Technology Enabled Learning

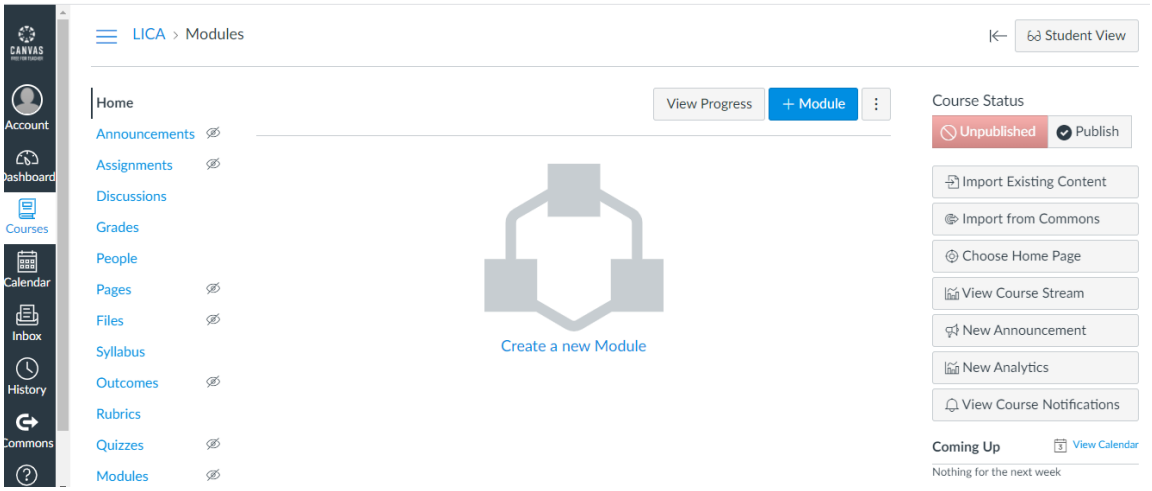
(*Dissemination of content through course sites, Use of LMS tools*)

Course Name: **Linear Integrated Circuit Applications** Year of Study: **2016-17**

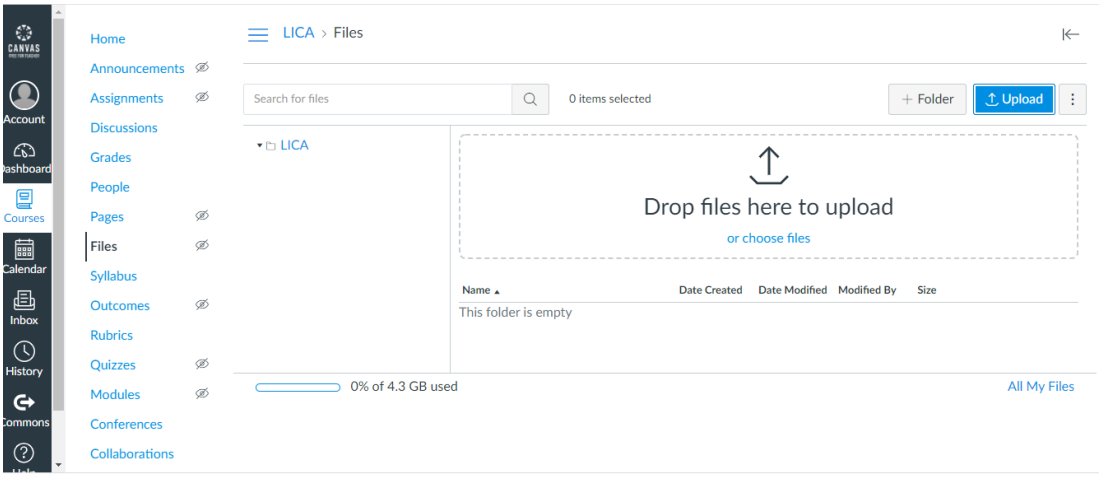
Year/Sem: **III/I** Platform of LMS tool used: **Canvas**

