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# B028412(028)

## B. Tech. (Fourth Semester) Examination, April-May 2022

**(AICTE Scheme)**

**(Electronics & Telecommunication Engineering Branch)**

## ANALOG CIRCUITS

***Time Allowed : Three hours***

***Maximum Marks : 100***

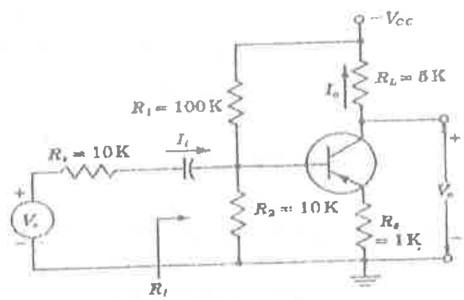
***Minimum Pass Marks : 35***

***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 suitable data whenever required.*

### Unit-I

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

(b) For the amplifier shown compute $A_I = \frac{I_0}{I_i}$, $A_v$, $A_{vs}$ and $R_i$.



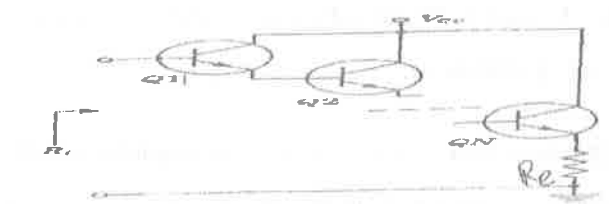

(c) (i) Show that the exact expression for $h_{fb}$ in terms of CE hybrid parameters is :

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

(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) Draw h-parameter equivalent circuit for a generalized transistorized amplifier and derive expressions for $A_i$, $A_v$, $R_i$.

## Unit-II

2. (a) What is the meaning of upper 3-dB frequency and lower 3dB frequency? Show it on frequency response.

(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) The following low frequency parameters are known for a given transistor at $I_C$ = 1.3 mA, $V_{CE}$ = 10 V at room temperature and h-parameters are $h_{fe}$ = 50, $h_{je}$ = 1100 Ω, $h_{re}$ = 2.5×10$^{-4}$, $h_{oe}$ = 24 μA/V. At the same point $F_T$ = 50 MHz, $CC$ =

3pF. Compute all the values of hybrid $\pi$ parameter of a CE transistor.

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

## 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. Briefly 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 $R' = R_o' + R_i'$ is expressed in k$\Omega$ and $C$ in microfarad.

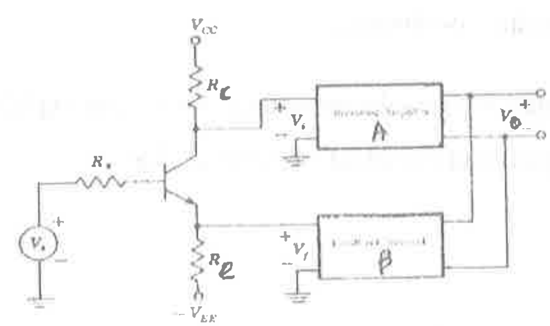
## Unit-IV

**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 circuit shown find the ac voltage $V_i$ as a function of $V_s$ and $V_f$. Assume that the inverting amplifier input resistance is infinite and that $A = A_v = -1000$.

$$\beta = V_f / V_0 = 1,\ R_e = R_c = R_c = 1K,$$

$$h_{ie} = 1\text{K},\ h_{re} = h_{oe} = 0,\ h_{fe} = 100.\ \text{Find } A_{vf} = V_0 / V_s.$$



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(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.