

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) Draw the circuit diagram and small signal model of Common Emitter amplifier. Derive expressions for its current gain, input resistance and voltage gain.
- b) The small-signal equivalent circuit of common emitter amplifier using h-parameters is shown in figure.1. If the transistor is connected in common base mode instead of common emitter mode in the circuit, keeping all other components unchanged, estimate overall voltage gain, overall current gain, input resistance and output resistance of the common base amplifier? [7+8]

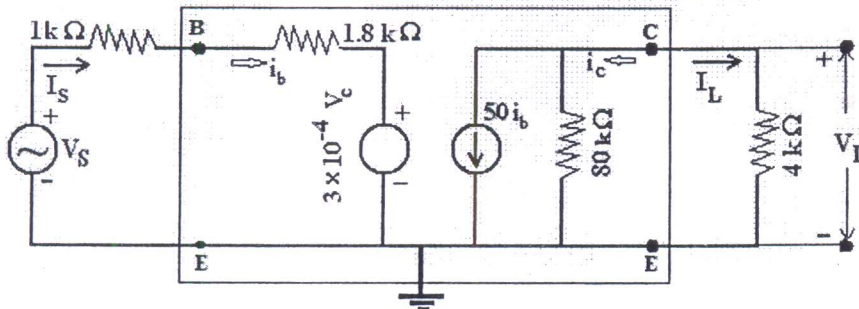


Figure.1

- 2.a) Draw the circuit diagram and small-signal model of high input resistance amplifier using Darlington-pair. Derive expressions for its overall current gain, voltage gain and input resistance?
- b) The first and second non-identical stages of a two-stage amplifier have the lower cut-off frequencies of 100 Hz and 200 Hz respectively. Their upper cut-off frequencies are 140 KHz and 100 KHz respectively. Find the overall 3-dB bandwidth of the amplifier? [10+5]
- 3.a) With the help of neat diagrams and necessary equations, explain the effect of coupling capacitor on the performance of an amplifier at low frequencies. Also derive the expression for lower 3-dB frequency established by the coupling capacitor?
- b) Draw the hybrid- π model of BJT. Describe each component in the model in detail. Also derive the expressions for input conductance, feedback conductance, output conductance and base-spreading resistance in the hybrid- π model? [7+8]
- 4.a) What is the purpose of diode connected load in MOSFET amplifiers? Draw the circuit diagram and small-signal model of common source MOSFET amplifier with diode connected load. Derive an expression for its voltage gain.
- b) In the common source amplifier shown in figure.2, the MOSFET has $I_{DSS} = 10\text{mA}$, $V_p = -8\text{V}$ and $r_d = 20\text{K}\Omega$. Assuming the capacitors C_1 and C_2 are very large, estimate the approximate voltage gain, input and output resistance of the amplifier? [8+7]

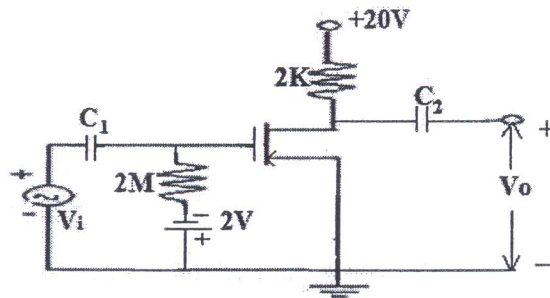


Figure.2

5.a) The block diagram shown in figure.3 is the topology of a feedback amplifier. Mention the

- i) Name of the feedback amplifier
- ii) Name of the basic amplifier
- iii) Name of the input signal, X_i
- iv) Name of the feedback signal, X_f
- v) Sampling and mixing techniques implemented
- vi) Expressions for R_{if} and R_{of} .

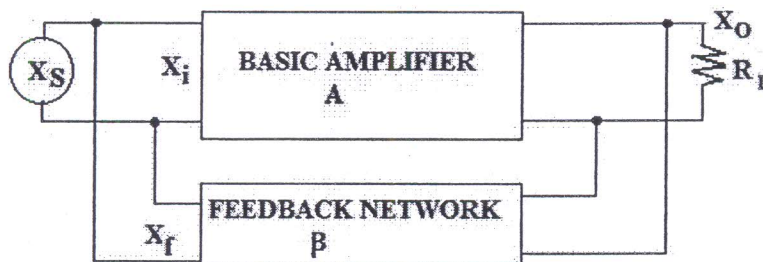


Figure.3

b) It is desired to reduce the total harmonic distortion of an amplifier from 8% to 2% by implementing 5% negative feedback. Estimate the gain of the amplifier with original distortion and with reduced distortion? [8+7]

6.a) Draw an RC oscillator to generate stable oscillations with variable frequency facility. Derive expression for its frequency of oscillation. Also show that the minimum gain required for maintaining oscillation is 3?

b) A Colpitts oscillator has a coil with an inductance of 50mH and is tuned by a capacitor of 300pF across the amplifier input and 100pF across the output. Find the frequency of oscillation and minimum for maintaining oscillation? [10+5]

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

b) A transformer-coupled class-A amplifier supplies 2W of power to speaker. If the supply voltage is 36V and I_{CQ} is 150mA, find the efficiency of the circuit. [10+5]

8.a) Explain the operation of a double-tuned amplifier with a neat sketch and obtain an equation for its gain-bandwidth product?

b) What is meant by parasitic oscillation in tuned amplifiers? How it can be suppressed? [12+3]

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