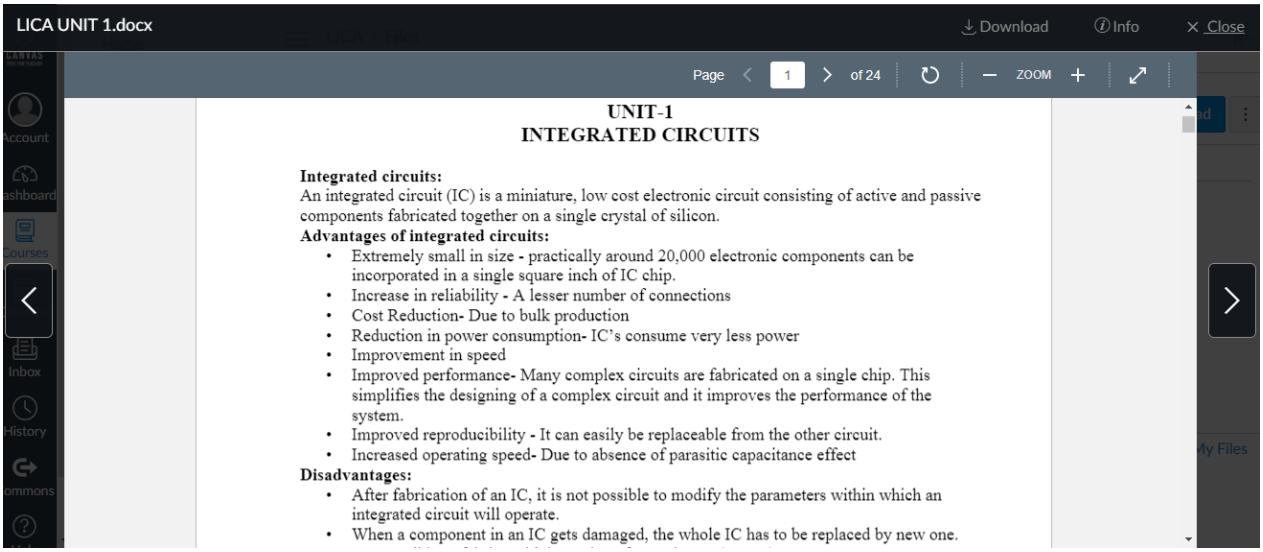
The course content like syllabus, course delivery plan, lecture notes of all units and previous question papers for the course Linear Integrated Circuit Applications is provided in "Canvas", a Learning Management System to create a professional structured course content. This facility helps the students to learn more in less time.

Creation of Course rack in Canvas:



Uploaded Lecture notes in course website:





UNIT-1
INTEGRATED CIRCUITS

Integrated circuits:
An integrated circuit (IC) is a miniature, low cost electronic circuit consisting of active and passive components fabricated together on a single crystal of silicon.

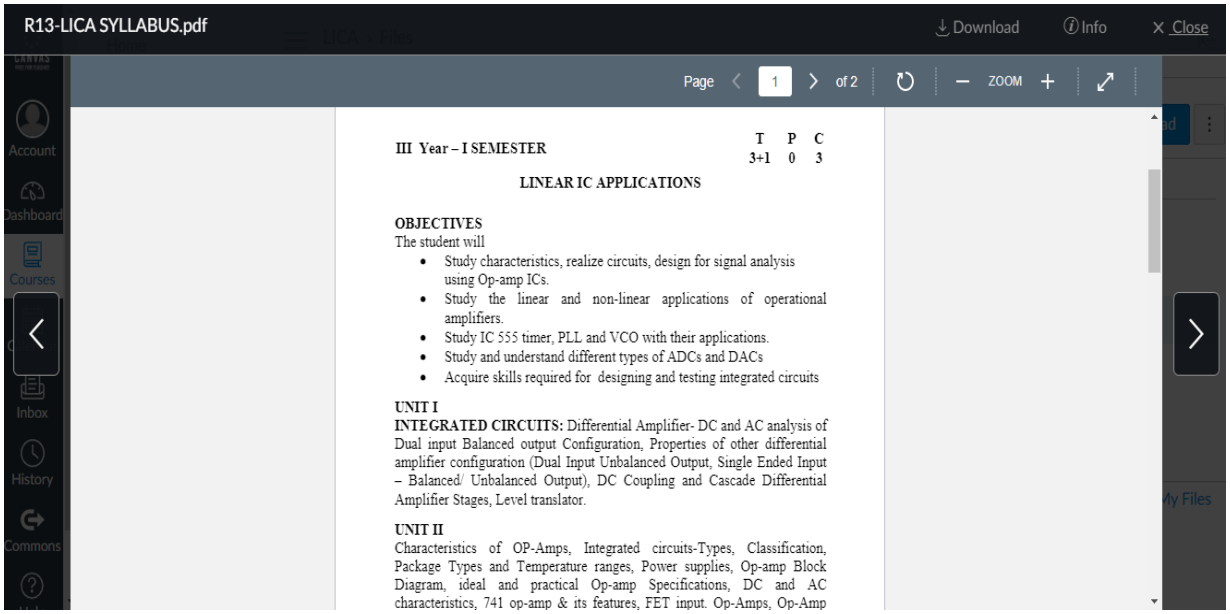
Advantages of integrated circuits:

