Code: 9A04402

1

II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

ELECTRONIC CIRCUIT ANALYSIS

(Common to EIE, E. Con. E & ECE)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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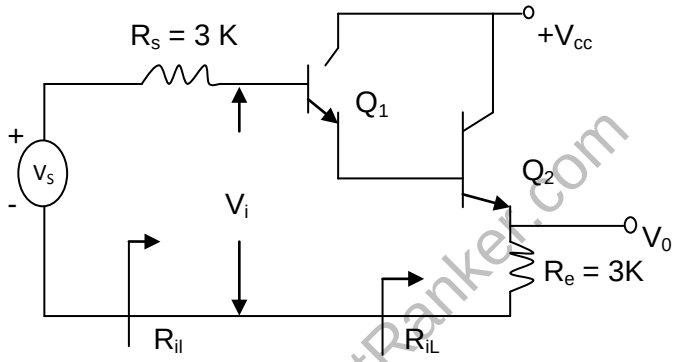
1 (a) Draw the circuit of an emitter follower and its equivalent circuit. List out its characteristics.

(b) The h-parameters of the transistor used in CE amplifier are h_{fe} = 50, h_{ie} = 1.1KΩ, h_{re} = 2.5 x 10^{-4}, h_{oe} = 24 µA/V. Find out current gain and voltage gain with and without source resistance, input and output impedances, given that R_L = 10 K and R_s = 1 K.

2 (a) Draw the circuit diagram of cascade amplifier with and without biasing circuit. What are the advantages of this?

(b) For the circuit shown in figure, calculate R_i, A_i, A_v and R_o. Assume h_{ie} = 1.1 K, h_{fe} = 50, h_{re} = 2.5 x 10^{-4}, h_{oe} = 25 µA/v.



3 (a) Draw hybrid – π model for a transistor in the CE configuration and explain the significance of every component in this model.

(b) A HF amplifier uses a transistor which is driven from a source with R_s = 1 K. Calculate value voltage gain, gain bandwidth product, upper 3 dB cut off frequency f_H, if R_L = 0 and R_L = 2 K. Typical values for hybrid – π parameters are: $r_{b'e}$ = 1 K, rbb^1 = 100 ohms, c_e = 100 PF. C_c = 3 PF and g_m = 50 mA/v.

4 (a) Discuss using the concept of a load line superimposed on the transistor characteristics, how a simple common source circuit can amplify a time varying signal.

(b) Determine the small signal voltage gain and input and output resistances of a common source amplifier. For the circuit shown in figure the parameters are: V_{DD} = 10 V, R_1 = 70.9 KΩ, R_2 = 29.1 KΩ and R_D = 5 KΩ. The transistor parameters are: V_{TN} = 1.5 V, K_n = 0.5 mA/V^2 and λ = 0.01 V^{-1}. Assume R_{si} = 4 KΩ. See figure (no.4) in the next page.

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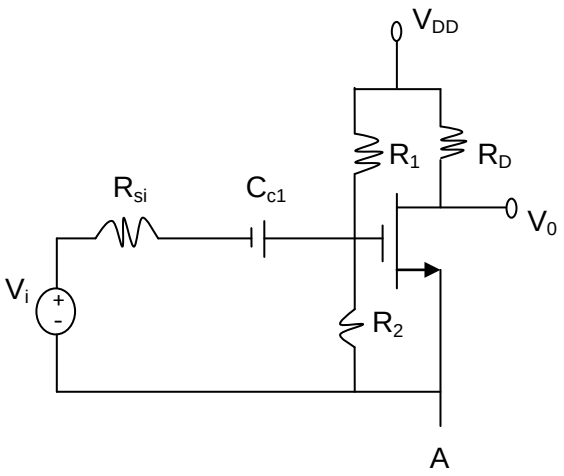

Figure 4

5 (a) Discuss the effects of negative feedback on frequency response of an amplifier.
(b) An amplifier with an open loop voltage gain of 1000 delivers 10 W of power output at 10% harmonic distortion when input is 10 mV. If 40 dB negative feedback is applied and output power is to remain at 10 W, determine required input signal V_s and second harmonic distortion with feedback.

