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QUESTION BANK (DESCRIPTIVE)

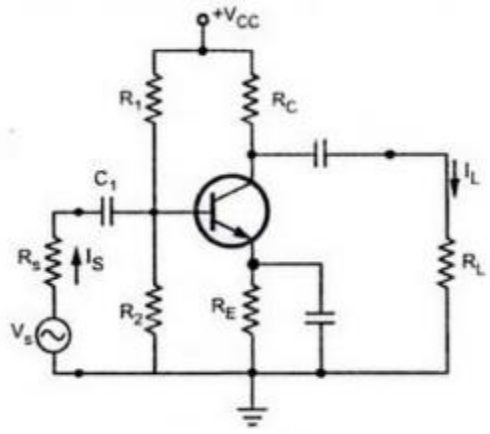
Subject with Code : Electronic Circuit Analysis (16EC407) **Course & Branch**: B.Tech - ECE

Year & Sem: II-B.Tech & II-Sem **Regulation:** R16

UNIT –I

SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER ANALYSIS

1. a) Why hybrid model is used for the analysis of BJT amplifier at low frequencies? Draw the hybrid model for CE transistor and derive the parameters. [6M]
   b) Compare the CE, CB and CC transistor amplifier parameters. [6M]
2. Using low frequency h-parameter model, derive the expressions for voltage gain, current gain, input impedance and output admittance for a BJT Amplifier in CE configuration. [12M]
3. a) With neat diagram, derive the CE amplifier parameters using approximate analysis. [6M]
   b) Obtain the expressions for current gain, voltage gain, input impedance and output impedance of CB amplifier using simplified hybrid model. [6M]
4. a) Determine the parameters A_i, R_i, A_v and R_0 of Emitter Follower using simplified hybrid model analysis. [6M]
   b) A voltage source of internal resistance R_s = 900Ω drives a CC amplifier using load resistance R_L=2000Ω. The CE h parameters are h_{fe}=60, h_{ie}=1200Ω, h_{oe} = 25μA/V and h_{re} = 2 x 10^{-4}. Compute A_i, R_i, A_v and R_0 using approximate analysis. [6M]
5. A CE amplifier is driven by a voltage source of internal resistance R_s = 800Ω and the load impedance of R_L=1000Ω. The h-parameters are h_{ie}=1k, h_{fe}=50, h_{oe} = 25μA/V and h_{re} = 2 x 10^{-4}. Calculate current gain, voltage gain, input impedance and output impedance using exact analysis and approximate analysis. [12M]
6. Consider a single stage CE amplifier with R_s = 1kΩ, R_1 = 50kΩ, R_2 = 2kΩ, R_c = 1kΩ, R_L = 1.2kΩ, h_{fe}=50, h_{ie}=1.1k, h_{oe} = 25μA/V and h_{re} = 2.5 x 10^{-4}, as shown in Fig. Find A_i, R_i, A_v, A_{vs}, A_{IS} and R_0. [12M]



7. a) Obtain the expression for current gain, voltage gain, input impedance and output impedance For Common Emitter Amplifier with Emitter Resistor. [6M]

   b) A CE amplifier is driven by a voltage source of internal resistance R_s = 1000Ω and the load impedance of R_C=2kΩ. The h-parameters are h_{ie}=1.3k, h_{fe}=55, h_{oe} = 22μA/V and h_{re} = 2 x10^{-4}. Neglecting biasing resistors, compute current gain, voltage gain, input impedance, output impedance for the value of Emitter Resistor R_E = 200Ω inserted in the emitter circuit. [6M]

8. a) Draw the circuit diagram of a single stage RC coupled Amplifier and discuss the steps used for designing it. [6M]

   b) Determine Voltage Gain, Current Gain, Input resistance and Output resistance for a CE amplifier using NPN transistor with h_{ie} = 1200Ω, h_{re} = 0, h_{fe} = 36 and h_{oe} = 2 x 10^{-6} mhos, R_L = 2.5kΩ and R_S = 500Ω (neglect the effect of biasing circuit). [6M]

9. Design a single stage RC coupled BJT amplifier for the following values. Assume that for Silicon transistor, V_{cc} = 10V, I_c = 4mA, h_{fe} = 100, h_{ie} = 1kΩ, R_{L-} = 100kΩ and f_L = 100Hz. [12M]