- Extremely small in size - practically around 20,000 electronic components can be incorporated in a single square inch of IC chip.
- Increase in reliability - A lesser number of connections
- Cost Reduction- Due to bulk production
- Reduction in power consumption- IC's consume very less power
- Improvement in speed
- Improved performance- Many complex circuits are fabricated on a single chip. This simplifies the designing of a complex circuit and it improves the performance of the system.
- Improved reproducibility - It can easily be replaceable from the other circuit.
- Increased operating speed- Due to absence of parasitic capacitance effect

Disadvantages:

- After fabrication of an IC, it is not possible to modify the parameters within which an integrated circuit will operate.
- When a component in an IC gets damaged, the whole IC has to be replaced by new one.

Uploaded Course syllabus in course website:



III Year – I SEMESTER T P C 3+1 0 3

LINEAR IC APPLICATIONS

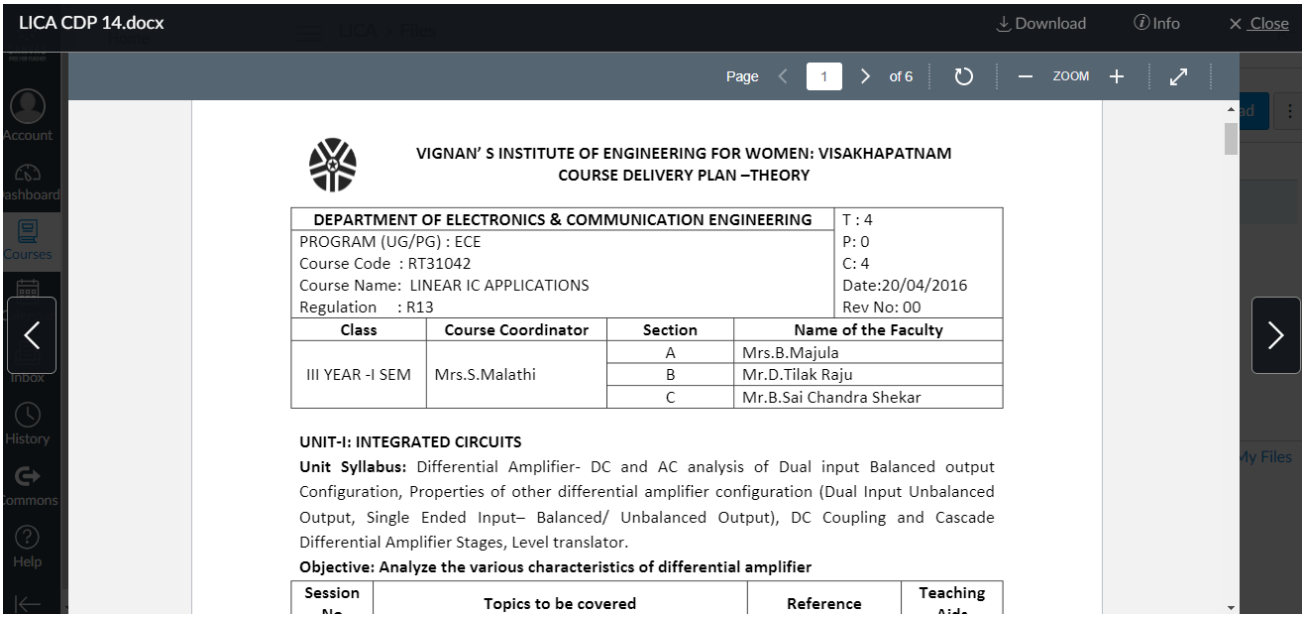
OBJECTIVES
The student will

- Study characteristics, realize circuits, design for signal analysis using Op-amp ICs.
- Study the linear and non-linear applications of operational amplifiers.
- Study IC 555 timer, PLL and VCO with their applications.
- Study and understand different types of ADCs and DACs
- Acquire skills required for designing and testing integrated circuits

UNIT I
INTEGRATED CIRCUITS: Differential Amplifier- DC and AC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single Ended Input – Balanced/ Unbalanced Output), DC Coupling and Cascade Differential Amplifier Stages, Level translator.

UNIT II
Characteristics of OP-Amps, Integrated circuits-Types, Classification, Package Types and Temperature ranges, Power supplies, Op-amp Block Diagram, ideal and practical Op-amp Specifications, DC and AC characteristics, 741 op-amp & its features, FET input. Op-Amps, Op-Amp

Uploaded Course delivery Plan in course website: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VIGNAN' S INSTITUTE OF ENGINEERING FOR WOMEN: VISAKHAPATNAM
COURSE DELIVERY PLAN –THEORY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING			T : 4
PROGRAM (UG/PG) : ECE			P: 0
Course Code : RT31042			C: 4
Course Name: LINEAR IC APPLICATIONS			Date:20/04/2016
Regulation : R13			Rev No: 00
Class	**Course Coordinator**	**Section**	**Name of the Faculty**
III YEAR -I SEM	Mrs.S.Malathi	A	Mrs.B.Majula
		B	Mr.D.Tilak Raju
		C	Mr.B.Sai Chandra Shekar