6 (a) What type of feedback is employed in oscillators and what are the advantages? Discuss the conditions for sustained oscillations.
(b) Discuss and explain the basic circuit of an LC oscillator and derive the condition for the oscillations.
(c) A crystal has l = 0.1 H, C = 0.01 PF, R = 2 Ω and C $_M$ = 1 PF. Find the series resonance and Q-factor.

7 (a) Draw a practical circuit of a complimentary symmetry push pull amplifier circuit. Explain its function.
(b) State the expression relating the total output power 'P'; total harmonic distortion 'D' and the fundamental power 'P' in power amplifiers. If total distortion in the amplifier is 9%; calculate its contribution to the total power.

8 (a) Explain the working of a single tuned amplifier. Draw its frequency response.
(b) Derive the equation for the 3 dB band width of capacitance coupled single tuned amplifier.

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ELECTRONIC CIRCUIT ANALYSIS

(Common to EIE, E. Con. E & ECE)

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1 (a) Design a single stage emitter follower having R_i = 500 KΩ and R_o = 20 Ω. Assume h_{fe} = 50, h_{ie} = 1 K, h_{oe} = 25 μ A/V.

(b) For a single stage transistor amplifier, R_s = 5K and R_L = 10 K. The h-parameter values are h_{fe} = 50, h_{ie} = 1.1 KΩ, h_{re} = 2.5 x 10^{-4}, h_{oe} = 25μA/V. Find A_I, A_v, A_{vs}, R_i and R_o for the CE transistor configuration.

2 (a) Compare emitter follower and Darlington emitter follower configurations in respect of:
(i) Current gain. (ii) Input impedance
(iii) Voltage gain (iv) Output impedance.

(b) If four identical amplifiers are cascaded each having f_L = 100 Hz, determine the overall lower 3 dB frequency. Assume non interacting stages.

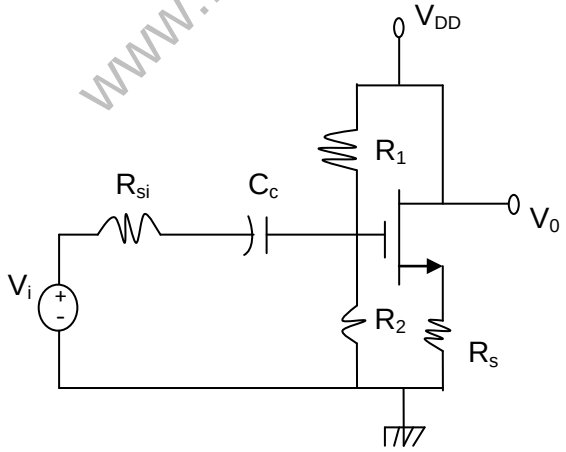
(c) Write a short note on Gain-Band width product of amplifiers.

3 (a) Derive the expressions for trans-conductance and input conductance of CE amplifier using HF model.

(b) The LF parameters of a transistor at I_c = 20 mA, V_{ce} = 10 V and at room temperature h_{ie} = 400, h_{oe} =10^{-5} A/V, h_{fe} = 150, h_{re} = 10^{-4}. At the same operating point f_T = 60 MHz and C_{ob} = 3 PF, compute the values of the entire hybrid – π parameters.

4 (a) Sketch a simple common drain amplifier circuit and discuss general ac circuit characteristics.

(b) Calculate the small signal voltage gain of the source follower circuit shown in figure. Assume the circuit parameters are V_{DD} = 12V, R_1 = 162 KΩ, R_2 = 463 KΩ and R_s = 0.75 KΩ. The transistor parameters are: V_{TN} = 1.5 V, K_n = 4 mA/V^2 and λ = 0.01 V^{-1}. Assume R_{si} = 4 KΩ.



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5 (a) A voltage series negative feedback amplifier has a voltage gain without feedback of A = 500, input resistance R_i = 3 K, output resistance R_o = 20 K and feedback ratio β = 0.01. Calculate the voltage gain, input resistance and output resistance of the amplifier with feedback.

