Name:_____
Roll No:_____

MAR ATHANASIUS COLLEGE OF ENGINEERING KOTHAMANGALAM - 686666

(Govt. Aided Autonomous Institution)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B. TECH FIRST SERIES EXAMINATION, AUGUST 2026
(S3 ECE A &B) B24EC2T01 ANALOG CIRCUITS 2

Max. Marks: 40 Duration: 1.5 Hours

PART A

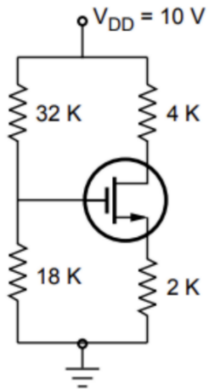
Answer all questions. Each question carries 3 marks.

1	Differentiate between Enhancement MOSFET and Depletion MOSFET.	CO1
2	Discuss the effect of source-to-body voltage on threshold voltage of a MOSFET.	CO1
3	An electric vehicle battery management system uses an NMOS transistor to control the connection between the battery pack and the power electronics. Depending on the gate voltage, the transistor either allows current to flow from the battery or disconnects the battery from the circuit. Given: $V_T = 2V$, $V_G = 10V$,$V_S = 6V$ · Identify the operating application of the NMOS transistor in this system. · Calculate the gate-to-source voltage (V_{GS}). · Determine whether the transistor conducts or remains OFF.	CO2
4	Describe the working principle of a MOSFET current source.	CO2

PART B

Answer all questions. Each question carries 14 marks.

5. a)	Discuss the drain characteristics of a MOSFET having channel length modulation.	CO1 6marks
b)	Consider the NMOS transistor circuit shown below. The MOSFET parameters are V_T=1V, k_n=0.5 mA/V^2. Assuming the MOSFET operates in the saturation region, determine V_{GS}, I_D, V_{DS}.	CO1 8marks



P.T.O

6. a) An engineer is designing a portable hearing aid where chip area must be minimized. Explain why a MOS transistor operating as an active resistor is preferred over a large polysilicon resistor. Using the small-signal equivalent model, derive an expression for its small-signal resistance when the MOSFET is having both body-effect and channel length modulation.

CO2

7 marks

b) A designer is developing the biasing circuit of an analog sensor interface IC. One branch of the circuit generates a stable reference current of 80 µA, while another branch requires a current of 240 µA derived from the same reference without using an additional reference circuit. The designer decides to use two matched NMOS transistors so that the output current is obtained by appropriately choosing the transistor dimensions.

CO2

7 marks

The reference transistor M_1 has:

- W_1=4 µm
- L_1=0.5 µm

The second transistor has the same channel length (L_2=0.5 µm)

Other parameters are:

- λ=0.04 V^{-1}
- V_{DS1}=0.8 V
- V_{DS2}=1.5 V

Identify the appropriate MOSFET circuit required for this application. Then determine the required width W_2 of transistor M_2 to obtain the desired output current.
