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10EC63/10EC638

Sixth Semester B.E. Degree Examination, Jan./Feb. 2021

Microelectronics Circuits

Time: 3 hrs. Max. Marks:100

Note: Answer any FIVE full questions, selecting THREE questions from Part-A and TWO questions from Part-B.

PART – A

1 a. Explain the implementation of biasing circuit by fixing V_G and connecting a resistance in the source with neat diagram. **(06 Marks)**

b. Design the circuit in Fig.Q1(b) to establish a drain voltage of 0.1V. What is the effective resistance between drain and source at this operating point. Let V_t = 1V, $K_n'\left(\frac{W}{L}\right) = 1\ mA/V^2$.

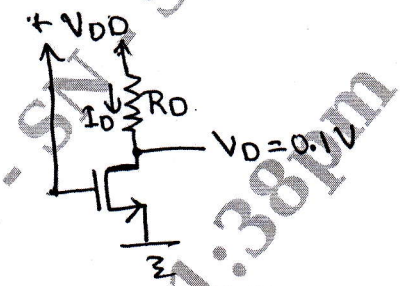

Fig.Q1(b) **(06 Marks)**

c. Explain common gate amplifier with neat circuit diagram and small signal equivalent circuit. **(08 Marks)**

2 a. Compare MOSFET and BJT in terms of :
(i) Low frequency hybrid π model
(ii) Current voltage characteristics
(iii) High frequency model **(06 Marks)**

b. With relevant equations and neat circuit diagram, explain working of MOS steering circuits. **(08 Marks)**

c. With neat diagram, explain working of basic MOS current mirror circuit. **(06 Marks)**

3 a. Draw high frequency equivalent circuit model of common source amplifier and analyze using Miller's theorem. **(08 Marks)**

b. Analyze common base amplifier to find R_{in} and R_{out}. **(07 Marks)**

c. How does cascade MOS current mirror improves the performance of current mirror circuit? **(05 Marks)**

4 a. With neat diagrams, explain small signal operation of MOS differential pair. Derive expression for differential gain. **(10 Marks)**

b. For circuit in Fig.Q4(b), the differential amplifier uses transistor with β = 100. Evaluate:
(i) Input differential Resistance R_{id}
(ii) Overall differential gain $\frac{V_0}{V_{sig}}$ (neglect effect of r_0)

(iii) The worst case common mode gain if the 2 collector resistances are accurate to within ±1%.

(iv) The CMRR in dB.

(v) The input common mode resistance (assume $V_A = 100$ V)

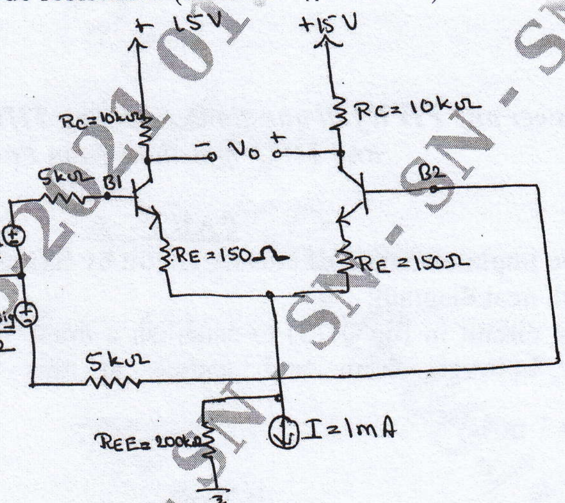

Fig.Q4(b) **(10 Marks)**

5 Write short notes on:
- a. T-equivalent circuit model of MOSFET
- b. Multistage amplifiers
- c. Source follower
- d. Current source **(20 Marks)**

PART – B

6 a. Explain the three properties of negative feedback. **(09 Marks)**
b. Draw and explain Nyquist plot of an unstable amplifier. **(05 Marks)**
c. With graph, explain how stability analysis is done using bode plot. **(06 Marks)**

7 a. With neat diagram, explain a single op amp difference amplifier and derive an expression for differential gain Ad. **(07 Marks)**
b. Briefly explain logarithmic amplifier and derive an expression for output voltage. **(08 Marks)**
c. Explain basic principle of sample and hold circuit using basic circuit. **(05 Marks)**

8 a. Write a short note on domino CMOS logic circuits. **(06 Marks)**
b. Implement $F = \overline{AB + \overline{A}\,\overline{B}}$ using AOI gate logic. **(08 Marks)**
c. Explain the Voltage Transfer Characteristics (VTC) of CMOS inverter when Q_N and Q_P are matched. **(06 Marks)**

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