10. a) Draw the circuit diagram of JFET Common Source amplifier with voltage divider bias for bypassed R_s and determine the expression for input impedance, output impedance and voltage gain. [6M]

    b) Derive input impedance, output impedance and voltage gain of JFET Common Drain amplifier with neat diagram. [6M]

UNIT –II

SMALL SIGNAL HIGH FREQUENCY TRANSISTOR AMPLIFIER ANALYSIS

1. a) Draw the Hybrid-pi model and explain the significance of each and every component in it. [6M]
   b) Derive the expression for Hybrid- π capacitance of CE transistor at high frequency. [6M]
2. Derive the expressions for the hybrid π parameters g_m, $g_{b'e}$, $g_{b'c}$, $r_{bb'}$ and g_{ce}. [12M]
3. a) Mention the typical values of Hybrid- π parameters. [6M]
   b) A BJT $g_m = 38m℧$, $r_{b'e} = 5.9k\Omega$, $h_{ie} = 6k\Omega$, $r_{bb'} = 100\Omega$, $C_{b'c} = 12pF$, $C_{b'e} = 63pF$ and $h_{fe} = 224$ at 1 kHz. Calculate f_α, f_β and f_T cutoff frequencies. [6M]
4. With the help of necessary circuit diagrams and approximations obtain the expression for CE Short circuit current gain and derive the relation between f_β and f_T. [12M]
5. a) Discuss the dependency of hybrid-pi parameters upon collector current, V_{CE} and Temperature. [6M]
   b) A BJT has the following parameters measured at I_c=1mA, h_{ie}=3kΩ, h_{fe}=100, C_c=2pF and C_e=18pF. Find g_m, $r_{b'e}$, and $r_{bb'}$ for R_L=1 KΩ. [6M]
6. a) At I_c = 1mA and V_{CE}=10V, a certain transistor data shows $C_c = C_{b'c} = 3pF$, $h_{fe} = 200$ and w_T = -500 M rad/sec. Calculate g_m, $r_{b'e}$, $C_e = C_{b'e}$ and w_β. [10M]
   b) Define Unity Gain Frequency f_T. [2M]
7. Obtain the expression for Current gain with load resistor and explain the variation of frequency Response with R_L. [12M]
8. a) Short circuit CE current gain of a transistor is 25 at a frequency of 2MHz. If f_β = 200KHz Calculate (i) f_T (ii) h_{fe} (iii) Find $|A_i|$ at frequency of 10MHz and 100MHz. [6M]
   b) Derive the expression for cut off frequencies f_α, f_β and f_T. [6M]
9. a) Describe the relationship between low frequency h-parameters and high frequency Parameters. [8M]
   b) Write about Collector junction capacitance and Emitter junction capacitance of hybrid-pi model. [4M]
10. A transistor has $h_{ie} = 6k\Omega$ and $h_{fe} = 224$ at I_C = 1mA, with f_T = 80MHz and $C_{b'c}$ = 12pF. Determine g_m, $r_{b'e}$, $r_{bb'}$ and $C_{b'e}$ at room temperature. [12M]

UNIT –III

MULTISTAGE AMPLIFIERS

1. (a) Explain the classification of amplifiers. [6M]
   (b) Discuss the need of cascading amplifiers. [6M]
2. Describe different methods used for coupling multistage amplifiers with their frequency response. [12M]
3. Draw the block diagram of n-stage cascaded amplifier and analyze its various parameters. [12M]
4. Analyze Two stage RC coupled amplifier with neat diagrams. [12M]
5. With neat diagram explain cascode amplifier and derive the overall voltage gain of cascode amplifier. [12M]
6. a) What is Darlington Connection? Mention the advantages of Darlington Pair Amplifier.[4M]
   b) With diagram, derive the expression for current gain and input resistance of Darlington amplifier. [8M]
7. Explain how the input impedance is increased by Bootstrap Emitter Follower with neat diagram. [12M]
8. a) Explain the effect of cascading of amplifiers on bandwidth. [6M]
   b) An amplifier consists of 3 identical stages in cascade, the bandwidth of overall amplifier extends from 20 Hz to 20 kHz. Calculate the bandwidth of individual stage. [6M]
9. The following figure shows CE-CE cascade amplifier with their biasing arrangements. Calculate R_i, A_i, A_v, R_i', A_{vs} and A_{is} if circuit parameters are: R_s=1K, R_{c1} = 15K, R_{E1}= 100Ω, R_{C2} = 4 KΩ, R_{E2} = 330Ω with R_1 = 200K and R_2 = 20K for first stage and R_1 = 47K and R_2 = 4.7K for second stage. Assume that h_{ie} = 1.2kΩ, h_{fe} = 50, h_{re} = 2.5 x 10^{-4} and h_{oe} = 25 x 10^{-6} A/V. [12M]