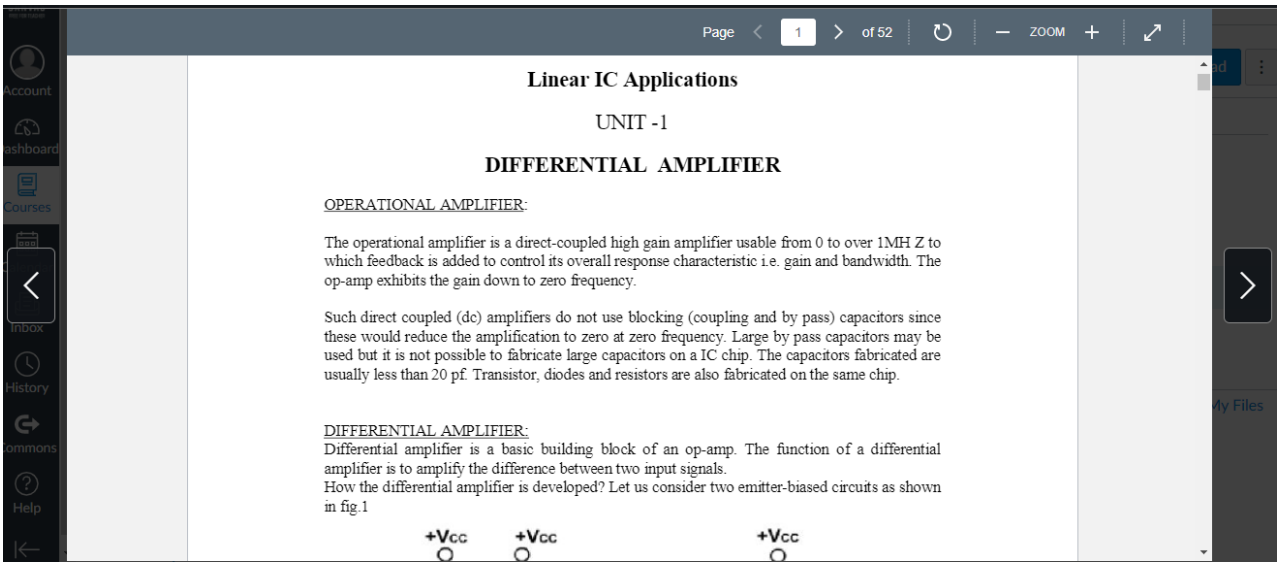
UNIT-I: INTEGRATED CIRCUITS

Unit Syllabus: Differential Amplifier- DC and AC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single Ended Input– Balanced/ Unbalanced Output), DC Coupling and Cascade Differential Amplifier Stages, Level translator.

Objective: Analyze the various characteristics of differential amplifier

Session No.	Topics to be covered	Reference	Teaching Aids

Uploaded Course concepts in website: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Linear IC Applications

UNIT -1

DIFFERENTIAL AMPLIFIER

OPERATIONAL AMPLIFIER:

The operational amplifier is a direct-coupled high gain amplifier usable from 0 to over 1MH Z to which feedback is added to control its overall response characteristic i.e. gain and bandwidth. The op-amp exhibits the gain down to zero frequency.

