Code: 9A02405

1

B.Tech II Year II Semester (R09) Regular & Supplementary Examinations, April/May 2013

ANALOG ELECTRONIC CIRCUITS

(Electrical and Electronics Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Compare the small signal model of BJT and FET.

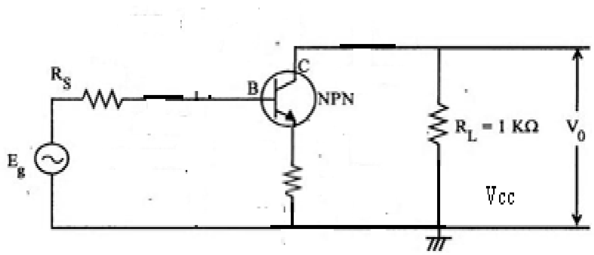
(b) For a CB transistor amplifier driven by a voltage source of internal resistance $R_s = 600\,\Omega$, the load impedance is a resistor $R_L = 1200\,\Omega$. The h-parameters are $h_{ib} = 22\ \Omega$, $h_{rb} = 4 \times 10^{-4}$, $h_{fb} = -0.98$ and $h_{ob} = 0.25\ \mu A/V$. Compute the current gain A_I, the input impedance R_i, voltage gain A_V, overall voltage gain A_{VS}, overall current gain A_{IS}, output impedance Z_o and power gain A_p.

2 (a) Sketch the frequency response of R-C coupled amplifier and explain the effect of emitter capacitance

(b) In an R-C coupled amplifier, AVM = 60, $f_L = 50$ Hz and $f_H = 100$ KHz. Find the values of frequencies at which the gain reduces to 50 on either side of midband region.

3 (a) Effect of feedback in the amplifiers frequency response and stability by its poles.

(b) The current series feedback type of transistor amplifier of figure shown has the following data of circuit constants: R_L= 1 kΩ, R_e = 100 kΩ, R_2 = 20 kΩ, R_1 = 30 kΩ, and h_{fe} = 100. Calculate A_v, R_i, R_{if}, A_{vf} and loop gain in dB. h_{ie}= 1 kΩ.



4 (a) What is meant by Barkhausen criterion and derive open loop and closed loop gains of an BJT amplifier.

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

5 (a) Explain about power amplifiers and its features.

(b) Derive an expression for efficiency of class-A amplifier.

6 (a) Explain the response of the clamping circuit when a square wave input is applied under steady state conditions.

(b) Explain the effect of diode characteristics on clamping voltage.

7 Derive the expression for collector to emitter voltage with R_B in base in series with V_{BB}.

8 Explain the method of unsymmetrical triggering of the binary with relevant circuit diagram.

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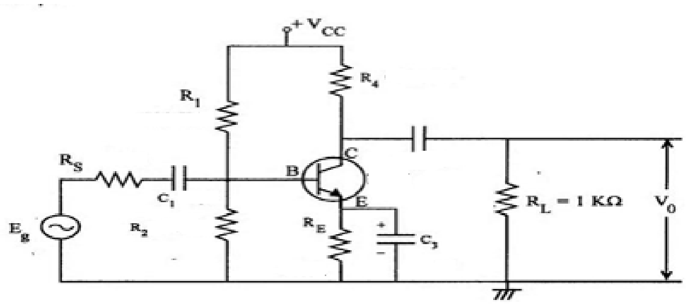
1 (a) Compare the performances of BJT and FET.

(b) Draw the AC equivalent circuit of a CE amplifier with un-bypassed emitter resistor using h-parameter model and derive the equations for input impedance, output impedance, voltage gain and current gain.

2 (a) Draw the high frequency π model of a transistor and explain it.

(b) For the CE amplifier in figure. Calculate the mid frequency voltage gain and lower 3-dB point. The transistor has h-parameters of h_{fe} = 400 and h_{ie} = 10 kΩ. The circuit details are R_S = 600 Ω, R_L = 5 kΩ, R_E = 1 kΩ, V_{CC} = 12 V, R_1 = 15 kΩ, R_2 = 2.2 kΩ and C_E = 50 µF.



3 Draw and explain voltage-shunt amplifier using h-parameter model, derive voltage gain, input resistance, output resistance and current gain closed loop and open loop.

4 Consider RC network in the FET phase shift oscillator. If R_o is the output impedance of the amplifier, derive that the frequency of oscillation f and the minimum gain A.

5 (a) Show that in the case of transformer coupled class A power amplifier, maximum theoretical efficiency is 50%.

(b) Compare series fed and transformer coupled class-A amplifiers.

6 (a) Explain double divide clipper using circuit and necessary waveforms.

(b) Give the applications of voltage comparators.