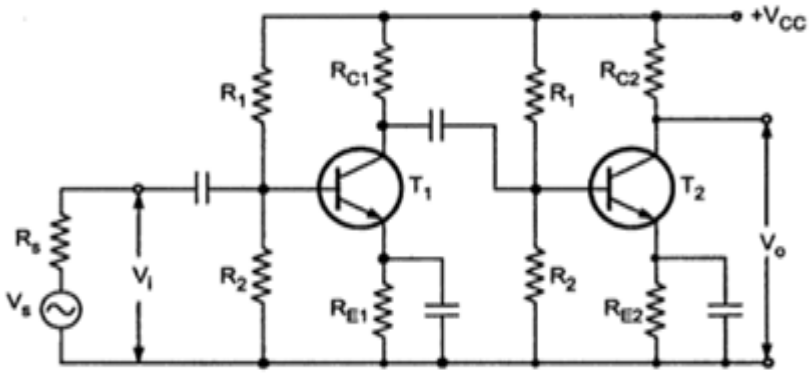
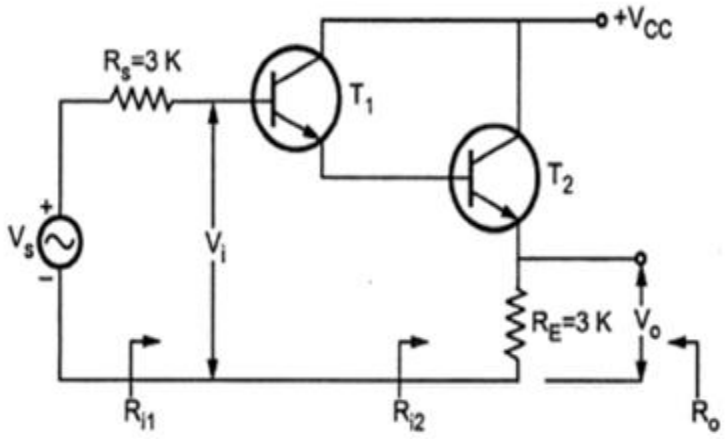


Fig. CE-CE Cascade amplifier

10. For the circuit shown in Fig. Calculate R_i, A_i, A_V and R_o. h_{ie}=1.1k, h_{fe}=50, h_{oe} = 25μA/V and $h_{re} = 2.5 \times 10^{-4}$. [12M]



UNIT –IV

FEEDBACK AMPLIFIERS AND OSCILLATORS

1. Explain the characteristics of negative feedback amplifiers. [12M]
2. a) Discuss Feedback topologies. [6M]
   b) An amplifier has an open loop gain of 1000 and a feedback ratio of 0.04. If the open loop gain changes by 10% due to temperature, find the percentage change in gain of the amplifier with feedback. [6M]
3. a) Derive the expressions of input and output resistances for Voltage Series FBA. [6M]
   b) Determine the input and output resistances of Current Shunt feedback amplifier. [6M]
4. a) Derive the expressions of input and output resistances for Voltage Shunt FBA. [6M]
   b) Determine the input and output resistances of Current Series feedback amplifier. [6M]
5. a) An amplifier has a voltage gain of 400, f_1 = 50 Hz, f_2 = 200kHz and a distortion of 10% without feedback. Determine the amplifier voltage gain, f_{1f}, f_{2f} and D_f when a negative feedback is applied with feedback ratio of 0.01. [6M]
   b) A voltage series negative feedback amplifier has a voltage gain without feedback of A = 500, input resistance R_i = 3kΩ, output resistance R_0 = 20kΩ and feedback ratio β = 0.01. Calculate the voltage gain A_f, input resistance R_{if}, and output resistance R_{of} of the amplifier with feedback. [6M]
6. a) State Barkhausen Criterion for oscillations. Explain the principle of operation of oscillator. [6M]
   b) Classify the different types of oscillators. [6M]

