Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 19 / 12/ 2025 **Time: 01:00pm – 04:00pm**

School: School of Engineering	**Program:** B.Tech-ECE	
Course Code: ECE3043	**Course Name:** Mixed Signal Circuit Design	
Semester: Vth	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**26**	**26**	**24**	**24**	

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

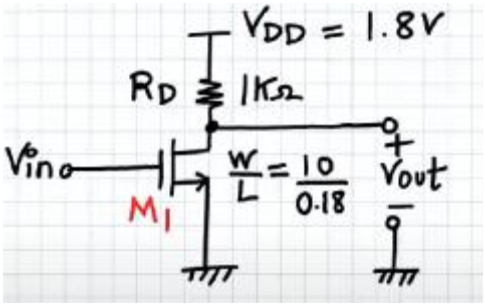
Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	In amplifiers, the small signal model of the device is of high importance. If NMOS has the trans-conductance of 20mA/V in saturation region. Calculate the ON resistance.	**2 Marks**	**L1**	**CO1**
2.	A folded cascode amplifier achieves high gain and large output swing by "folding" a current path from a common-source input to a common-gate output. Sketch the Large Signal Characteristics of folded Cascode.	**2 Marks**	**L2**	**CO1**
3.	Pole compensation is an electronics technique, that introduces a dominant pole into the system's open-loop gain to ensure stability and prevent oscillation in a closed-loop configuration. Mention the advantages and dis-advantages of dominant pole compensation.	**2 Marks**	**L1**	**CO1**
4.	A comparator is a device that compares two inputs and provides a digital output indicating their relative magnitudes. List the static and dynamic characteristics of comparator.	**2 Marks**	**L1**	**CO2**
5.	PLL refers to an electronic feedback control system that synchronizes a locally generated signal to an input signal. List the applications of PLL.	**2 Marks**	**L1**	**CO2**
6.	The switched capacitor resistor consists of one capacitor and two switches S_1 and S_2 which connects the capacitor alternately to the input. Differentiate between passive resistor and switch capacitor resistor.	**2 Marks**	**L1**	**CO2**

7.	Analog to digital parameter settings allows to tune the transceiver analog functions in the digital while designing high-speed serial protocol solutions. Define following performance parameters of D/A converters: a) settling time b) Sensitivity	**2 Marks**	**L1**	**CO3**
8.	An analog-to-digital converter is a device that converts continuous analog signals into discrete digital numbers. Describe the advantages and disadvantages of a dual-slope A/D converter.	**2 Marks**	**L2**	**CO3**
9.	A filter is a circuit that separates desired frequency components from a set of frequency. Draw the ideal and practical characteristics of band pass and band stop filter.	**2 Marks**	**L2**	**CO4**
10.	An active filter is a type of analog circuit implementing an electronic filter using active components. What is roll off rate of filter. Why higher order filters are needed?	**2 Marks**	**L2**	**CO4**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	The MOSFET, is a type of FET with an insulated gate that is assembled by the controlled oxidation of that semiconductor. Explain the working of N Channel Depletion type MOSFET. Why it is also called as D-E MOSFET.	**10 Marks**	L2	CO1
	b.	The resistance of the channel is inversely proportional to its width-to-length ratio; reducing the length leads to decreased resistance and hence higher current flow. Derive the expression of channel length modulation in saturation region.	**10 Marks**	L3	CO1
		Or			
12.	**a.**	A CS amplifier is a single-stage MOSFET amplifier used as a trans-conductance amplifier. Evaluate the small-signal voltage gain of the CS amplifier as shown in figure if I_D=1mA, $\mu_n C_{ox}$=100μA/V^2, V_{th}=0.5V and λ=0. Verify that MOFET is operating in saturation region. 	**10 Marks**	L3	CO1
	b.	The common-source (CS) amplifier, which uses the gate as its input terminal and the drain as its output. The source terminal is common to both the input and output in terms of the AC signal. Derive the Voltage Gain (Av), Input Impedance (Zi) and output impedance (Z_0) of Common Source Amplifier with RL (considering Channel Length Modulation).	**10 Marks**	**L3**	**CO1**

13.	**a.**	A Schmitt trigger is an electronic comparator circuit that converts noisy analog signals into clean digital square waves using two different voltage thresholds. Explain the working of Schmitt Trigger with hysteresis waveform.	**10 Marks**	L2	CO2
	b.	A phase-locked loop or phase lock loop (PLL) is a control system that generates an output signal whose phase is fixed relative to the phase of an input signal. Explain the working of Basic block diagram in PLL. Also define Lockin Range, Capture Range and Pullin Time	**10 Marks**	L2	CO2
		Or			
14.	**a.**	PLLs are circuits that keep the phase of the output synchronized with the phase of the input. Explain the Frequency Multiplication /Frequency Divison using PLL.	**10 Marks**	**L3**	**CO2**
	b.	A switched capacitor circuit is an electronic circuit that implements a function by moving charges into and out of capacitors when electronic switches are opened and closed. Explain the working of switch capacitor resistor circuit indicating phase diagram.	**10 Marks**	**L3**	**CO2**

15.	**a.**	An ADC converts a continuous-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude digital signal. Draw and explain the circuit diagram of parallel comparator type Analog to digital convertor.	**10 Marks**	**L3**	**CO3**
	b.	A digital-to-analog converter is an electronic device that converts a digital signal (0^s and 1^s) into a continuous analog signal, such as a voltage or current. The basic step size of a9 bit DAC is 10.3nV. If 000000000 represents 0V, what output is produced if the input is 101101111?	**10 Marks**	**L4**	**CO3**
		Or			
16.	**a.**	An ADC converts a continuous-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude digital signal. Explain the working of counter type A/D convertor with stair case waveform.	**10 Marks**	**L4**	**CO3**
	b.	A Digital-to-Analog Converter is required to convert digital audio files into analog signals that speakers and headphones can produce as sound waves. Calculate the value of LSB, MSB and full scale output for an 8 bit DAC for the 0 to 10V range.	**10 Marks**	**L4**	**CO3**

17.	**a.**	Second Order Filters which are also referred to as VCVS filters, because the op-amp is used as a Voltage Controlled Voltage Source amplifier, are another important type of active filter design. Derive the expression for second order low pass filter	**10 Marks**	L4	CO4
	b.	Second Order Filters consist of two RC filter sections cascaded together which attenuates unwanted signals more effectively than a first-order filter. Design a second order low pass filter for 2KHz	**10 Marks**	L4	CO4

		Or			
18.	**a.**	A band-pass filter is a circuit or device that allows signals within a specific frequency range (the passband) to pass through while blocking or attenuating signals with frequencies outside of that range. Derive the expression for second order Band pass filter.	**10 Marks**	L4	CO4
	b.	Bandpass filters are widely used in wireless transmitters and receivers. The main function of such a filter in a transmitter is to limit the bandwidth of the output signal to the band allocated for the transmission. Design a wide band pass filter with fL= 400Hz, fH= 2 kHz and a pass band gain of 4.Find the value Q of the filter.	**10 Marks**	L4	CO4