Paper Code: EEC-401 **Roll No.** | | | | | | | | | | |

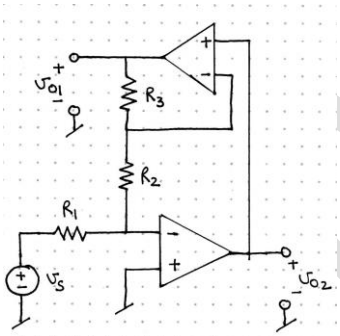
B. Tech.
(SEM. IV) Back Paper EXAMINATION, 2015-16
ELECTRONIC CIRCUITS

[Time: 3 hrs.] **[Max. Marks: 100]**

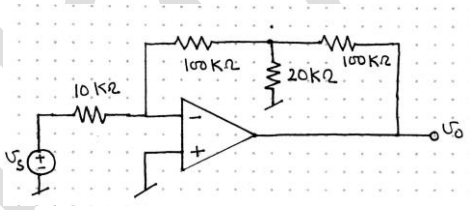
Note:- (1) Attempt all questions.
(2) All questions carry equal marks.

1. Attempt any four parts of the following:- **[5x4 =20]**

(a) Find expression for the voltage v_{o1} and v_{o2} in terms of v_s, R_1, R_2, and R_3 for the circuit in figure. The op-amps are ideal.



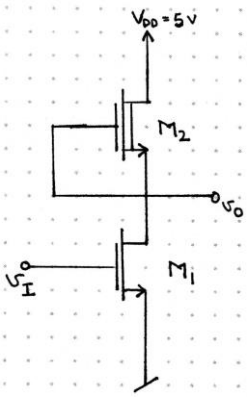
(b) Draw the integrator and differentiator circuit using op-amp and find out the transfer function.
(c) Draw and explain the operation of three op-amps instrumentation amplifier and find the expression for the output voltage.
(d) Describe how the performance of an op-amp is affected by the finite open loop gain of op-amp.
(e) Find the voltage gain, input resistance and output resistance for the circuit show in figure.



(f) Using op-amp draw the practical circuits of VCCS and CCCS. Justify your answer.

2. Attempt any four parts of the following:- **[10x2 = 20]**

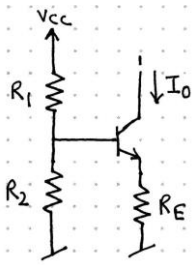
(a) Discuss the small signal model operation and small signal equivalent circuit model for the MOSFET.
(b) Derive an expression for the characteristics parameters of discrete MOS common gate amplifier.
(c) The transistor parameters are for M_1, V_{TH} = +0.8V and $k_n' = 40\mu A/V^2$, and for M_2, V_{TH} = -2V and $k_n' = 40\mu A/V^2$ and W/L = 1. Determine the W/L ratio for M_1 such that v_O = 0.15V when v_I = 5V.



3. Attempt any four parts of the following:- **[10x2 = 20]**

(a) Discuss merits and demerits of the different types of biasing used in BJT amplifier circuits. The circuit shown in figure provides a constant current I_0 as long as the circuit to which the collector is connected maintains the BJT in the active mode.

$$I_0 = \alpha \frac{V_{CC}[R_2/(R_1+R_2)]-V_{BE}}{R_E+(R_1||R_2)/(\beta+1)}$$



(b) Consider a common-emitter amplifier with emitter resistance and find the expression for the amplifier input resistance, overall voltage gain, output resistance, short circuit current gain.

(c) (i) Discuss the various internal capacitances in detail for BJT.
(ii) Draw the high frequency hybrid π model of BJT. Derive the expression given bellow:

$$f_T = \frac{g_m}{2\pi(C_\pi + C_\mu)}$$

4. Attempt any four parts of the following:- **[10x2 = 20]**

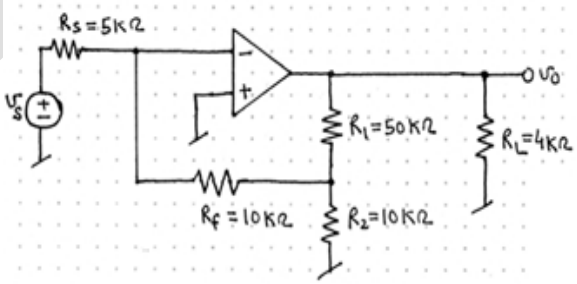
(a) What are the merits and demerits of the differential amplifier over the single ended amplifier? Draw and explain the operation of MOS differential amplifier with a common mode input voltage and find out the range of v_{cm} over which the differential pair amplifier operates properly.

(b) Derive an expression that show the effect on CMRR when the g_m mismatch in MOS differential amplifier.

(c) Derive an expression for BJT differential amplifier for
   i. Input differential resistance
   ii. Differential voltage gain

5. Attempt any four parts of the following:- **[10x2 = 20]**

(a) Enlist the merits and demerits of the negative feedback. The op-amp in the circuit in figure has an open loop differential voltage gain of $A_d=10^4$. Neglect the current into the op-amp, and assume the output resistance looking back into the op-amp is zero. Determine
   i. The close loop voltage gain $A_v= v_o/v_s$.
   ii. The input resistance R_{if} and
   iii. The output resistance R_{of}.



(b) Explain the working of a RC phase shift oscillator. Derive an expression for the frequency of oscillations. What are the merits and demerits of such oscillator?

(c) Write a short notes on any two of the following:
   i. Slew rate and full power bandwidth
   ii. Early effect and early voltage
   iii. LC oscillators