(b) An amplifier has mid band gain of 125 and a bandwidth of 250 KHz.
(i) If 4% negative feedback is introduced, find the new bandwidth and gain.
(ii) If bandwidth is restricted to 1MHz, find the feedback ratio.

6 (a) What are the factors that affect the frequency stability of an oscillator? How frequency stability can be improved in oscillators?

(b) Find c and h_{fe} of a transistor to provide f_o of 50 KH_Z of an Rc phase shift oscillator, given R_1 = 22 kΩ, R_2 = 68 kΩ, R_c = 20 kΩ, R = 6.8 kΩ and h_{ie} = 2 kΩ.

(c) What is piezoelectric effect? Explain the working of crystal oscillator.

7 (a) Distinguish between large signal and small signal amplifiers.

(b) Compare the series fed and transformer coupled class – A power amplifiers. Why is the conversion efficiency doubled in transformer coupled class – A amplifier?

8 (a) Explain as to how you can increase the selectivity of single tuned amplifier. Draw the circuit diagram and explain its operation and also draw its frequency response.

(b) What is a stagger tuned amplifier and explain its working?

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ELECTRONIC CIRCUIT ANALYSIS

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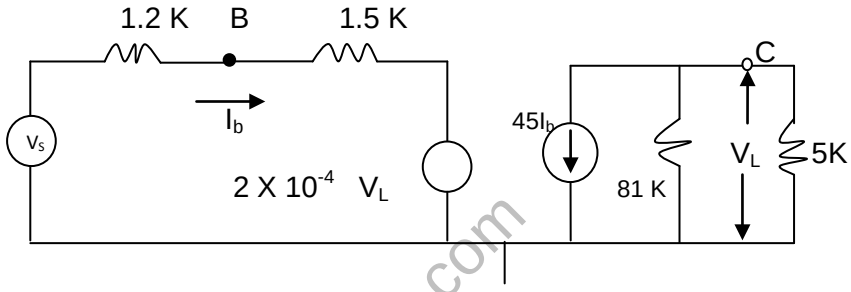
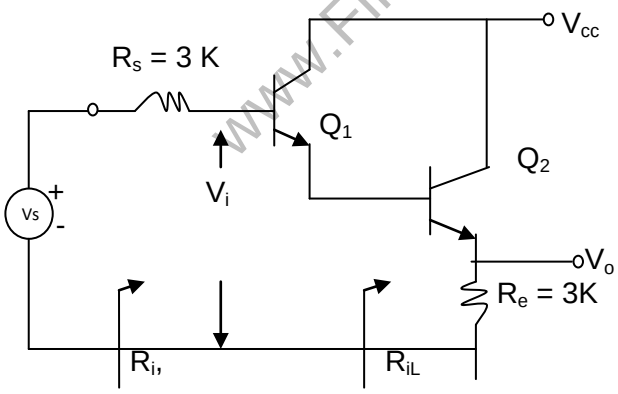
1 (a) For a single stage transistor amplifier, R_s = 10 K and R_L = 10 K. The h-parameter values are h_{fc} = -51, h_{ic} = 1.1 KΩ, h_{rc} = 1, h_{oc} = 25μA/V. Find A_I, A_V, A_{VS}, R_i and R_o for the CC transistor configuration.

(b) The small signal h-parameter ac equivalent circuit of a certain transistor connected in CE configuration is shown in figure. Calculate current gain, voltage gain, input impedance and output impedance by deriving the expressions for the above.



2 (a) Discuss the effect of emitter bypass capacitor and input & output coupling capacitors on the lower cut-off frequency if number of amplifiers is cascaded.

(b) For the circuit shown in figure, calculate R_i, A_i, A_v and R_o. Assume h_{ie} = 1.1 K, h_{fe} =50, h_{re} =2.5 x 10^{-4}, h_{oe} = 25μ A/v.



3 (a) Define f_α, f_β and f_T and derive the relation between f_β and f_T.

(b) Derive all components in the hybrid – π model in terms of h parameters in CE configuration.

