Code No: R22043 **R10** SET - 1

II B. Tech II Semester Regular Examinations April/May – 2013
ELECTRONIC CIRCUIT ANALYSIS
(Com. to ECE, EIE)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Draw the circuit diagram of Common Drain amplifier and derive an expression for its Voltage gain.
   b) The h-parameters of the transistor used in CE amplifier are h_{fe} = 50, h_{ie} =1.1K, h_{re} = 2.5×10^{-4}, h_{oe} = 24μ A/V. Find out current gain and voltage gains with and without source resistance , input and output impedances , given that R_L= 10 K and R_S= 1 K

2. a) Explain the nature of feedback in an emitter follower circuit. State the advantages of this circuit and mention its use. Can this circuit be used as a voltage amplifier?
   b) The total harmonic distortion of an amplifier is reduced from 15% to 3% when 4% negative feedback is used. Find (i) voltage gain without feedback (ii) voltage gain with feedback?

3. a) Describe the crystal oscillator. What is the advantage of a crystal oscillator over an LC oscillator?
   b) A tuned collector oscillator connected across the primary has a capacitance of 100pF.The d.c resistance of the primary coil is 10 ohm and the transistor used has h_{ie}=1k ohm, h_{re}=10^{-4}, h_{fe}=50 and h_{oe}=10^{-4} A/V. Find the frequency of oscillation and the mutual inductance between the primary and secondary coils required to sustain the oscillations ?

4. a) Draw the circuit of two stages R-C coupled JFET amplifier and explain its working.
   b) Draw the circuit diagram of single stage R-C coupled BJT amplifier. Discuss the effect of an emitter bypass capacitor on low-frequency response.

5. a) Derive the expression for the CE short circuit current gain Ai as a function of frequency using Hybrid - π model.
   b) A single-stage CE amplifier is measured to have a voltage - gain bandwidth f_H of 5 MHz with R_L = 500. Assume h_{fe} = 100, g_m=100 mA/V, $r_{bb'}$ = 100, C_c = 1pF, and f_T = 400 MHz. Find the value of the source resistance that will give the required bandwidth.

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6. a) Classify large signal amplifiers based on its operating point. Distinguish these amplifiers in terms of the conversion efficiency.
   b) Draw the push-pull power amplifier circuit. Derive the expression for the output current in push- pull amplifier with base current as $I_b = I_{bm} \sin\omega t$.

7. a) Draw the circuit diagram of a Double tuned amplifier. Draw and explain in detail the frequency response for different values of coefficient of coupling (K) i.e. K=1, K= 1.5, K=2 and also explain what is Loose coupling and Tight coupling?
   b) What is synchronous tuning? Derive an expression for bandwidth of an n-stage synchronously tuned amplifier?

8. a) The voltage regulator in Figure 8 maintains an output voltage of 25 V.
   i) What value of R_{sc} should be used to limit the maximum current to 0.5A?
   ii) With the value of R_{sc} found in (i) what will be the output voltage when R_L= 100 ohms?

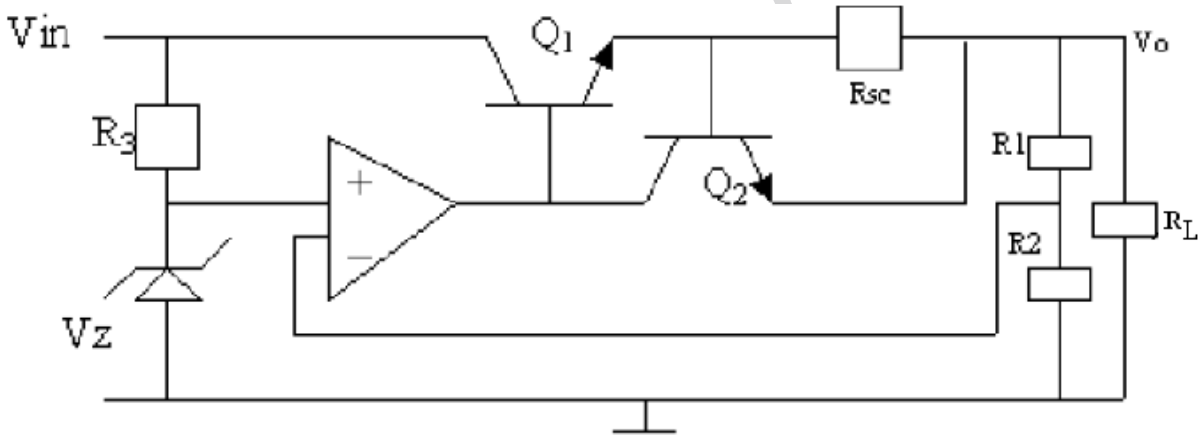

Figure 8

   b) What type of protection circuits are required in power supplies?

