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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22 | **Date**: 27th April 2022

Course Code: ECE 3001 | **Time**: 03:00 pm to 04:00 pm

Course Name: Linear Integrated Circuits | **Max Marks**: 30

Program & Sem: B. Tech., 4th Semester | **Weightage**: 15 %

Instructions:

(i) Read the all questions carefully and answer accordingly.

(ii) Use of scientific (non – programmable) calculators is permitted

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Part A [Memory Recall Questions]

Answer all the Questions. Each question carries 1 marks. (6Qx 1M= 6M)

1. Ideally, opamps has the ability to amplify any frequency signal from 0 to infinite Hz without attenuation, hence bandwidth of opamps is _____.

(a) Zero (b) 20 Hz (c) Infinite (d) Finite

(C.O.No.1) [Knowledge]

2. Slew rate is a parameter of opamps, which represent the performance of opamps. Hence, it is define as _____.

(a) $\frac{\Delta V0}{t}$ (b) $\frac{\Delta Vin}{t}$ (c) $\frac{\Delta V0}{\Delta t}$ (d) $\frac{\Delta Vin}{\Delta t}$

(C.O.No.1) [Knowledge]

3. The block diagram of opamps consists of various stages to perform the complete operation, the stage after intermediate stage is _____.

(a) Input stage (b) Level shifting (c) Output stage (d) No stage

(C.O.No.1) [Knowledge]

4. Opamps has two input terminals, one is inverting (-) the other one is non-inverting (+). If the (+) terminal of an inverting op-amp is connected to ground, the (–) terminal will _____.

(a) not need an input resistor (b) be virtual ground

(c) not invert the input signal (d) make input zero

(C.O.No.1) [Knowledge]

5. Ideally, open loop gain of opamp is infinite. To have a finite gain and to get a stabilized output the circuit should have a _____.

(a) negative feedback (b) positive feedback

(c) no feedback (d) both positive & negative feedback

(C.O.No.2) [Knowledge]

6. Input resistance and output resistance of open loop opamps are R_i and R_0 respectively. When a feedback is connected, the input impedance _____ and output impedance _____ by a factor $(1 + A_{OL}\ \beta)$.

(a) Decreases, Decreases (b) Decreases, Increase

(c) Increase, Increase (d) Increase, Decreases

(C.O.No.2) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries 7 marks. (2Qx7M=14M)

7. Opamps has the ability to suppress the commonness that are present at the inputs and produces the differential output with some gain. However, due to imperfection in the opamp IC µA741, it has a common mode input of 100 mV. Estimate the typical output voltage for this common mode input. Assume non-inverting amplifier with a voltage gain of 56 and CMMR for µA 741 is 90dB.

(C.O.No.1) [Comprehension]

8. Opamps have very good characteristics like high input impedance, high gain and low output impedance, hence many applications uses opamps in designing the circuits. It is required to have an audio amplifier where the output is invert of input signal. Discuss a suitable amplifier circuit to have a voltage gain of 28dB and output voltage of 2.5V. Use a 741 Opamp.

(C.O.No.2) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries 10 marks. (1Qx10M=10M)

9. Opamps are less sensitive to noise so it is preferred in designing audio mixer circuit. It is required to have a stereo mixer of combining various signals. Sketch a suitable circuit to perform this operation where it has three different signals each of 0.02V and design the circuit. Use a 741 Opamp in non-inverting configuration and assume gain of 20. Also, calculate input impedance and out impedance of the circuit.

(C.O.No.2) [Application]

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TEST 2

Winter Semester: 2021 - 22 | **Date**: 2nd June 2022

Course Code: ECE 3001 | **Time**: 03:00 pm to 04:00 pm

Course Name: Linear Integrated Circuits | **Max Marks**: 30

Program & Sem: B. Tech(ECE), 4th Semester | **Weightage**: 15 %

Instructions:

(i) Read the all questions carefully and answer accordingly.

