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B028412(028)

B. Tech. (Fourth Semester) Examination, April-May 2021

(AICTE Scheme)

(Electronics & Telecommunication Engineering Branch)

ANALOG CIRCUITS

Time Allowed : Three hours

Maximum Marks : 100

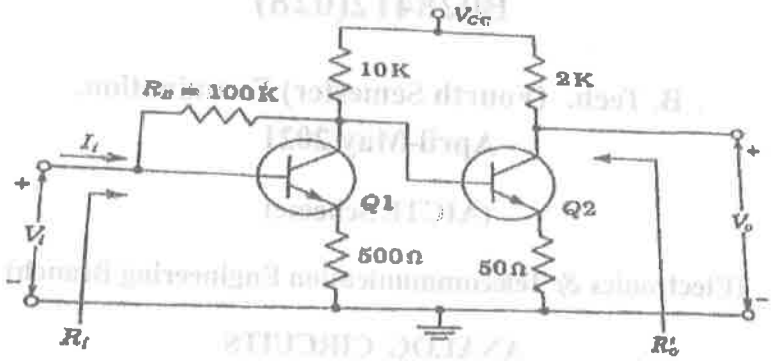
Minimum Pass Marks : 35

***Note** : All questions are compulsory. Part (a) of each question is compulsory and carries 4 marks. Attempt any **two** parts from (b), (c) and (d) from each question which carry 8 marks each. Assume any data if required or if found missing or misprint it with proper justification.*

Unit-I

1. (a) State Miller's theorem and Dual of Miller's theorem.

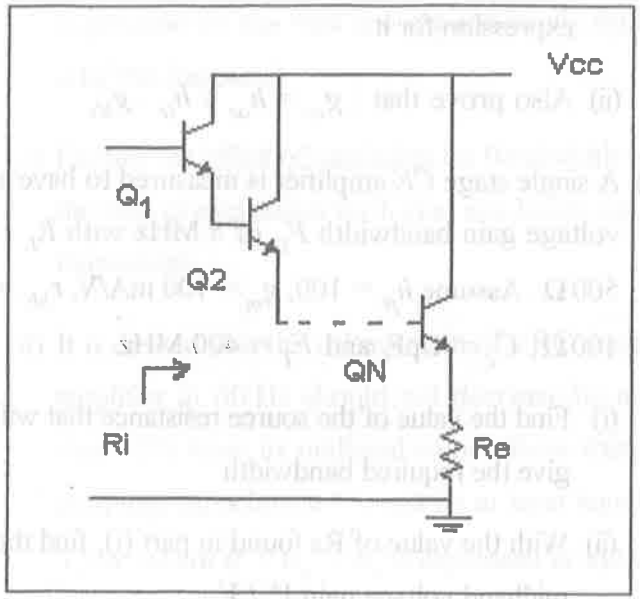
(b) For the two stage cascade shown find A_i, A_v, R_i and R_o'.



(c) (i) Show that the exact expression for h_{fb} in terms of CE hybrid parameters is :

$$h_{fb} = -\frac{h_{fe}\cdot(1-h_{re})+h_{ie}\cdot h_{oe}}{(1+h_{fe})\cdot(1-h_{re})+h_{ie}\cdot h_{oe}}$$

(ii) The cascade configuration shown is the tendem emitter follower. Find the input resistance R_i if $h_{ie} = h_{re} = h_{oe} = 0$ and h_{fe} is the same for each transistors Q_1 to Q_N.



(d) What is Darlington Pair Circuit? Why and where is it used? Derive expression for A_i and R_i for such a pair?

Unit-II

2. (a) What is the physical origin of the two capacitors in the hybrid $-\pi$ model? which one is having a greater magnitude and why? What is the order magnitude of each capacitance?

(b) (i) Define Transconductance g_m and derive the expression for it.