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1. a) Discuss the classification of amplifiers based on frequency range, type of coupling, power delivered, and signal handled.
   b) The h-parameters of a transistor are h_{fe} = 50, h_{ie} = 1.1K, h_{re} = $2.5x10^{-4}$, h_{oe} = 24 μA/V Calculate A_I, A_V, A_{VS}, R_i, and R_o for Figure 1b

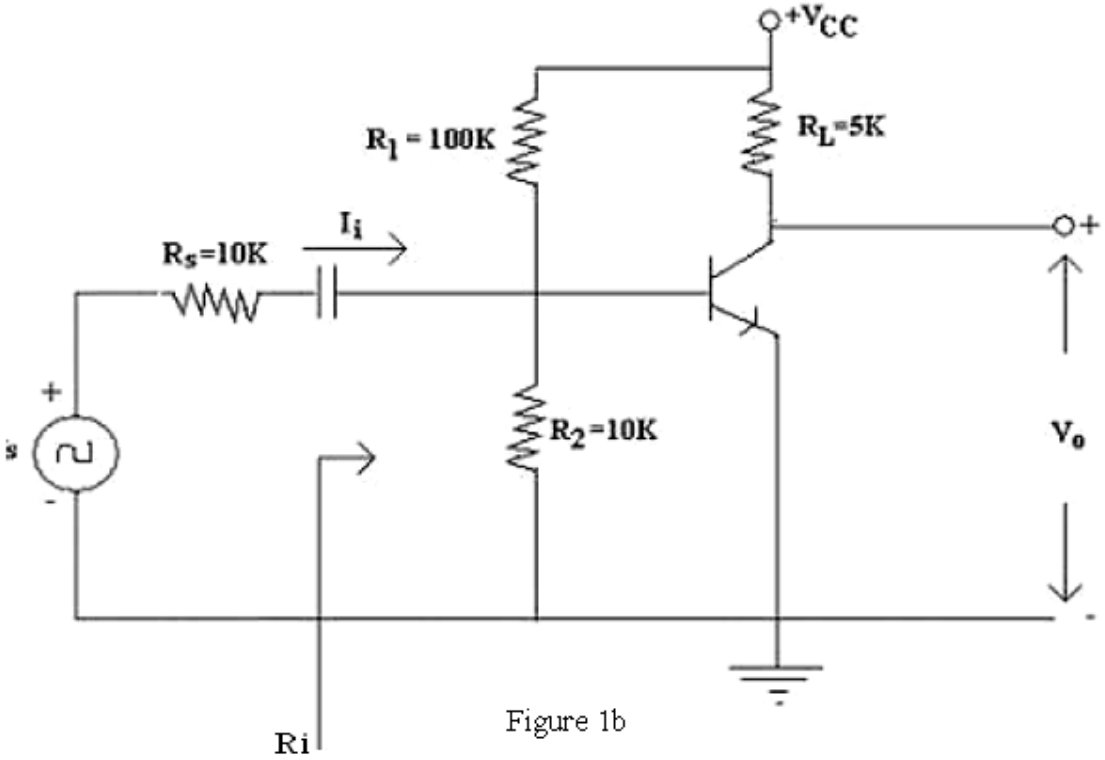

Figure 1b

2. a) Explain the effects of negative feedback on amplifier characterisitcs?
   b) An amplifier having a gain of 500 without feedback has an overall negative feedback applied which reduces the gain to 100.Calculate the fraction of output voltage feedback? If due to ageing of components, the gain without feedback falls by 20% calculate the percentage fall in gain with feedback?

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3. a) Describe the circuit diagram of Colpitt's oscillator and explain its operation?
   b) A Hartley oscillator is to span a frequency range from 50 KHz to 150 KHz. The variable capacitance has the values in the range 50 pF to 450 pF. The transistor to be used has h_{fe}=50 and Δh = 0.5. Determine the values of the inductances. Neglect mutual inductance between the coils and use CE circuit configuration.

