, C = 0.47pF and generator voltage is $V_G = 5V$

Find the loaded, unloaded (filter) and external quality factor; power generated by the source; power absorbed by the load at resonance and plot the insertion loss in the range of ∓20% of the resonance frequency. (16)

(OR)

(b) An N = 3 Chebyshev bandpass filter is to be designed with a 3 dB passband ripple for a communication link. The center frequency is at 2.4GHz and the filter has to be inserted into a 50 Ω characteristic line impedance. Find the inductive and capitative elements and plot the attenuation response in the frequency range 1 to 4 GHz. (16)

13. (a) (i) What is transition frequency of a microwave BJT? Briefly explain. (6)

(ii) Briefly explain the IV curves of Tunnel Diodes and indicate how it can be used as an oscillator or amplifier. (10)

(OR)

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

(ii) Derive the geral expression for the amplifier efficiency η as a function of conduction angle $\theta_\circ$. List the values of η for both Class A and Class B amplifiers. (10)

14. (a) What is operating power gain ? Derive an expression for the operating power gain circle of an amplifier. (16)

(OR)

(b) (i) What are broad band amplifiers. Explain how you will design a broad band amplifier using frequency compensated matching networks. (8)

(ii) What is harmonic distortion and inter modulation distortion. Explain where and how they are generated, and their effects. (8)

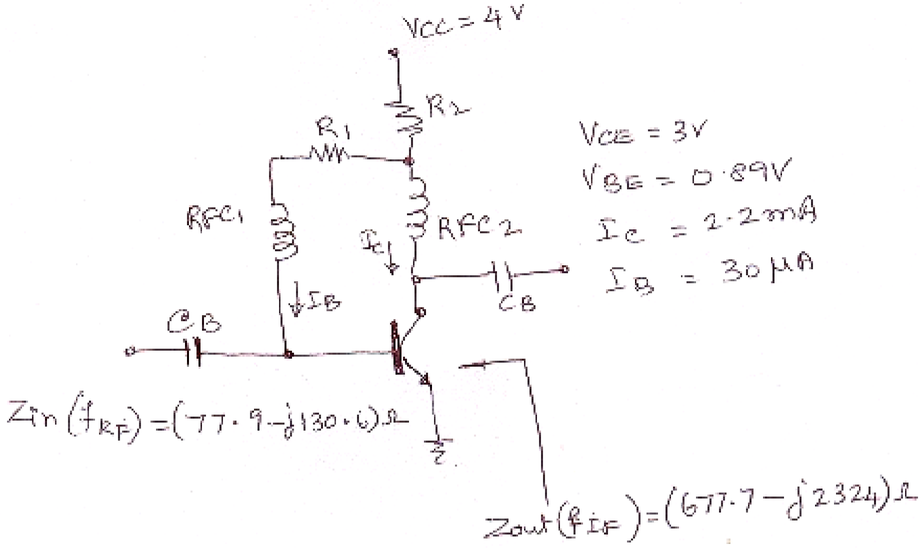
15. (a) (i) Design a low frequency colpitts oscillator. (6)

(ii) For a 200 MHz Oscillation frequency, a colpitts BJT oscillator in common emitter configuration has to be designed. For the bias point of Vce = 3 V and Ic = 3mA, the following circuit parameters are givenat room temperature of 25ºC: C_{BC}= 0.1pF, r_{BE}= 2 KΩ, C_{BE}=100pF. If the inductance should not exceed L_3=L=50 nH, find the values of the capacitances in the feedback loop. (10)

(OR)

(b) (i) Briefly explain single – ended mixer design. Indicate the major parameters to be considered for the design. (6)

(ii) For the DC – biasing topology shown in figure, compute the values of the resistors R_1 and R_2 such that biasing conditions are satisfied. Using this network as a starting point, design a low – side injection mixer for f_{RF} = 1900 MHz and f_{IF} = 200 MHz. The BJT is measured at IF to have an output impedance of Z_{out} = (677.7 – j2324) Ω for short – circuit input , and an input impedance of Z_{in} = (77.9- j 130.6) Ω for short – circuit output at RF frequency. Attempt to minimize the component count in this design.



Prob. 15 b (ii)

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