

**Sixth Semester B.E. Degree Examination, Feb./Mar. 2022  
Microelectronics Circuits**

Time: 3 hrs.

Max. Marks: 100

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

**PART - A**

- 1 a. With neat diagram, derive an expression for drain current both in triode and saturation region. What happens to  $i_d$  if channel length modulation is considered? (10 Marks)
  - b. For an  $0.8\mu\text{m}$  technology for which  $t_{\text{ox}} = 15\text{nm}$ ,  $\mu_n = 550 \text{ cm}^2/\text{V}$ . Find  $k'_n$  and  $c_{\text{ox}}$  and the overdrive voltage  $V_{\text{ov}} = V_{\text{as}} - V_t$  required to operate a transistor having  $W/L = 20$  in saturation with  $I_D = 0.2 \text{ mA}$ . What is the minimum  $V_{\text{DS}}$  needed? (06 Marks)
  - c. Explain the operation of drain to gate feedback resistor circuit. List the merits and demerits. (04 Marks)
- 2 a. Draw the CG amplifier circuit, its equivalent circuit. Also derive the expressions for input resistance, output resistance, voltage gain, open circuit voltage gain and overall voltage gain. (10 Marks)
  - b. Using the equivalent circuit, find the values of  $R_{\text{in}}$ ,  $R_{\text{out}}$ ,  $A_v$ ,  $A_{v_o}$  and  $G_v$  for the circuit shown in Fig.Q.2(b).

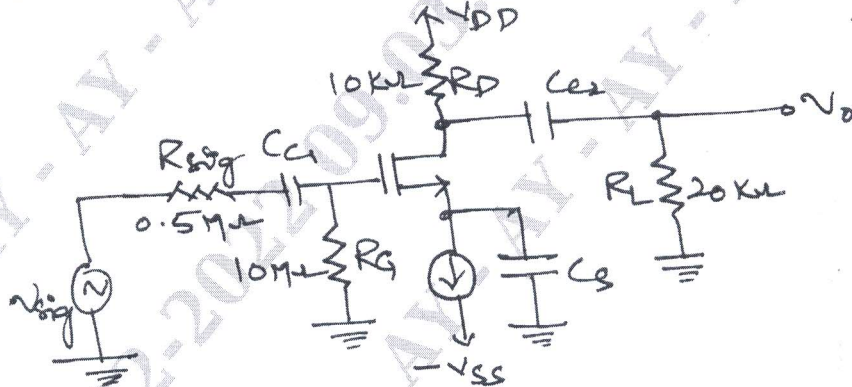


Fig.Q.2(b)

Assume  $g_m = 2\text{mA/v}$ ,  $r_o = 50\text{K}\Omega$

(10 Marks)

- 3 a. What is meant by current mirror? With a circuit and graph explain MOSFET current mirror circuit. (06 Marks)
- b. Explain briefly MOSFET current steering circuit. (10 Marks)
- c. Implement current source circuit using BJT. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. Define a cascade amplifier. Explain the small signal analysis of a MOS cascade amplifier with equivalent circuit diagram. (10 Marks)  
b. What is a Wilson current mirror? Analyze the circuit to determine its output resistance. (10 Marks)
- 5 a. Draw the circuit for MOS differential pair with a common mode input voltage and explain its working. (06 Marks)  
b. Show that CMRR is infinite in case of MOS differential amplifier when matched perfectly. (06 Marks)  
c. With a neat figure explain 4-stage bipolar opamp. (08 Marks)

**PART – B**

- 6 a. Explain the four basic feedback topologies. (06 Marks)  
b. Draw the ideal structure and equivalent circuit for the series-shunt feedback amplifier and explain it. (08 Marks)  
c. Write a note on the effect of feedback on amplifier poles. (06 Marks)
- 7 a. Derive the expression for closed loop gain in non-inverting opamp. (06 Marks)  
b. With neat circuit diagram, explain operation of instrumentation amplifier. (10 Marks)  
c. Design an inverting amplifier having a gain of -10 and input resistance of 100K $\Omega$ . (04 Marks)
- 8 a. Implement OAI gate for the function  $F = \overline{(A + B)(C + D)}$  (06 Marks)  
b. Explain charge sharing problem in dynamic 3-input NAND circuit. (10 Marks)  
c. Design domino 2-i/p AND gate with the help of basic domino logic circuit. (04 Marks)

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