4. a) Differentiate between direct and capacitive coupling of multiple stages of amplifiers.
   b) With the help of a neat circuit diagram, describe the working of a Cascode amplifier

5. a) Explain how hybrid Π parameters, g_m and g_{ce} vary with I_c, V_{ce} and temperature.
   b) Discuss the effect of different type of loads to a common source MOS amplifier.

6. a) A single stage class A amplifier V_{cc}=20V, V_{CEQ} =10V, I_{CQ} =600 mA, R_L=16 Ω. The ac output current varies by 300mA, with the ac input signal. Find
      i) The power supplied by the dc source to the amplifier circuit.
      ii) AC power consumed by the load resistor.
      iii) AC power developed across the load resistor.
      iv) DC power wasted in transistor collector.
      v) Overall efficiency
   b) What are the drawbacks of transformer coupled power amplifiers?

7. a) Derive an expression for bandwidth of a capacitive coupled tuned amplifier in CE configuration. Make necessary assumptions and mention them
   b) Discuss the necessity of stabilization circuits in tuned amplifiers

8. a) Explain different types of protections required in IC Voltage Regulators.
   b) Draw and explain the output of pulse width modulator for different types of inputs with respect to switching regulator.

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1. a) State Miller's theorem. Explain its significance in transistor circuit analysis.
   b) For the Common Gate amplifier shown below Figure 1, derive expressions for voltage gain, input impedance and output impedance. Power supplies are omitted for simplicity. Neglect capacitances.

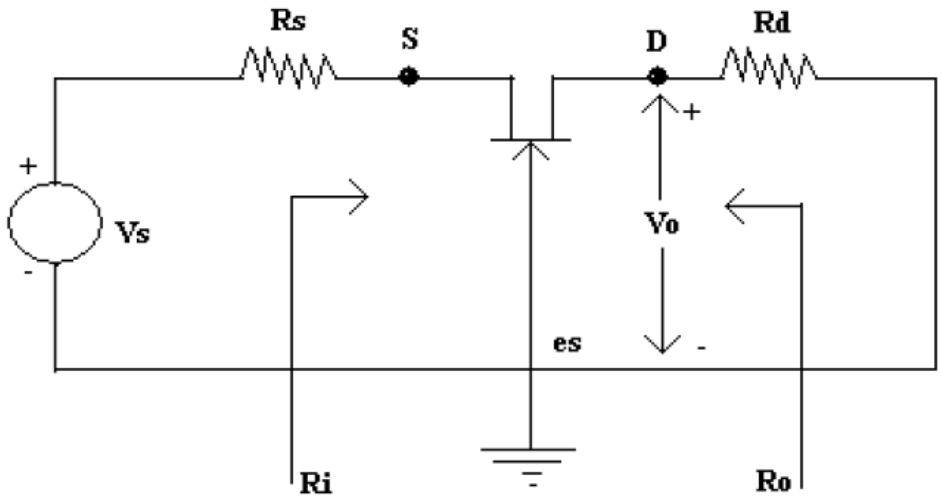

Figure 1

2. a) If the non-linear distortion in a negative feedback amplifier with an open loop gain of 100 is reduced from 40% to 10%with feedback, compute the feedback factor, β of the amplifier.
   b) Draw the circuit diagram of a current series feedback amplifier, Derive expressions to show the effect of negative feedback on input & output impedances, bandwidth, distortion of the amplifier.

3. a) Derive the expression for frequency of oscillation in a Hartley Oscillator.
   b) With the help of suitable schematic and description, show that both positive and negative feedback are used in a Wien Bridge oscillator. Establish the condition for oscillations

4. a) The gain of an RC coupled 2 stage FET amplifier falls by 90% of the mid band value at 400 kHz. If g_m of each FET is 10 m A/V, and total output capacitance for each stage is 20 pF, calculate the R_L required and the mid band gain of each stage
   b) Write a short note on Bandwidth of amplifiers.

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5. a) What are the typical values of various components in Hybrid - π model? Show that at low frequencies the Hybrid - π model with $r_{b'e}$ and r_{ce} taken as infinite reduces to the approximate CE h- parameter model.
   b) The following low- frequency parameters are known for a given transistor at I_C = 10mA, V_{CE} =10 V, and at room temperature, h_{ie} = 500, h_{oe} = $4x10^{-5}$ A/V, h_{fe} = 100, h_{re} = 10^{-4}.
   At the same operating point, f_T = 50MHz and Cc=3pF, compute the values of all the Hybrid - π parameters

6. a) What is Harmonic distortion in transistor amplifier circuits? Discuss second harmonic distortion.
   b) A single transistor is operating as an ideal class B amplifier with a 500 load. A dc meter in the collector circuit reads 10 mA. How much signal power is delivered to the load?