7. a) Derive the expression for frequency of oscillations for RC phase shift Oscillator. [6M]

   b) Discuss the working principle of Wein bridge oscillator and derive the expression for frequency of oscillations. [6M]

8. a) With neat diagram, explain Hartley Oscillator and derive the expression for frequency of oscillation. [6M]

   b) Discuss Colpitts Oscillator and obtain the expression for frequency of oscillation. [6M]

9. a) Give the general analysis of an LC Oscillator. [6M]

   b) Draw the equivalent circuit of a Quartz Crystal and explain its principle of operation with the help of neat circuit diagram. [6M]

10. a) Explain the concept of stability of Oscillators. [6M]

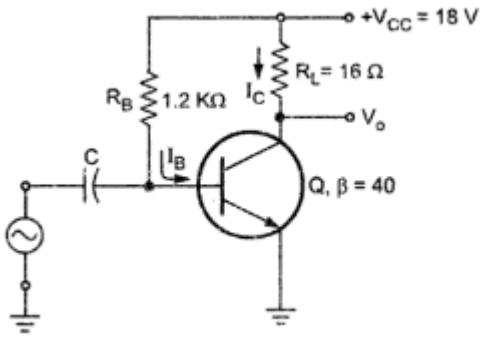
    b) In the Hartley oscillator, L_2 = 0.4mH and C = 0.004 µF. If the frequency of the oscillator is 120 kHz, find the value of L_1. Neglect the mutual inductance. [6M]

UNIT V

POWER AMPLIFIERS & TUNED AMPLIFIERS

1. a) With neat diagram explain Series fed, Directly coupled Class A Power Amplifier and derive its maximum efficiency. [6M]

   b) A series fed Class A amplifier shown if the Fig, operates from dc source and applied sinusoidal input signal generates peak base current 9mA. Calculate : (i) Quiescent current I_{CQ}, (ii) Quiescent voltage V_{CEQ}, (iii) DC input power P_{DC}, (iv) AC output power P_{AC} and (v) Efficiency. [6M]



2. a) Discuss with diagram, Transformer coupled Class A Power Amplifier and derive its Maximum efficiency. [6M]

   b) Explain second harmonic distortion by three point method. [6M]

3. a) Describe Higher order harmonic distortion by five point method. [6M]

   b) With neat diagram explain Push Pull Class B Power Amplifier and derive its maximum

efficiency. [6M]

4. a) Describe Complementary Symmetry Class B Power Amplifier with diagram and write about crossover distortion in class B power amplifiers. [6M]

b) A class B push pull amplifier supplies power to a resistive load of 12Ω. The output transformer has a turns ratio of 3:1 and efficiency of 78.5%. Obtain (i) Maximum power output, (ii) maximum power dissipation in each transistor and (iii) Maximum base and collector current. For each transistor, assume h_{fe} = 25 and V_{CC} = 20V. [6M]

5. a) Write notes on Class AB operation. [6M]

b) Discuss the need of Heat sink for power transistors. Mention about thermal stability of power transistors. [6M]

6. a) Compare Single Tuned and Double Tuned Amplifier. [2M]

b) Describe the operation of a single tuned capacitive coupled amplifier with diagram and derive the expression for its centre frequency, Quality factor, Voltage gain and bandwidth. [12M]

7. Discuss Double Tuned Amplifier with neat diagram and derive the expression for its bandwidth. [12M]

8. a) Explain the effect of cascading single tuned amplifiers on bandwidth. [6M]

b) The bandwidth of single tuned amplifier is 20kHz. Calculate the bandwidth if such three stages are cascaded. Also calculate the bandwidth for four stages. [6M]

9. a) With circuit diagram, explain the stagger tuning operation. Give necessary graph. [6M]

b) Explain the stability considerations of a tuned amplifier. [6M]

10. a) A single tuned RF amplifier uses a transistor with an output resistance of 50 KΩ, output capacitance of 15 pF and internal resistance of next stage is 20 kΩ. The tuned circuit consists of 47 pF capacitance in parallel with series combination of 1μH inductance and 2Ω resistance. Calculate resonant frequency, effective quality factor and bandwidth of the circuit. [6M]

b) Explain the advantages, disadvantages and applications of Tuned Amplifiers. [6M]

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