Roll No.											

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – March 2026

Date: 13- 03-2026 **Time:**11.45am to 01.15pm

School: SOE	**Program:** B. Tech. in ECE	
Course Code: ECE2501	**Course Name:** Linear Integrated Circuits	
Semester: IV	**Max Marks:** 50	**Weightage:** 25%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	26	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 2 marks. **5Q x 2M=10M**

1	Explain why open-loop op-amp configurations are not used in linear applications.	2 Marks	L2	CO2
2	List the three open-loop configurations of an operational amplifier and state which input terminal is grounded in the open-loop inverting amplifier configuration.	2 Marks	L1	CO2
3	An op-amp has an open-loop gain $A = 2 \times 10^5$ and output saturation voltages of $\pm 14V$. Calculate the linear input voltage range (differential input v_{id}) for which the output remains unsaturated.	2 Marks	L3	CO1
4	Differentiate between input bias current (I_B) and input offset current (I_{io}) in an op-amp. Give typical values for IC 741.	2 Marks	L2	CO1
5	Sketch the equivalent circuit of an ideal operational amplifier and briefly explain why the input resistance is shown as an open circuit and the output resistance as a short circuit.	2 Marks	L3	CO1

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	You are required to design an inverting amplifier using an op-amp with the following specifications: • Desired closed-loop voltage gain: $A_V = -15$ • Input resistance (seen from v_{in}) should be 5 kΩ • The op-amp is a 741C with $V_{CC} = +12V$ and $V_{EE} = -12V$ • Maximum expected input signal: $v_{in} = 0.5$ V peak at $f =$ 1 kHz (i) Choose suitable standard resistor values for R_1 and R_f to achieve the required gain while meeting the input resistance constraint. (ii) Calculate the output voltage expression for a sinusoidal input $v_{in}(t) = 0.5\sin(2\pi \times 1000t)$ V, and determine its peak value.	**10 Marks**	**L3**	**CO2**
	b.	An inverting amplifier has $R_1 = 4.7k\Omega$ and $R_f = 22k\Omega$. Calculate the output voltage, current through the resistors, the input current and the voltage gain for an input voltage of 1.5 V.	**10 Marks**	**L3**	**CO2**
		Or			
7.	**a.**	(i) Design an inverting summing amplifier circuit to perform the following mathematical operation: $\boldsymbol{V_o = -3V_1 - 5V_2}$ where V_1 and V_2 are DC input voltages. (ii) Sketch the complete circuit diagram of the inverting summing amplifier, labeling all components, inputs, outputs, and power supplies. (iii) Calculate the theoretical output voltage if $\boldsymbol{V_1 = 1.2V}$ **and** $\boldsymbol{V_2 = 0.8V}$.	**10 Marks**	**L3**	**CO2**
	b.	Sketch the circuit of an inverting adder with three inputs and determine (derive) an expression for the output voltage.	**10 Marks**	**L3**	**CO2**

8.	**a.**	**i**) In an open-loop inverting amplifier using a 741 op-amp with $\boldsymbol{A = 3 \times 10^5}$ and supply voltages $\boldsymbol{V_{CC} = +12V, V_{EE} = -12V}$, calculate the output voltage for: **(a)** $\boldsymbol{v_{in} = 25}$ **µV (DC)** **(b)** $\boldsymbol{v_{in} = 4\sin(2\pi \cdot 2000t)}$ **mV** ii) For case (b), sketch the input and output waveforms, indicating saturation limits.	**10 Marks**	**L3**	**CO1**
	b.	i) An op-amp has a differential gain $A_d = 1.2 \times 10^5$ and a common-mode gain $A_c = 0.05$. Calculate CMRR in dB. ii) If a differential input signal of 30 µV and a common-mode interference of 2 mV are applied simultaneously, find the output voltage.	**10 Marks**	**L3**	**CO1**

		iii) What should be the maximum common-mode interference allowed if the error at the output due to common-mode signal should be less than 2% of the desired differential output?			
		Or			
9.	**a.**	i) A 741 op-amp has a slew rate of 0.6 V/μs. What is the maximum frequency of a 12 V peak-to-peak sine wave that can be amplified without slew-rate distortion? ii) If the same op-amp is used as a voltage follower with an input step of 10 V, calculate the rise time (10% to 90%) of the output. iii) If the input is a square wave of $\pm$6 V at 40 kHz, will the output be distorted due to slew rate? Show calculations.	**10 Marks**	**L3**	**CO1**
	b.	i) The input bias current for a 741 op-amp is 600 nA and input offset current is 150 nA. Calculate the two input bias currents I_{B1} and I_{B2}. ii) If this op-amp is used in an inverting amplifier with $R_1 =$ 15 kΩ and $R_f =$ 150 kΩ, and the non-inverting input is grounded through a resistor R_2, find the value of R_2 to minimize the output offset voltage due to bias currents. iii) Calculate the output offset voltage due to input offset current alone after compensation.	**10 Marks**	**L3**	**CO1**