7. a) What is synchronous tuning? Derive an expression for bandwidth of an n-stage synchronously tuned amplifier?
   b) Show that for an 'n' stage synchronously tuned amplifier; maximum bandwidth is obtained when the single stage gain is 4.34 dB.

8. a) Draw the functional block diagram of Series Voltage Regulator and explain each block.
   b) A 50V power supply has line regulation 0.2%V. How large would the 75V input voltage to the supply have to become for the output voltage to rise to 52V?

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1. a) Sketch the circuit of a Common Source amplifier. Derive an expression for the Voltage gain at low frequencies. What is the maximum value of A_V.
   b) Calculate the voltage gain A_V = Vo/Vi at 1 KHz for the circuit shown in 1b.The FET parameters are g_m=2 mA and r_d=10K. Neglect capacitances. If the capacitance 0.003F is also considered, calculate the voltage gain.

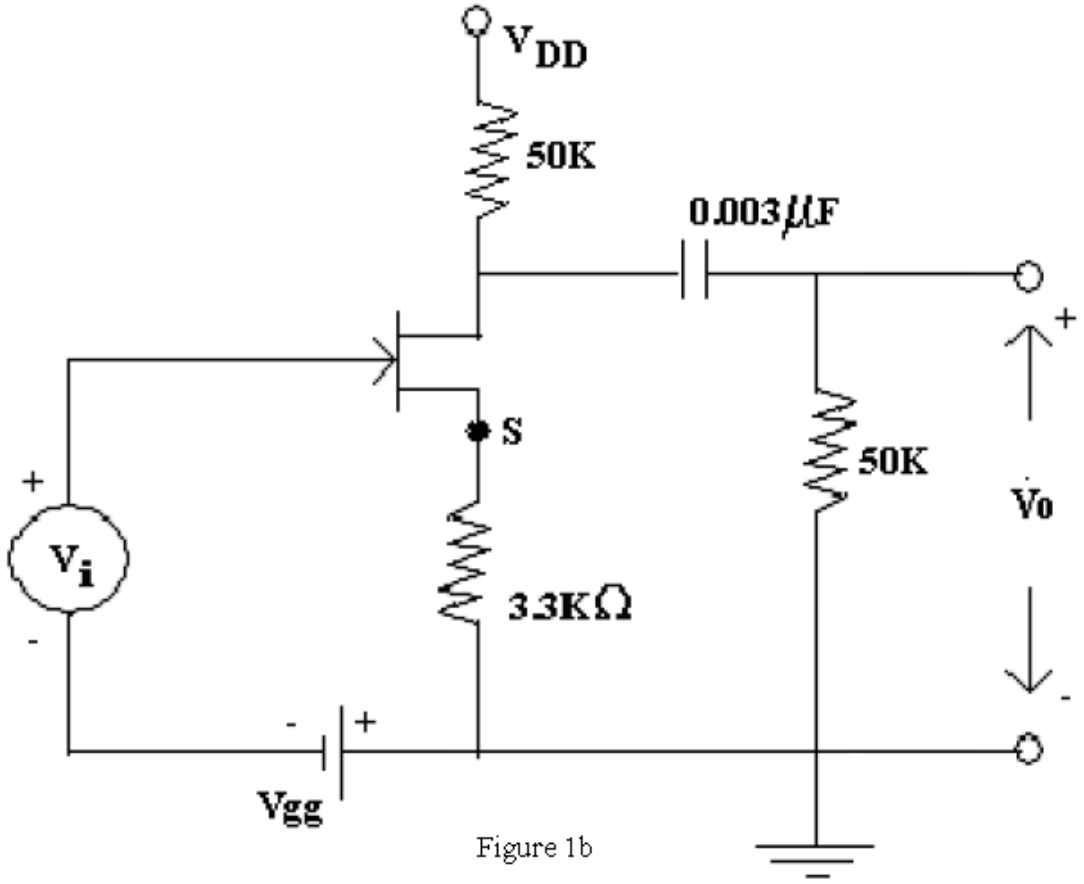

Figure 1b

2. a) The β and the open loop gain of an amplifier are -10% and -80 respectively. By how much % the closed loop gain changes if the open loop gain increases by 25%?
   b) With the help of a suitable BJT based voltage series feedback amplifier diagram, explain the features and benefits of negative feedback in amplifiers.