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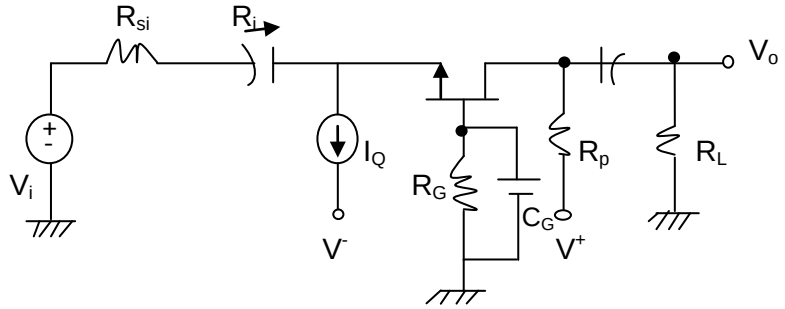
4 (a) Sketch a simple common gate amplifier circuit and discuss the general ac characteristics.

(b) For the circuit shown in figure, determine the output voltage for a given input current. The circuit parameters are: I_Q = 1MA, V^+ = 5V, V^- = -5V, R_G = 100 KΩ, R_D = 4 KΩ and R_L = 10 KΩ. The transistor parameters are: V_{TN} = 1 V, K_n = 1m A/V^2 AND λ = 0. Assume the input current is 100 sin wt μA and assume R_{si} = 50 KΩ.



5 (a) Explain the concept of feedback with block diagram.

(b) Define desensitivity. For large values of D, what is Af? What is the significance of this result?

(c) An amplifier has a voltage gain of 400, f_1 = 50 Hz, f_2 = 200 KHz and a distortion of 10 % without feedback. Determine the voltage gain f1f, f2f and Df when a negative feedback is applied with feedback ratio of 0.001.

6 (a) Classify different types of oscillators based on frequency range.

(b) Why RC oscillators are not suitable for high frequency applications?

(c) Show that the gain of Wien bridge oscillator using BJT amplifier must be atleast 3 for the oscillations to occur.

7 (a) A transistor in a transformer coupled (class – A) power amplifier has to deliver a maximum of 5 W to a load of 4 Ω load. The quiescent point is adjusted for symmetrical swing, and the collector supply voltage is V_{cc} = 20 volts. Assume V min = 0 volts:
(i) What is the transformer turns ratio?
(ii) What is the peak collector current?

(b) What is cross over distortion? How can a class – AB power amplifiers avoid cross-over distortion?

(c) What are the advantages and disadvantages of push pull configuration? Show that in class –B push pull amplifier the maximum conversion efficiency is 78.5%.

8 (a) Explain in detail how do you alter the bandwidth of an RF amplifier which is:
(i) Single tuned. (ii) Double tuned (iii) Stagger tuned.

(b) Explain the operation of a double tuned amplifier. Explain the advantages of double tuned circuit over single tuned circuit.

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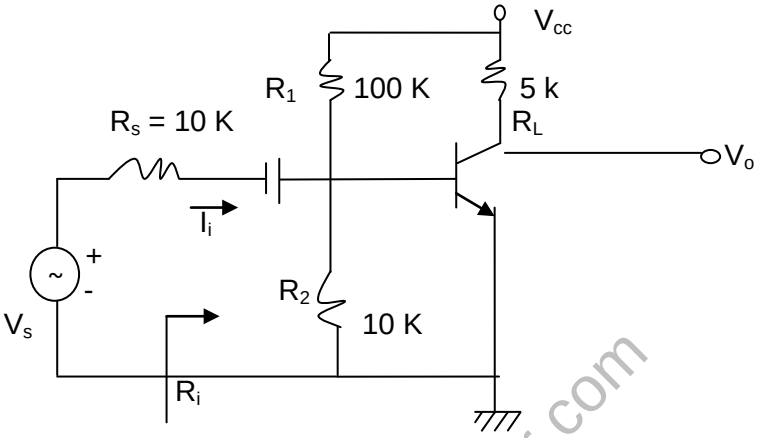
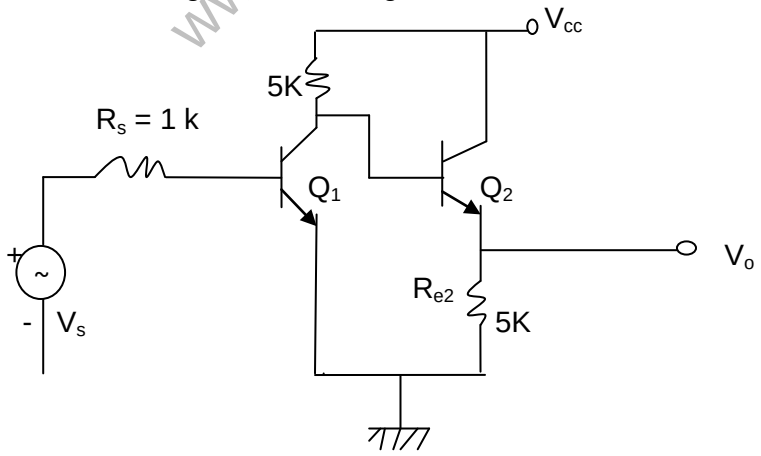
1 (a) The h-parameters of a transistor are h_{fe} = 50, h_{ie} = 1.1 KΩ, h_{re} = 2.5 x 10^{-4}, h_{oe} = 24 µA/V. Calculate A_I, A_V, A_{VS}, R_i and R_o shown in figure.