7 (a) Explain the variation in V_{BE} with temperature with the help of suitable waveform.

(b) Explain the temperature dependence of h_{FE}.

8 A collector coupled one shot using n-p-n silicon transistors has the following parameters: V_{CC} = 3 V, V_{BB} = 9 V, R = 2.7 kΩ, R_C = 270 Ω, R_1 = 1 kΩ, R_2 = 15 kΩ, C = 0.01 µF, h_{FE} = 25 and r'_{bb} = 100 Ω. Neglect saturation voltages. Calculate and plot the waveforms at each base and collector.

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1 (a) Classify the amplifier and discuss the distortion in BJT and FET amplifiers.

(b) Design a single stage dc coupled CE amplifier for the given specification: V_{CC} = 24 V, I_C = 1 mA and R_L = 120 kΩ.

2 (a) Explain the miller theorem and derive miller capacitance.

(b) Draw and explain the miller's high frequency equivalent circuit with resistive load for a NPN transistor.

3 (a) Define the amount of feedback in decibels and state the three fundamental assumptions which are made in order that the expression A_I / (1 + Aβ).

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

4 A crystal has the following parameters: L = 20 mH, C_1 = 65 μF, C_h = 1.0 pF and R = 4.5 kΩ. Find the series resonant frequency and Q-factor of the crystal. (i) Find the series resonant frequency. (ii) By what percent does the parallel resonant frequency exceed the series resonant frequency? (iii) Find the Q of the crystal.

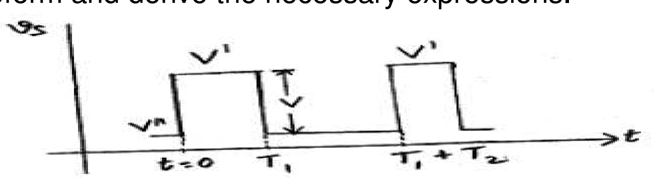
5 (a) Explain the reasons for harmonic distortion in push-pull power amplifiers.

(b) Derive the expression for the power of output signal having distortion.

(c) Calculate the transformer turns ratio required to match a 8 Ω speaker load to an amplifier so that the effective load resistance is 3.2 kΩ.

6 (a) State and prove clamping-circuit theorem.

(b) A square wave input as shown in figure below is applied to the clamping circuit. Sketch the steady-state output waveform and derive the necessary expressions.



7 (a) How transistor can be used as a switch in the circuit.

(b) A germanium transistor is operated at room temperature in the CE configuration. The supply voltage is 12 V, the collector-circuit resistance is 400 and the base current is 40 percent higher than the minimum value required to drive the transistor into saturation. Assume the following transistor parameters: I_{CO} = -10 μA, I_{EO} = -4 μA, h_{FE} = 200, and r_{bb0} = 500. Find V_{BE}(Sat) and V_{CE}(Sat).

8 Calculate the stable state currents and voltages for the self biased bistable multivibrator which uses n-p-n silicon transistors. The various parameters for the circuit are: V_{CC} = 12 V, R_1 = 30 kΩ, R_C = 4 kΩ, R_2 = 10 kΩ and R_E = 500 Ω.

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1 (a) Derive the voltage gain and input resistance of CG amplifier.
(b) Design a single stage DC coupled CE amplifier for the given specification: V_{CC} = 20 V, I_C = 1 mA and R_L = 100 kΩ.

2 Derive the voltage gain, input admittance and input miller capacitance of CD amplifier using its high frequency equivalent circuit.

3 (a) Explain with circuit diagram a negative feedback amplifier and obtain expression for its closed loop gain.
(b) An amplifier with stage gain 200 is provided with negative feedback of feedback ratio 0.05. Find the new gain.

4 Using Barkhausen criterion to the tuned drain oscillator and verify the following equation, and derive $g_m.w^2 = \frac{1}{LC}\left(1 + \frac{r}{r_d}\right)$.

5 (a) Define the conversion efficiency of a power amplifier A class? A power amplifier with a direct coupled load has a collector efficiency of 15% and delivers a power output of 5 Watts. Find:
(i) The DC power input. (ii) Power dissipation at maximum output.
(b) Draw the push-pull power amplifier circuit. Derive the expression for the output current in push pull amplifier with base current as $i_b = I_{bn}$ sin wt.

6 Explain the response of a low pass RC circuit to an exponential input and ramp input. Derive the required equations.

7 (a) Describe the switching times of BJT by considering the charge distribution across the base region. Explain this for cut off, active and saturation regions.
(b) Define the following terms:
(i) Storage time. (ii) Delay time. (iii) Rise time. (iv) Fall time.

8 Design and explain the fixed bias bistable multivibrator

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