3. a) With the help of neat circuit diagram, explain how sustained oscillations are obtained in RC phase shift BJT based oscillator. Derive the expression for frequency of oscillation.
   b) Differentiate between LC and RC oscillators?

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4. a) List out the special features of Darlington pair and Cascode amplifiers
   b) A two-stage amplifier circuit (CE-CC configuration) is shown in figure 4b. The h-parameter values are h_{fe} = 50, h_{ie}=2 K , h_{re} =6× 10^{-4}, h_{oe} = 25μA/V. h_{fc} = -51, h_{ic} =2 K, h_{rc} = 1, h_{oc} = 25μ A/V. Find the input and output impedances and individual, as well as overall voltage and current gains.

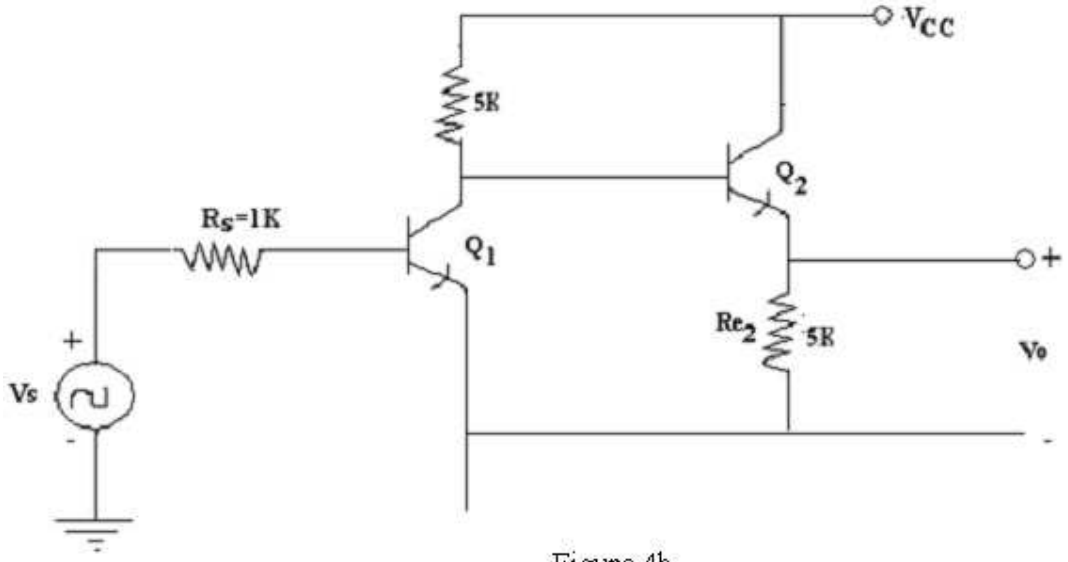

Figure 4b

5. a) A transistor amplifier in CE configuration is operated at high frequency with the following specifications. f_T=6MHz, g_m=0.04, h_{fe}=50, $r_{bb'}$=100 Ω, R_s=500 Ω , $C_{b'c}$=10 pF, R_L=100 Ω. Compute the voltage gain, upper 3dB cut-off frequency, and gain bandwidth product.
   b) Derive the expression for the CE short circuit current gain A_I as a function of frequency using Hybrid - π model.

6. a) Write short notes on requirement and types of heat sinks for power dissipation in large signal amplifiers.
   b) With the help of a neat circuit diagram, explain the operation of a complementary symmetry configured class B power amplifier.
   c) A push pull amplifier utilizes a transformer whose primary has a total of 160 turns and whose secondary has 40 turns. It must be capable of delivering 40W to an 8 Ω load under maximum power conditions. What is the minimum possible value of V_{cc}?

7. a) Draw the circuit diagram and small signal AC equivalent circuit of a single tuned amplifier (using BJT) with the tank circuit connected at the input side.
   b) With a neat diagram show how to cascade tuned amplifiers and determine gain and band width?

8. a) What type of protection circuits are required in power supplies?
   b) A 50V power supply has line regulation 0.2%V. How large would the 75V input voltage to the supply have to become for the output voltage to rise to 52V?
   c) Give the disadvantages of the series and shunt regulators.