(ii) Use of scientific (non – programmable) calculators is permitted

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Part A [Memory Recall Questions]

Answer all the Questions. Each question carries ONE mark. (6Qx 1M= 6M)

1. For linear application of opamps, it uses a negative feedback. Mention the application of opamps, which does not have feedback_____.

(a) Voltage Comparator (b) Voltage Amplifier (c) Schmitt Trigger (d) Current Amplifier

(C.O.No.3) [Knowledge]

2. The most commonly used Instrumentation amplifiers consist of three op-amps. The op-amps 1 & 2 of the instrumentation amplifier are _____ amplifiers and together they form an input stage.

(a) Difference Amplifier
(b) Non-Inverting Amplifier
(c) Inverting Amplifier
(d) Summing Amplifier

(C.O.No.2) [Knowledge]

3. Schmitt trigger devices are typically used in signal conditioning applications to remove noise from signals used in digital circuits. A Schmitt trigger is _____.

(a) A Comparator with only one trigger point
(b) A Comparator with three trigger points
(c) A Comparator with hysteresis
(d) A Non-comparator with hysteresis

(C.O.No.3) [Knowledge]

4. An active filter generally uses an operational amplifier within its design and we know that an op-amp has a high input impedance, a low output impedance. Find out the incorrect statement about active and passive filters.

(a) Gain is not attenuated in active filter (c) Active filter does not cause loading of source

(b) Passive filters are less expensive (d) Passive filters are difficult to tune or adjust

(C.O.No.3) [Knowledge]

5. Advantage of an active filter is that they are economical or cost-effective. Unlike passive filter circuits, Active Filter Circuits require power supply. A filter that has two stop bands_____.

(a) Low Pass Filter (c) only Band Elimination Filter

(b) High Pass Filter (d) Band Elimination Filter & Band Pass Filter

(C.O.No.3) [Knowledge]

6. An instrumentation amplifier is usually employed to amplify low-level signals, rejecting noise and interference signals. Which of the following is a desirable quality of an instrumentation amplifier

(a) High Output Impedance (c) High Input Impedance

(b) A CMRR of zero (d) Able to vary gain using two controls

(C.O.No.2) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries SEVEN marks. (2Qx7M=14M)

7. The practical difference amplifier circuit amplifies the common mode signal, whereas in instrumentation amplifier, common mode signals will be passed at the output but it is not amplified. Illustrate with circuit diagram and proper functioning of instrumentation amplifier.

(C.O.No.2) [Comprehension]

8. Communication system uses filters to tune the radio signal and to suppress the noise. It is required to have a low pass filter at the receiver of FM radio. Compute the various components used in the 1st order low pass active filter circuit to have a cutoff frequency of 12KHz with a gain of 5. Use 741 Opamp with $V_{CC} = \pm 15V$

(C.O.No.3) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries TEN marks. (1Qx10M=10M)

9. Operational amplifiers are particularly versatile circuit blocks. They find applications in a host of different circuits where their attributes of high gain, high input impedance, low output impedance and a differential input enable them to provide a high performance circuit with a minimum of components. Mr. Praise wired a circuit to have a UTP = +4V, and LTP = -6V using 741 Opamp with $V_{CC} = \pm 15.7V$. Compute the design of Non-Inverting Schmitt Trigger. (C.O.No.3) [Application]

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

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SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021 - 22
Course Code: ECE 3001
Course Name: Linear Integrated Circuits
Program & Sem: B. Tech., 4th Semester

Date: 4th July 2022
Time: 09:30 AM to 12:30 PM
Max Marks: 60
Weightage: 30%

Instructions:
(iii) Read the all questions carefully and answer accordingly.
(iv) Use of scientific (non – programmable) calculators is permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries 01 marks. (9Qx 1M= 9M)