(b) List out the characteristics of CB amplifier and mention their typical values. Draw the basic CB amplifier circuit and its equivalent h-parameter model. Derive an expression for its R_i and R_o.

2 (a) How multistage amplifiers are classified depending upon the type of coupling?

(b) A two-stage amplifier circuit (CE – CC configuration) is shown in figure. The h-parameter values are h_{fe} = 50, h_{ie} =2 KΩ, h_{re} = 6 x10^{-4}, h_{oe} = 25 µA/V. h_{fe} = -51, h_{ic} = 2 KΩ, h_{rc} =1, h_{oc} = 25 µ A/V. Find the input and output impedances and individual, as well as overall voltage and current gains.



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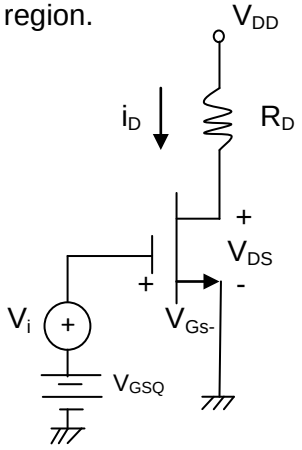
3 (a) Draw hybrid – π model for a transistor in the CE configuration and explain the significance of every component in this model.

(b) Draw the small signal equivalent circuit for an emitter follower stage at high frequencies. Derive expression for voltage gain.

4 (a) Compare the ac characteristics of the common source, source follower and common gate circuits.

(b) Determine the small signal voltage gain of a MOSFET circuit. For the circuit shown in figure, the parameters are: V_{GSQ}= 2.12 V, V_{DD} = 5 V, R_D = 2.5 KΩ. The transistor parameters V_{TN} = 1 V, K_n = 0.8 mA/V^2 and λ = 0.02 V^{-1}. Assume the transistor is biased in the saturation region.



5 (a) What are the different types of negative feedback? Briefly explain how the input and output impedances of an amplifier are affected by the different types of negative feedback.

(b) An amplifier has a voltage gain of 400, f_1 = 50 Hz, f_2 = 200 KHz and a distortion of 10% without feedback. Determine the voltage gain, f_{1f}, f_{2f} and D_f when a negative feedback is applied with feedback ratio of 0.001.

6 (a) Draw the circuit diagram of a RC phases shift oscillator using BJT. Derive the expression for frequency of oscillators.

(b) In a transistorized Hartley oscillator the two inductances are 2 mH and 20 µH while the frequency is to be changed from 950 KH_Z to 2050 KH_Z. Calculate the range over which the capacitor is to be vaired.

7 (a) Derive the expression for maximum collector power dissipation Pc (max) in the case of class B power amplifiers.

(b) Derive the expression, with necessary diagrams, to calculate the total harmonic distortion 'D' in power amplifiers using the five-point method of analysis.

8 (a) Why do we use tuned amplifiers in the IF and RF range?

(b) Derive the expression for bandwidth in terms of resonant frequency and quality factor in case of double tuned amplifiers.

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