**QP Code:EC2T01-1** **(Pages:3)**

Reg No : ..... Name : .....

**MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Third Semester B.Tech. Degree (SAY) Examination, February, 2026

Course Code: B24EC2T01

Course Name: ANALOG CIRCUITS 2

Max. Marks: 100 Duration:3 Hours

## PART - A: 30 Marks (10 Qns x 3 Marks)

**Answer all questions**

1. Draw the symbols of enhancement mode n channel and p channel MOSFETs by marking its terminals.
2. Write the expression for threshold voltage including body effect in a MOSFET.
3. Explain how a diode-connected MOSFET can act as an active resistor.
4. Explain why biasing by fixing $V_{GS}$ is not considered a good technique for MOSFETs.
5. Review the effects of the internal capacitors in the frequency response of a CS amplifier.
6. Compare between Common Source amplifier and Common Gate amplifier.
7. State the factors that limit the linear region in the transfer characteristic of a differential amplifier.
8. Define a differential amplifier and mention two of its main applications.
9. Examine the role of biasing in reducing crossover distortion.
10. What are the different types of distortions in a power amplifier?

## PART - B: 70 Marks (5 Qns x 14 Marks)

**Answer any One full question from each module.**

**Module 1**

11. a) Examine the key components of the low-frequency small-signal model of an NMOS transistor in the saturation region, and explain their physical significance. (7 marks)

    b) Discuss the differences between the low-frequency and high-frequency small-signal models of a MOSFET. (7 marks)

OR

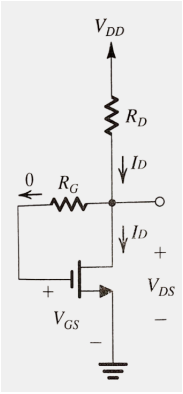
12. a) Derive the expression for drain current in different regions of operation of a MOSFET. (8 marks)

    b) An enhancement-type NMOS transistor with $V_t$= 0.7V has its source terminal grounded and a 1.5V DC applied to the gate. In what region does the device operate for i) $V_D$ = 0.5V ii) $V_D$ = 0.9V iii) $V_D$=3V (6 marks)

**Module 2**

13. a) Explain the working principle of MOSFET biasing with a drain-to-gate feedback resistor. (7 marks)

b) Design the circuit to operate at a DC drain current of 0.5mA. Assume $V_{DD}$=+5V, $k_n'$ W/L=1mA/$V^2$, $V_t$=1V and λ=0. Determine the values of $R_D$, $I_D$ and $V_D$. (7 marks)




OR

14. a) A simple N-channel MOSFET current mirror has a reference current of 50 μA, with both transistors having k' = 100 μA/V², $V_t$ = 0.7 V, and W/L = 10 for the reference transistor. Calculate the output current if the output transistor has W/L = 20. (8 marks)

b) Describe the impact of temperature variations on the performance of a simple MOSFET current mirror. How do changes in mobility and threshold voltage affect the output current? (6 marks)

**Module 3**

15. Derive the expression for input impedance, output impedance and voltage gain of Common Drain amplifier with active load with suitable diagrams.

OR

16. a) Compare the bandwidth performance of common-source, common-gate, and cascode amplifiers. (7 marks)

b) Explain the effect of load resistance on the bandwidth of MOSFET amplifiers and how it can be optimized. (7 marks)

**Module 4**

17. Derive an expression for the Common-Mode Rejection Ratio (CMRR) considering drain resistance mismatch.

OR

18. a) Discuss the trade-off between gain and bandwidth in CS and cascode amplifiers. Examine how cascode offer both high gain and wider bandwidth. (7 marks)

b) Discuss the effect of finite output resistance and finite tail current source resistance on the small signal gain. (7 marks)

## Module 5

19. a) Compare and contrast series-fed and Transformer-Coupled class A amplifiers in terms of power output, efficiency, and signal swing. (7 marks)

b) What is a class C amplifier? Discuss the limitations of class C amplifiers for use in audio frequency amplification. (7 marks)

OR

20. a) Explain the biasing condition of a Class C amplifier and why it conducts for less than 180° of the input signal. (7 marks)

b) Describe the method for calculating DC input power, AC output power, and power dissipation in a transformer-coupled amplifier. (7 marks)

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