1. Gain in dB is a very useful unit when dealing with very high gains. If an amplifier has a gain of 1000, the corresponding gain in dB will be _____. (C.O.No.1) [Knowledge]
2. Inverting and non-inverting amplifiers are the basic applications that can be develop using operational amplifiers. The phase difference between the input and output of an inverting amplifier will be _____. (C.O.No.2) [Knowledge]
3. Opamps have many applications such as amplifier, integrator, differentiator, summer, etc. In a basic integrator circuit, the element in the feedback will be a (an) _____. (C.O.No.2) [Knowledge]
4. An inverting summing amplifier with gain 1 has different input voltages: 1.2V, 3.2V and 4.2V. Find the output voltage _____. (C.O.No.2) [Knowledge]
5. Communication systems use filters to suppress undesired signals to pass through. The gain of the third order low pass filter in stop band decreases by _____ dB/decade. (C.O.No.3) [Knowledge]
6. To a Schmitt trigger in non-inverting configuration an input triangular wave of $1V_{P-P}$ is applied. What will be the output waveform, if the upper and lower threshold voltages are 0.25V? (C.O.No.3) [Knowledge]
7. R-2R ladder DAC circuit is most commonly used to converts digital data to analog signals. A 3-bit ladder has a digital input of 110, V_{ref} of +10V. Its output voltage will be _____. (C.O.No.3) [Knowledge]
8. The 555 timer is a linear IC. It has various components, such as comparators, RS flip flop, etc. The 555 IC timer has _____ number of comparators. (C.O.No.3) [Knowledge]
9. SAR ADC circuit is fast and more reliable analog to digital converter. It consists of various components such as latch, R-2R etc. The purpose of Latch in the SAR ADC circuit is _____. (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries 07 marks. (3Qx7M=21M)

10. Opamps have very good characteristics like high input impedance, high gain and low output impedance, hence many applications uses opamps in designing the circuits. It is required to have an audio amplifier where the output is invert of input signal. Estimate an inverting amplifier circuit to have a voltage gain of 28dB and output voltage of 2.5V. Use a 741 Opamp. (C.O.No.2) [Comprehension]
11. Opamps are less sensitive to noise so it is preferred in designing audio mixer circuit. It is required to have a stereo mixer of combining various signals. Sketch a non-inverting summing amplifier circuit to perform mixing of analog signals where it has three different signals using 741 Opamp in non-inverting configuration. (C.O.No.2) [Comprehension]
12. Processing and storing of Analog signals are very is difficult compare to Digital signals. Many applications use analog signals that have to be process before using. Conversion of these analog signals to digital signal is required. Discuss 8-bits SAR ADC circuit with diagram to have fast and more reliable analog to digital converter. (C.O.No.3) [Comprehension]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries 10 marks. (3Qx10M=30M)

13. Signal generators are required in testing and characterization of electronic circuits. A device requires a symmetrical square wave for its operation. It is required to have a frequency of 1 KHz of symmetrical square wave for this device to operate. Illustrate a suitable circuit with proper design values for its components using Opamps to generate a symmetrical square wave. Assume that the power supply for Opamp is $\pm$ 10V. (C.O.No.3) [Application]
14. Operational amplifiers are particularly versatile circuit blocks. They find applications in a host of different circuits where their attributes of high gain, high input impedance, low output impedance and a differential input enable them to provide a high performance circuit with a minimum of components. Solve all the values of circuit components used in a non-inverting Schmitt with a suitable diagram, which has trigger points of $\pm$ 4V with a power supply of $\pm$15V. (C.O.No.3) [Application]
15. Multiple key press detector system uses a circuit that produces a suitable analog voltage for every switch pressed. Consider a key pressed detector system has three switches S2, S1 & S0. Compute the analog output voltage produced by R-2R DAC circuit which is present in key pressed detector system for the following keys pressed (i) S2 & S1 (ii) S2 & S0 along with suitable diagram. Assume the V_{ref} as 8V. (C.O.No.3) [Application]