# Question Paper

Exam Date & Time: 13-Dec-2022 (02:30 PM - 05:30 PM)

## MANIPAL ACADEMY OF HIGHER EDUCATION

Department of Instrumentation & Control Engineering
III Semester B.Tech. End Semester Examination, December 2022

**ANALOG ELECTRONIC CIRCUITS [ICE 2151]**

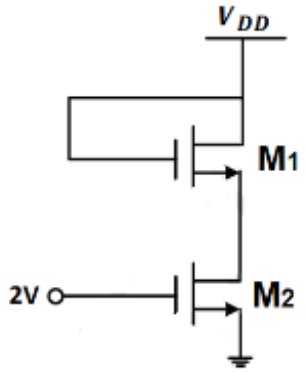
**Marks: 50** **Duration: 180 mins.**

**A**

**Answer all the questions.**

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) A) In the circuit shown below, both enhancement mode NMOS transistors have the following characteristics: $Kn = {}_nC_{ox}(W/L) = 1mA/V^2$; $V_{TH} = 1V$. Assume that the channel length modulation parameter λ is zero and body is shorted to source. Calculate the minimum supply voltage $V_{DD}$ (in volts) needed to ensure that transistor $M_1$ operates in the saturation mode. [CO1,BL3, PO2] (2)

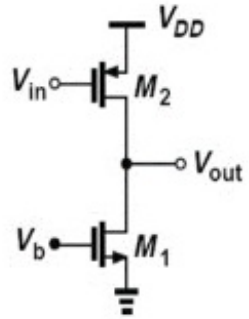



B) What are the different second order effects observed in a MOSFET? Describe with the help of suitable diagrams and necessary equations. [CO1,BL2,PO1] (4)

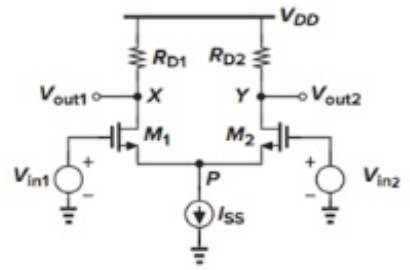
C) Define the need of cascode stage with suitable example and derive the expression of output impedance for cascode stage with the help of small signal model. [CO2, BL3, PO3] (4)

2) For the circuit shown below, compute the voltage gain using small signal analysis. [CO2, BL3, PO2] (2)

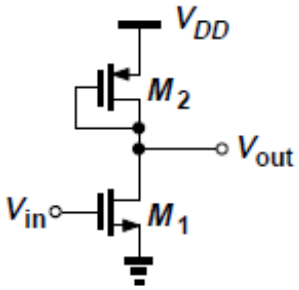
A)




B) Analyse the following circuit using half circuit method and calculate ($V_X$-$V_Y$) if $V_{in1} \neq V_{in2}$ and consider the effect of channel length modulation ($\lambda_1 = \lambda_2$) . [CO3, BL4, PO4] (4)



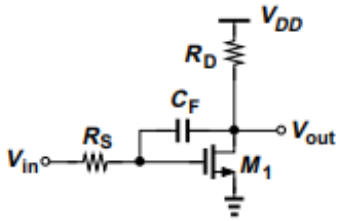

C) Identify and draw all of the capacitances in the following circuit and show the circuit with reduced capacitances. [CO3, BL4, PO3] (4)




3) State and explain Miller's theorem. [CO3, BL2, PO3] (2)

A)

B) Estimate the poles of the following circuit. [CO3, BL2, PO3] (3)




C) Find the pole frequencies of a common source amplifier (with $R_G$ and $R_D$), using Miller's approximation and plot it's frequency response using Bode's rules. [CO3, BL4, PO3] (5)

4) State and explain the properties of negative feedback system. [CO4, BL2, PO3] (2)

A)

B) Draw the ideal and realistic model for (a) transimpedance, (b) transconductance, and (c) current amplifiers. [CO4, BL3, PO3] (3)

C) Determine the closed-loop gain, input and output impedances of the voltage-voltage feedback topology and analyze the effect of feedback on the input and output impedances. [CO4, BL4, PO3] (5)

5) With suitable circuit diagram, derive an expression of differential gain for diode connected MOS differential pair. [ CO2, BL3, PO3] (3)

A)

B) Calculate the efficiency of Class B power amplifier for supply voltage of 20 V, with peak output voltage $V_L$ (p) = 6 V, and also calculate the efficiency of transformer coupled Class A amplifier for a supply voltage of 15 V with output voltage V(p) = 5 V. [CO5, BL3, PO2] (3)

C) With neat circuit diagram explain the operation of FET based phase-shift and Colpitts oscillators. (4)
[CO5, BL3, PO1]

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