(ii) Also prove that : $g_{ce} = h_{oe} - h_{fe} \cdot g_{b'c}$

(c) A single stage *CE* amplifier is measured to have a voltage gain bandwidth F_H of 5 MHz with R_L = 500 Ω. Assume h_{fe} = 100, g_m = 100 mA/V, $r_{bb'}$ = 100 Ω, C_c = 1 pF, and F_T = 400 MHz.

(i) Find the value of the source resistance that will give the required bandwidth.

(ii) With the value of Rs found in part (i), find the midband voltage gain V_o / V_s.

(d) Analyse common emitter transistor amplifier at high frequencies for short circuit current gain. Also prove that $F_T = h_{fe} \cdot F_B$.

Unit-III

3. (a) Define the following types of distortion :

(i) Non-Linear Distortion

(ii) Frequency Distortion

(b) Explain the step response of an amplifier. Derive the expression for rise time and sag and briefly explain why this happens?

(c) Explain the effect of cascading on Bandwidth with the help of expression for higher and lower cut-off frequencies.

(d) It is desired that the voltage gain of a RC coupled amplifier at 60 Hz should not decrease by more than 10% from its midband value. Show that the coupling capacitance *C* must be at least equal to $5.5/R'$ where $R' = R_o' + R_l'$ is expressed in kΩ and *C* in microfarad.

Unit-IV

4. (a) Draw a feedback amplifier in one-line block diagram form. What is the relation between transfer gain with feedback A_f and that without feedback *A* for a negative feedback amplifier.

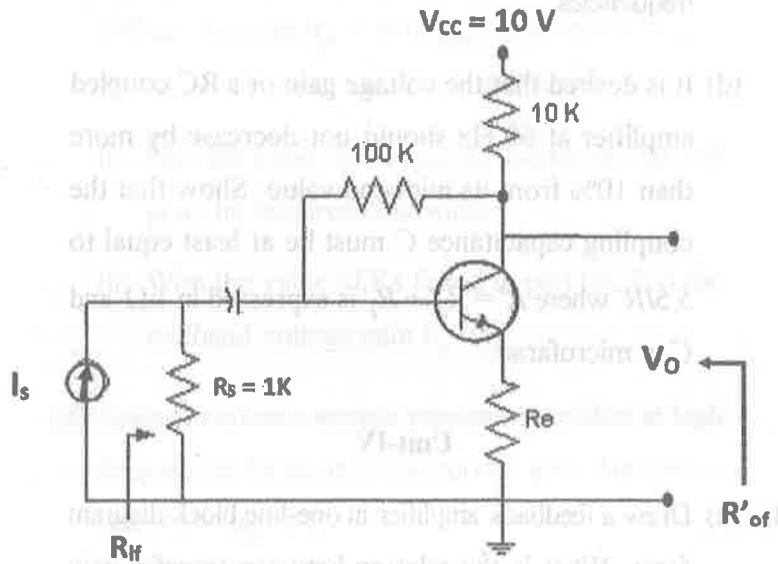
(b) For the transistor feedback amplifier stage shown, h_{fe} = 100, h_{ie} = 1 kΩ while h_{re} and h_{oe} are negligible. Determine with R_e = 0.

(i) $R_{Mf} = V_o / I_s$

(ii) $A_{Vf} = V_0 / V_s$

(iii) R_{if}

(iv) R_{of}



(c) What is the effect of negative feedback on input impedance of voltage shunt and current shunt amplifier?

(d) Enumerate the effects of negative Feedback on the various characteristics of the amplifier.

Unit-V

5. (a) Give the two Barkhausen conditions required in order for sinusoidal oscillations to be sustained.

(b) Draw the circuit and explain the working of Hartley oscillator using BJT. Write expression for frequency of oscillation.

(c) What is Weign bridge oscillator? Show that for such an oscillator gain of amplifier should be $A > 3$ to produce oscillations.

(d) What is piezoelectric effect? Draw and explain ac equivalent circuit of a crystal oscillator.