Such direct coupled (dc) amplifiers do not use blocking (coupling and by pass) capacitors since these would reduce the amplification to zero at zero frequency. Large by pass capacitors may be used but it is not possible to fabricate large capacitors on a IC chip. The capacitors fabricated are usually less than 20 pf. Transistor, diodes and resistors are also fabricated on the same chip.

DIFFERENTIAL AMPLIFIER:

Differential amplifier is a basic building block of an op-amp. The function of a differential amplifier is to amplify the difference between two input signals.

How the differential amplifier is developed? Let us consider two emitter-biased circuits as shown in fig.1

+Vcc +Vcc +Vcc

Details of Registered Students in Course Website:

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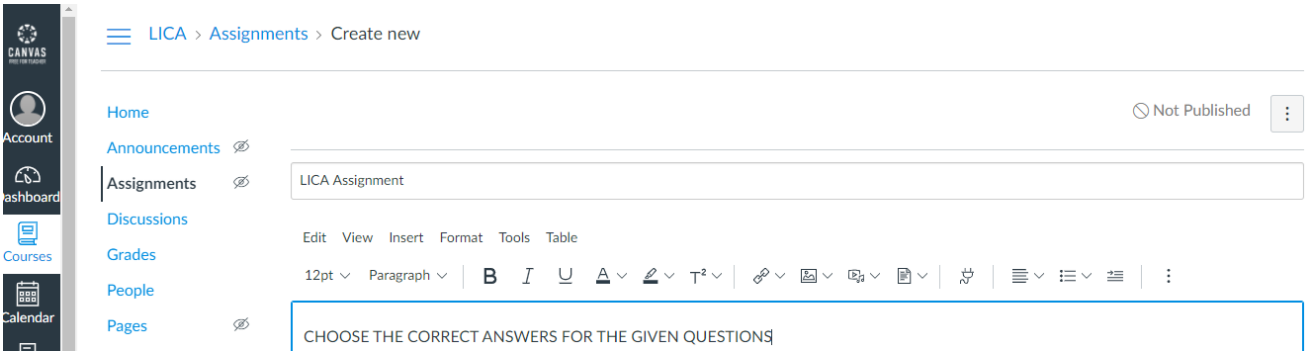
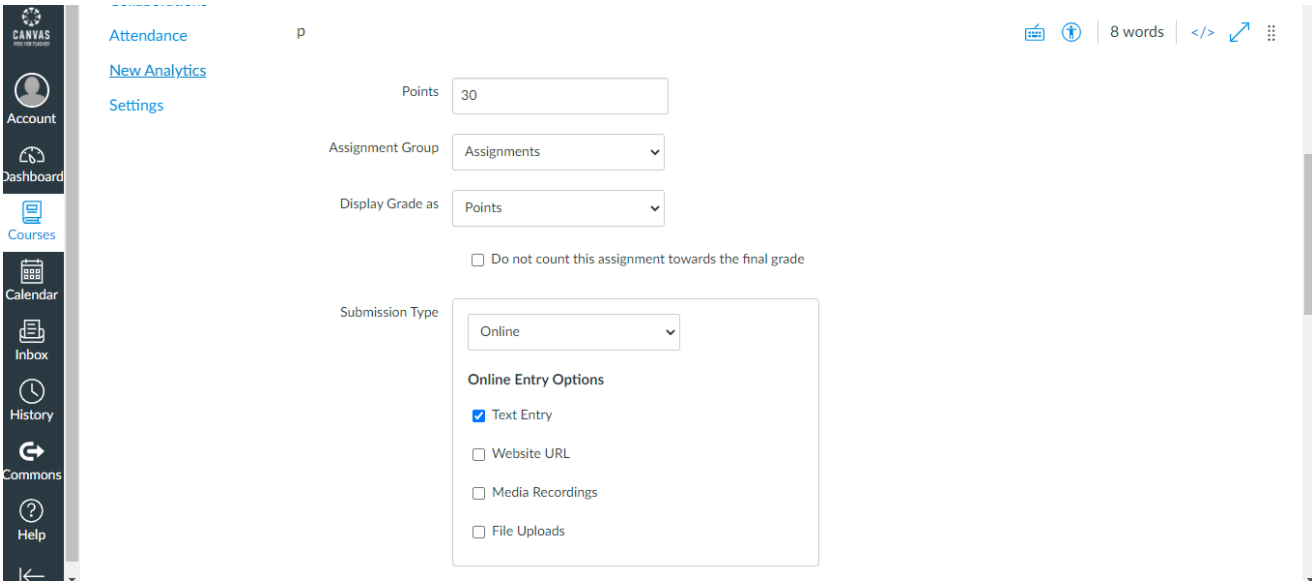
Assessment:

Creation of Online test for the course in website:





Online Quiz Questions:

1. Choose the correct answer in the following Which is not the internal circuit of operational amplifier?.

Options	Correct Answer	Answer
A		Differential amplifier
B		Output driver
C		Level translator
D	✓	Clamper

2. Mark the correct answer The purpose of level shifter in Op-amp internal circuit is to

Options	Correct Answer	Answer
A	✓	Adjust DC voltage
B		Increase impedance
C		Provide high gain
D		Decrease input resistance

3. Select the correct answer, What is the purpose of differential amplifier stage in internal circuit of Op-am?

Options	Correct Answer	Answer
A		Low gain to differential mode signal
B		Cancel difference mode signal
C		Low gain to common mode signal
D	✓	Cancel common mode signal

4.Mark the correct answer , At what condition differential amplifier function as a switch

Options	Correct Answer	Answer
A	✓	$4V_T < V_d < -4V_T$
B		$-2V_T \leq V_d \leq 2V_T$
C		$0 \leq Vd_d < -4V_T$
D		$0 \leq V_d \leq 2V_T$

5.Choose the correct answer, Find collector current I_{C2}, given input voltages are V_1=2.078v & V_2=2.06v and total current I_Q=2.4mA. (Assume α=1)

Options	Correct Answer	Answer
A	✓	0.8mA
B		1.6mA
C		0.08mA
D		0.16mA

6.Mark the correct answer which The ratio between differential gain and common-mode gain is called:

Options	Correct Answer	Answer
A		amplitude
B		differential-mode rejection
C	✓	common-mode rejection
D		Phase

7. Select the most common type, An ideal operational amplifier has

Options	Correct Answer	Answer
A		infinite output impedance
B		zero input impedance
C		infinite bandwidth
D	✓	All of the above

8.Mark the correct answer The common-mode voltage gain is

Options	Correct Answer	Answer
A	✓	smaller than differential voltage gain
B		greater than differential voltage gain
C		equal to voltage gain
D		None of the above

9.Select the correct answer,A differential amplifier has a common-mode gain of 0.2 and a common-mode rejection ratio of 3250. What would the output voltage be if the single-ended input voltage was 7 mV rms?

