CMR ENGINEERING COLLEGE

Kandlakoya(V), Medchal Road, Hyderabad

Department of Electronics & Communication Engineering

COURSE FILE

Sub:LINEAR INTEGRATED CIRCUITS AND ITS APPLICATIONS
A.Y:2022-2023

Year: II Year B.Tech II Semester

CONTENTS

HOD **PRINCIPAL**

1. DEPARTMENT VISION & MISSION:

VISION OF THE INSTITUTE:

To be recognized as a premier institution in offering value based and futuristic quality technical education to meet the technological needs of the society.

MISSION OF THE INSTITUTE:

- To impart value based quality technical education through innovative teaching and learning methods.
- To continuously produce employable technical graduates with advanced skills to meet the current and future technological needs of the society.
- To prepare the graduates for higher learning with emphasis on academic and industrial research.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

VISION

To promote excellence in technical education and scientific research in electronics and communication engineering for the benefit of society.

MISSION

- To impart excellent technical education with state of art facilities inculcating values and lifelong learning attitude.
- To develop core competence in our students imbibing professional ethics and team spirit.
- To encourage research benefiting society through higher learning.

2. LIST OF PEO'S, PO'S&PSO'S

PROGRAMMES EDUCATIONAL OBJECTIVES

- PEO 1: Excel in professional career & higher education in Electronics & Communication Engineering and allied fields through rigorous quality education.
- PEO 2: Exhibit professionalism, ethical attitude, communication skills, team work in their profession and adapt to current trends by engaging in lifelong learning.
- PEO 3: Solve real life problems relating to Electronics & Communication Engineering for the benefits of society.
- To prepare the graduates for developing administrative acumen,to adapt diversified and multidisciplinary platforms to compete globally.

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, social, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

3. MAPPING OF COURSE OUT COMES WITH POS AND PSOS

Course Name: Linear integrated and its applications

EC403PC.**1**	Understanding of operational amplifiers with linear integrated circuits
EC403PC.**2**	Attain the knowledge of functional diagrams and applications of IC 555 and IC 565
EC403PC.**3**	Acquire the knowledge about the Data converters.
EC403PC.**4**	Understand the theory and applications of analog multipliers and PLL.
EC403PC.**5**	Understand the concepts of waveform generation and introduce some special function ICs.

CO-PO Matrix:

CO's/ PO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	3	3	-	-	-	-	-	-	-	-	-	-
EC403PC.**2**	3	3	2	2	2	-	-	-	-	-	-	-
EC403PC.**3**	3	3	2	-	-	-	-	-	-	-	-	2
EC403PC.**4**	3	3	2	-	-	-	-	-	-	-	-	2
EC403PC.**5**	3	2	2	-	-	-	-	-	-	-	-	-

Course Outcome (CO)-Program Specific Outcome (PSO) Matrix:

Course Outcomes (CO's)	PSO1	PSO2
EC403PC.**1**	3	-
EC403PC.**2**	3	3
EC403PC.**3**	3	3

EC403PC.**4**	3	2
EC403PC.**5**	3	2

4. SYLLABUS

UNIT – I

Integrated Circuits: Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC Characteristics, 741 opamp and its features, modes of operation-inverting, non-inverting, differential.

UNIT - II

Op-amp and Applications: Basic information of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, Sample & hold circuits, multipliers and dividers, differentiators and integrators, comparators, Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723

UNIT - III

Active Filters & Oscillators: Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation - RC, Wien and quadrature type, waveform generators - triangular, sawtooth, square wave and VCO.

UNIT - IV

Timers & Phase Locked Loops: Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565.

UNIT - V

D-A and A-D Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC dual slope integration type ADC, DAC and ADC specifications.

TEXT BOOKS:

1. Linear Integrated Circuits, D. Roy Chowdhury, New Age International(p) Ltd.
2. Op-Amps & Linear ICs, Amaranth A. Gayakwad, PHI

REFERENCES BOOKS:

1. Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI.
2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.
3. Design with Operational Amplifiers & Analog Integrated Circuits, Sergio Franco, McGraw Hill.
4. Digital Fundamentals - Floyd and Jain, Pearson Education.

