# 328453(28)



BE (4th Semester)

Examination, April-May, 2018

**(New Scheme)**

## Analog Electronics

*Time Allowed :* 3 hours *Maximum Marks :* 80

*Minimum Pass Marks :* 28

***Note :*** (*i*) Part (*a*) of each question is compulsory. Attempt any **two** parts from (*b*), (*c*) and (*d*) of each question.

(*ii*) The figures in the right-hand margin indicate marks.

**1.** (*a*) What are the effects of adding emitter resistor $R_E$ to the common emitter amplifier? [2]

(*b*) Show that the exact expression for $h_{fe}$ in terms of the CB hybrid parameter is

$$h_{fe} = -\frac{h_{fb}(1-h_{rb}) + h_{ib}h_{ob}}{(1+h_{fb})(1-h_{rb}) + h_{ob}h_{ib}}$$ [7]



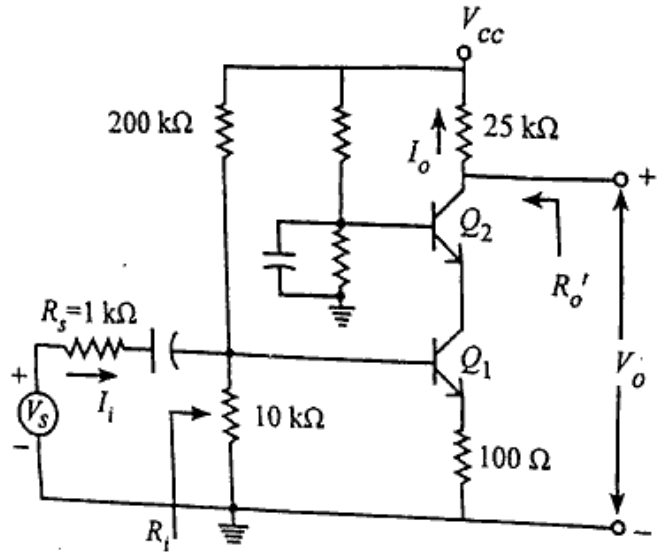






(*c*) State and prove Miller's theorem and its Dual. [7]

(*d*) Calculate $A_I = I_o / I_i$, $A_V$, $A_{V_s}$, $R_i$ and $R_o'$ for the cascade circuit shown. [7]




**2.** (*a*) What is $r_{b'b}$? How does it respond to temperature? [2]



(*b*) Prove that : [7]

(*i*) $h_{fe} = g_m r_{b'e}$ (*ii*) $h_{ie} = r_{b'b} + r_{b'e}$

(*iii*) $r_{b'c} = \frac{r_{b'e}}{h_{re}}$

(*c*) The following transistor measurements are made at $I_C$ = 5 mA, $V_{CE}$=10 V at room temperature, $h_{fe}$ = 100, $h_{ie}$= 600 Ω

$|A_{ie}|$ = 10 at 10 MHz, $C_C$ = 3 pF

Find $F_\beta$, $F_T$, $C_e$, $r_{b'e}$, $r_{bb'}$. [7]

(*d*) Derive the expression of $f_H$ for emitter follower at high frequencies. [7]

**3.** (*a*) Define rise time of an amplifier. How it is related with upper 3 dB frequency of the amplifier? [2]

(*b*) Prove that the bandwidth shrinks in cascading of identical non-interacting stages. [7]

(*c*) It is desired that the voltage gain of the 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 $R' = R_o' + R_i'$ and is expressed in kiloohms and $C$ in microfarads. [7]



(*d*) Show that the maximum conversion efficiency of the idealized class B push-pull amplifier circuit is 78.5%. [7]

**4.** (*a*) What is the effect of negative feedback on bandwidth of an amplifier? [2]

(*b*) How will the input impedance of an amplifier be effected by the introduction of

(*i*) voltage series feedback;

(*ii*) current shunt feedback? [7]

(*c*) Enumerate the effects of negative feedback on the various characteristics of the amplifier. [7]





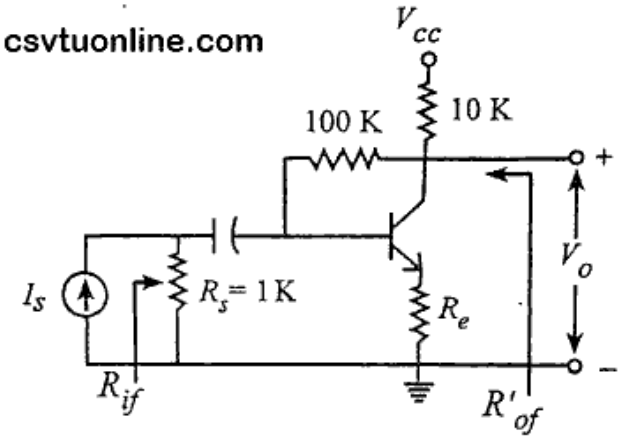


(*d*) For the transistor feedback amplifier stage shown $h_{fe} = 100$, $h_{ie} = 1$ K, while $h_{re}$ and $h_{oe}$ are negligible. Determine with $R_e = 0$

(*i*) $R_{mf} = \dfrac{V_o}{I_s}$, where $I_s = \dfrac{V_s}{R_s}$

(*ii*) $A_{vf} = \dfrac{V_o}{V_s}$ (*iii*) $R_{if}$ (*iv*) $R'_{of}$ [7]






**5.** (*a*) What are the essential conditions for maintaining oscillations? [2]

(*b*) Explain the operational characteristics of RC phase shift oscillator and prove that $h_{fe\,min} = 44.5$. [7]

(*c*) Draw the circuit of Wien bridge oscillator and explain its working principle. Derive the expression for frequency of oscillations. [7]

(*d*) Draw the circuit of Colpitts oscillator. How are the feedback requirements met in it? Derive the expression for frequency of oscillations. [7]

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