Options	Correct Answer	Answer
A		1.4 mV rms
B	✓	4.55 V rms
C		650 mV rms
D		0.455 V rms

10.Select the correct answer, How many leads does the TO-5 metal can package of an operational amplifier have?

Options	Correct Answer	Answer
A	✓	8, 10, or 12
B		8 or 14
C		6,8 or 10
D		8 or 16

11.Mark the correct answer,If an op-amp comparator has a gain of 100,000, an input difference of 0.2 mV above reference, and a supply of $\pm$12 V, the output will be

Options	Correct Answer	Answer
A		20
B	✓	12v
C		10v
D		15v

12.Decide An op-amp has an open-loop gain of 90,000. V_{sat} = ±13 V. A differential voltage of 0.1 $V_{p\text{-}p}$ is applied between the inputs. What is the output voltage?

Options	Correct Answer	Answer
A		13 V
B		$13V_{P-P}$
C	✓	-13 V
D		$26\ V_{P-P}$

13. Select the correct answer ,A major advantage of active filters is that they can be realized without using

Options	Correct Answer	Answer

A		op-amps
B	✓	inductors
C		resistors
D		capacitors

14.Choose the correct answer, A low-pass filter with a cut-off frequency of 30 Hz is cascaded with a high-pass filter with a cut-off frequency of 20Hz. The resultant system of filters will function as

Options	Correct Answer	Answer
A		an all-pass filter
B		a band stop (band-reject) filter
C		an all-stop filter
D	✓	a band-pass filter

15.Decide the resolution of 8 bit DAC/ADC?

Options	Correct Answer	Answer
A		562
B		625
C	✓	256
D		265

16.Decide Non-linearity in the output of converter is expressed in

Options	Correct Answer	Answer
A		none of the mentioned
B		Percentage of reference voltage
C	✓	Percentage of full scale voltage
D		Both B & C

17.Mark A binary input 000 is fed to a 3bit DAC/ADC. The resultant output is 101. Find the type of error?

Options	Correct Answer	Answer
A		Settling error
B	✓	Offset error

C		Gain error
D		Linearity error

18.Select the correct answer, How many equal intervals are present in a 14-bit D-A converter?

Options	Correct Answer	Answer
A	✓	16383
B		4095
C		65535
D		1023

19.Select Resolution of a 6 bit DAC can be stated as

Options	Correct Answer	Answer
A	✓	All of the mentioned
B		6-bit resolution
C		Resolution of 1.568% of full scale
D		Resolution of 1 part in 63

20.Decide the resolution of a 10-bit AD converter for an input range of 10v?

Options	Correct Answer	Answer
A		97.7mv
B		0.977mv
C	✓	9.77mv
D		977mv

21.Mark correct answer ,A good converter exhibits a linearity error

Options	Correct Answer	Answer
A		Less than or equal to (1/2) LSB
B		Greater than equal to (1/2) LSB
C		Greater than or equal to (1/2) LSB
D	✓	none of the mentioned

22.Choose the correct answer,The maximum deviation between actual and ideal converter output after the removal of error is

Options	Correct Answer	Answer
A		Absolute accuracy
B	✓	Relative accuracy
C		Relative /absolute accuracy
D		Linearity

23.Decide A monotonic DAC is one whose analog output increases for

Options	Correct Answer	Answer
A		Decreases in digital input
B	✓	An increases in digital input
C		An increases in analog input
D		Decreases in Analog input

24.Choose In a flash analog-to-digital converter, the output of each comparator is connected to an input of a:

Options	Correct Answer	Answer
A		decoder
B	✓	priority encoder
C		multiplexer
D		Demultiplexer

25.Choose the correct answer ,Which is not an analog-to-digital (ADC) conversion error?