5. INDIVIDUAL TIME TABLE

NAME: G.PRAVALIKA **II-A & II-B, LICA & ICA-LAB**

DAY/ TIME	9:10am-10:10am	10:10 am - 11:00 am	11:00 am - 11:50 am	11:50 am -12:40pm	12:40pm-01:20pm	01.20pm-02:20pm	02:20pm-03:10pm	03.10pm-4.00pm
MON		LICA-B	ICA LAB-B		L U N C H	LICA-A	ICA LAB-A	
TUE		LICA-A	ICA LAB-A			LICA-B	ICA LAB-B	
WED	T& P					T& P		

THU	**LICA-B**				**N C H**	**LICA-A**		
FRI		**LICA-B**					**LICA-a**	
SAT	**LICA-A**			**LICA-B**				

6. DETAILED LECTURE PLAN

Subject Code	Name of the subject	Year/Branch	Name of the Faculty
EC403PC	**Linear integrated and its applications**	II B.Tech II Sem ECE	Mrs.G.PRAVALIKA

Topic Name	No. of classes	Text books
UNIT I: Integrated Circuits		
Classification, chip size and circuit complexity	01	T1, T2
basic information of Op-amp,	01	T1, T2
ideal and practical Op-amp,	02	T1, T2
Internal circuits, Op-amp characteristics	02	T1, T2
DC and AC Characteristics	02	T1, T2
741 op-amp and its features,	01	T1, R2
modes of operation-inverting	02	T1, T2
non-inverting	02	T1, T2
Differential mode op-amp	01	T1, T2
	14	
UNIT II: Op-amp and Applications		
Basic information of Op-amp, instrumentation amplifier	01	T1, R3
ac amplifier, V to I and I to V converters	01	T1, R3
Sample & hold circuits, multipliers and dividers	02	T2, R2
differentiators and integrators	02	T1, T2
introduction to voltage regulators	02	T1, R1

features of723	02	T1, R1
	10	
UNIT III: Active Filters & Oscillators		
Introduction, 1st order LPF, HPF	02	T1, R2
waveform generators – triangular	01	T1, R2
sawtooth, square wave and VCO	02	T1, R3
Band pass, Band reject filter	01	T1, R3
Oscillator types and principle of operation	01	T1, R3
filters RC, Wien bridge oscillators	02	T1, R3
quadrature type oscillators	01	T1, T2
waveform generators - triangular, sawtooth, square wave and VCO.	02	T1, T2
	12	
UNIT IV: Timers & Phase Locked Loops		
Introduction to 555 timer	01	T1, T2
555 timer applications	02	T1.T2
monostable and astable operations	01	T1,R2
Schmitt Trigger.	02	T1, R2
PLL - introduction,	02	T2, R3
block schematic of 565	01	T2, R3
principles and description of individual blocks of 565	01	T2, R3
	10	
UNIT V: A-D Converters D-A Converters		
Introduction, basic DAC techniques	01	T1, T2
weighted resistor DAC, R-2R ladder DAC	01	T1, T2
inverted R-2R DAC,	02	T1, T2
and IC 1408 DAC	02	T1, T2
Different types of ADCs - parallel comparator type ADC	01	T1, T2

counter type ADC, successive approximation ADC	01	T1, R2
dual slope integration type ADC	01	T1, T2
DAC and ADC specifications	02	T1, R3
Total No. of Classes	**11**	
Total No. of Classes	**57**	

7. SESSION EXECUTION LOG:

II B.Tech II Sem A & B-Section

Sl.no	Syllabus	Scheduled completion date	Completed date	Remarks
1	I-UNIT	6-3-20223	15-4-2023	completed
2	II-UNIT	17-4-20223	15-5-2023	completed
3	III-UNIT	07-6-20223	23-6-2023	completed
4	IV-UNIT	24-6-20223	03-7-2023	completed
5	V-UNIT	4-7-20223	15-7-2023	completed

MID-I

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Kandlakoya (V), Medchal (M), Medchal - Malkajgiri (D)-501401

