Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Make Up Examinations – December 2025

Date: 26 – 12- 2025 **Time:** 1.00pm to 04.00pm

School: SOE	**Program:** B. Tech.	
Course Code: ECE3001	**Course Name:** Linear Integrated Circuits	
Semester: MK	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	32	42	26		

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.	An operational amplifier is a multistage, direct coupled, high gain amplifier with two inputs and one output. Sketch the pin diagram of a $\mu A741$ operational amplifier.	**2 Marks**	**L2**	**CO1**
2.	Parameters of an op-amp give an idea about the op-amp when it is used in any electronic circuit. Define SVRR and state the value of this parameter for $\mu A741$ op-amp.	**2 Marks**	**L2**	**CO1**
3.	Parameters of an op-amp give an idea about the op-amp when it is used in any electronic circuit. Define voltage gain or large signal voltage gain and state the value of this parameter for $\mu A741$ op-amp.	**2 Marks**	**L2**	**CO1**
4.	The differential gain of an op-amp is 1×10^5 and the common mode gain is 0.001. Find the CMRR in linear scale and in dB.	**2 Marks**	**L2**	**CO1**
5.	An amplifier using an op-amp with a slew rate of $\frac{1V}{\mu s}$ has a gain of 40 dB. If this amplifier is to faithfully amplify sinusoidal signals from dc to 20 KHz, without any slew rate induced distortion, what is the maximum input that can be applied?	**2 Marks**	**L2**	**CO1**

6.	An op-amp with slew rate of $\frac{8V}{\mu s}$ is driven by a 250 kHz sine wave. What is the maximum output voltage at which slew rate limit is reached?	**2 Marks**	**L2**	**CO1**
7.	An n-bit flash ADC requires 2^n resistors and $2^n - 1$ comparators. How many resistors and comparators are required for a 3-bit flash ADC?	**2 Marks**	**L3**	**CO3**
8.	For a n–bit binary weighted resistor DAC, the range of resistors required will be $2^0R, 2^1R, 2^2R, \dots, 2^{n-1}R$. So, what different values of resistors would a 3–bit binary weighted resistor DAC require?	**2 Marks**	**L3**	**CO2**
9.	A voltage comparator is an electronic circuit which compares two input voltages. List the two types of voltage comparators.	**2 Marks**	**L3**	**CO3**
10.	A zero-crossing detector is a circuit which detects the time instants when an input voltage crosses zero. List the two types of zero-crossing detectors.	**2 Marks**	**L3**	**CO3**

Part B

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

11.	**a.**	An inverting amplifier is an amplifier using operational amplifier which provides a negative gain to the input signal applied. Design an inverting amplifier for a gain of -10	**10 Marks**	**L3**	**CO 2**
	b.	A subtractor or a difference amplifier is an electronic circuit which will subtract one signal from another signal. Draw the circuit diagram of a subtractor and derive the expression for its output voltage.	**10 Marks**	**L3**	**CO 2**
		Or			
12.	**a.**	A Schmitt trigger or a squaring circuit uses positive feedback. Draw the circuit diagram, input waveform, output waveform, and the transfer characteristics of an inverting Schmitt trigger. Also, derive the expression for the hysteresis voltage.	**10 Marks**	**L3**	**CO 2**
	b.	Design a non-inverting Schmitt trigger for a lower threshold point of -5V and an upper threshold point of 5V. Draw the input waveform, output waveform and the transfer characteristics if the input is a 20V peak to peak sine wave. Given $V_{CC} = 15V$.	**10 Marks**	**L3**	**CO 2**

13.	**a.**	A successive-approximation register ADC is a type of analog-to-digital converter that converts an analog voltage into its equivalent digital representation using a binary search through all possible quantization levels before finally converging upon a digital output for each conversion. Draw the block diagram of a successive-approximation register type ADC and explain its	**10 Marks**	**L3**	**CO 3**

		operation by considering the digital equivalent of the analog input data to be converted to be 1010.			
	b.	The R-2R ladder DAC requires only resistors with values R and 2R. Draw the circuit diagram of a 2-bit R-2R ladder DAC. Find the expression for the output voltage in each case and the general expression. Let $V_{ref} = -4V$, find the output voltage in each case.	**10 Marks**	**L3**	**CO 3**
		Or			
14.	**a.**	A 2-bit binary weighted resistor DAC will have the resistors R, 2R. A 3-bit binary weighted resistor DAC will have the resistors R, 2R, 4R. Draw the circuit diagram of a 2-bit binary weighted resistor DAC. Find the expression for the output voltage in each case and the general expression. Let $V_{ref} = -5V$, find the output voltage in each case.	**10 Marks**	**L3**	**CO 3**
	b.	An n-bit flash ADC requires 2^n resistors and $2^n - 1$ comparators. Draw the circuit diagram of a 2-bit flash ADC. Analyze all the four cases. Also, design the 3:2 Encoder present in a 2-bit flash ADC.	**10 Marks**	**L3**	**CO 3**

15.	**a.**	Draw the circuit of an inverting adder/summer with two inputs and derive an expression for the output.	**10 Marks**	**L3**	**CO 2**
	b.	A non-inverting amplifier has $R_1 = 10K\Omega$ and $R_f = 33K\Omega$. Find and plot the input and output waveforms when the input to the amplifier is a) $V_{in} = 2\sin(2000\pi t)$ b) $V_{in} = 10\sin(2000\pi t)$ The biasing of the op-amp is given as $V_{cc} = 15V, V_{EE} = -15V$.	**10 Marks**	**L3**	**CO 2**
		Or			
16.	**a.**	Design an op-amp circuit with inputs V_1 and V_2 such that $V_o = 4V_2 - 8V_1$. Also, draw the circuit diagram.	**10 Marks**	**L3**	**CO 2**
	b.	An inverting amplifier has $R_1 = 5K\Omega$ and $R_f = 25K\Omega$. Find and plot the input and output waveforms when the input to the amplifier is a) $V_{in} = 1\sin(1000\pi t)$ b) $V_{in} = 15\sin(1000\pi t)$ The biasing of the op-amp is given as $V_{cc} = 12V, V_{EE} = -12V$.	**10 Marks**	**L3**	**CO 2**

17.	**a.**	With a neat block diagram explain the different stages in an operational amplifier.	**10 Marks**	**L2**	**CO 1**
	b.	Explain any five characteristics of an op-amp. Also, write their typical values for an ideal op-amp.	**10 Marks**	**L2**	**CO 1**

		Or			
18.	**a.**	Explain the equivalent circuits of an ideal and practical op-amp with neat diagrams.	**10 Marks**	**L2**	**CO 1**
	b.	Explain negative feedback in op-amp. Also, write the two conditions of virtual ground.	**10 Marks**	**L2**	**CO 1**