Options	Correct Answer	Answer
A	✓	differential nonlinearity
B		missing code
C		incorrect code
D		offset

26.Mark Sample-and-hold circuits in analog-to digital converters (ADCs) are designed to

Options	Correct Answer	Answer
A		sample and hold the output of the binary counter during the conversion process
B		stabilize the comparator's threshold voltage during the conversion process
C	✓	stabilize the input analog signal during the conversion process
D		sample and hold the D/A converter staircase waveform during the conversion process

27. Decide which of the following is a type of error associated with digital- to-analog converters (DACs)?

Options	Correct Answer	Answer
A		nonmonotonic error
B		incorrect output codes
C		offset error
D	✓	nonmonotonic and offset error

28.Select A binary-weighted digital-to-analog converter has an input resistor of 100 k Ω. If the resistor is connected to a 5 V source, the current through the resistor is:

Options	Correct Answer	Answer
A	✓	50 A
B		5 mA
C		500 A
D		50 mA

29. Select the correct answer ,The difference between analog voltage represented by two adjacent digital codes, or the analog step size, is the

Options	Correct Answer	Answer
A		quantization
B	✓	resolution
C		accuracy
D		monotonicity

30. Decide what is the major advantage of the R/2R ladder digital-to-analog (DAC), as compared to a binary-weighted digital-to-analog DAC converter?

Options	Correct Answer	Answer
A	✓	It only uses two different resistor values.
B		It has fewer parts for the same number of inputs
C		Its operation is much easier to analyze
D		The virtual ground is eliminated and the circuit is therefore easier to understand and troubleshoot

Test Report:

A	B	C	D	E	F	G	H	I
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Marks Sheet:

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4.	14NM1A0404	AYYAPUREDDI PRIYANKA	28
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7.	14NM1A0407	BAMMALI SWARUPA RANI	23
8.	14NM1A0408	BASWA DEVI	29
9.	14NM1A0409	BATHINA SRAVYA SREE	19
10.	14NM1A0410	BENDALAM SRUTHI	18
11.	14NM1A0411	BHOOMIREDDY SRAVANI	15
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21.	14NM1A0421	CHAPPA LAVANYA	21
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23.	14NM1A0423	CHELLURI SAI USHA	22
24.	14NM1A0425	CHUKKALA MOUNIKA`	25
25.	14NM1A0426	DAMODARA THANUJA	29
26.	14NM1A0427	DANDUPATI PRABANDHA	24
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29.	14NM1A0430	DONTHALA LALITHA SRAVANI	23
30.	14NM1A0431	EDAYAPURATH SRUTHI	29
31.	14NM1A0432	GADDEM JYOTHI	19
32.	14NM1A0433	GANDI LEELAVATHI	18
33.	14NM1A0434	LALAM SOWJANYA	15
34.	14NM1A0435	GANIVADA NEELIMA	25
35.	14NM1A0436	GANNU JHANSI LAXMIBAI	21
36.	14NM1A0437	GARIKINA SRAVANI	24
37.	14NM1A0438	GARRE MAHALAKSHMI CHANDRAKALA	23
38.	14NM1A0439	GEDELA KIRANMAI	18
39.	14NM1A0440	GEDELA LALITHA DEVI	26
40.	14NM1A0441	GOLAGANI SAIPRASANNA	29
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		ANUSHA	
42.	14NM1A0443	GORLE JYOTHI	22
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44.	14NM1A0445	GURUGUBELLI VISHNU PRIYA	25
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46.	14NM1A0448	JAMI GAYATHRI	16
47.	14NM1A0449	JAMPA DEEPTHI	25
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54.	14NM1A0456	KOSARA VARSHA	21
55.	14NM1A0457	KOTANA BHAGYA SRAVANTHI	22
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Activity Outcome-PO Mapping:

- Flexibility to learn one's own pace.
- Express self-study.
- Build life learning experience
- Extend knowledge and awareness on modern tools and developments.

Activity Outcome	Mapping to PO's
Flexibility to learn one's own pace.	**PO6,PO7, PO10**
Express self-study	**PO10**
Build life learning experience	**PO11, PO12**
Extend knowledge and awareness on modern tools and developments	**PO1,PO2,PO3,PO4,P05**

Post Implications:

- Provide a greater opportunity for teacher-to-teacher and student-to-student communication and collaboration.
- Give greater exposure to vocational and workforce skills for students.
- Provide opportunities for multiple technologies delivered by teachers.
- Create greater enthusiasm for learning amongst students. s
- Provide teachers with new sources of information and knowledge.

Students accessing LMS Tool