II.B.TECH- I-SEM –I MID ASSIGNMENT QUESTION PAPER

LINEAR INTEGRATED CIRCUITS AND ITS APPLICATIONS

SET-I

5. Derive the expression for A_{CL} in practical inverting amplifier with circuit diagram.(CO.1 [BTL1])

6. Describe the principle operation of an Integrator and obtain the necessary equations.(CO.2 [BTL3])

7. Draw the circuit of Instrumentation amplifier and derive its derivation.(CO.2 [BTL3])

8. Explain various AC and DC characteristics of an Op-Amp.(CO.1 [BTL2])

9. Briefly explain the operation of Astable multivibrator using IC 741 and find the frequency of oscillation.(CO.2 [BTL2])

SET-II

1. Derive the expression for A_{CL} in practical inverting amplifier with circuit diagram.(CO.1 [BTL1])

2. Describe the principle operation of an Integrator and obtain the necessary equations.(CO.2 [BTL3])

3. Draw the circuit of Instrumentation amplifier and derive its derivation.(CO.2 [BTL3])

4. What is meant by frequency compensation and explain types of frequency compensation techniques.(CO.1 [BTL1])

5. Briefly explain the operation of Astable multivibrator using IC 741 and find the frequency of oscillation.(CO.2 [BTL2])

SET-III

1. Derive the expression for A_{CL} in practical inverting amplifier with circuit diagram.(CO.1 [BTL1])
2. Describe the principle operation of an Integrator and obtain the necessary equations.(CO.2 [BTL3])
3. Draw the circuit of Instrumentation amplifier and derive its derivation.(CO.2 [BTL3])

(

4. What is meant by frequency compensation and explain types of frequency compensation techniques.(CO.1 [BTL1])
5. Explain various AC and DC characteristics of an Op-Amp.(CO.1 [BTL2])

MID-II

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II.B.TECH- I-SEM –II MID ASSIGNMENT QUESTION PAPER

LINEAR INTEGRATED CIRCUITS AND ITS APPLICATIONS

SET-I

1. .Design Band pass circuit using op-Amp.
2. a) Draw the circuit of Schmitt trigger using 555 timer and explain its operation.
b) Design a 555 Astable multivibrator to operate at 10 KHz with 40% duty cycle.

3.a) Draw the schematic circuit diagram of a counter type A/D converter and explain the operations of the system.
b)What is the conversion time of a 10 bit successive approximation ADC if its input clock is 5 MHz.
4.a)The free running frequency of a 565 PLL is 100 KHz ,the filter capacitor is 2µf and supply voltage is ±6v.Compute the lock in range, capture range frequency and value of external components RT and CT.
b). A 555 timer Astable multivibrator uses RA=6.8 KΩ RB=3.3KΩ and C=0.1µf.Calculate the free running frequency of oscillation.
5. .Draw the circuit diagram of inverted R-2R DAC & explain its operation.

SET-II

1.With neat diagram, explain the working principle

.Weighted resistor DAC.

2. Design band rejection filter using op-amp.

3.a).A 10 bit A/D converter has an input voltage of -10 to +10 v. Estimate resolution.

b) Draw the schematic circuit diagram of a Succesive approximation type A/D converter and explain the operations of the system.
4.List the basic blocks of IC 555 timer and explain the operation of monostable multivibrator.

5. a) Draw the block diagram of VCO & Explain its working.

b)The free running frequency of a 565 PLL is 100 KHz ,the filter capacitor is 2μf and supply voltage is ±6v.Compute the lock in range, capture range frequency and value of external components RT and CT.

SET-III

1. a) Draw the block diagram of VCO & Explain its working.

b). Draw the block diagram of PLL & Explain importance of each block. (

2.a) Explain the working of wein bridge oscillator

b). A 555 timer Astable multivibrator uses RA=6.8 KΩ RB=3.3KΩ and C=0.1μf.Calculate the free running frequency of oscillation.

. 3. Design a lowpasss filter using op-amp..

4. Design Astable multivibrator using 555 timers and explain its applications.

5. Describe the operation of Dual slope ADC with necessary diagrams.

9. SAMPLE ASSIGNMENT SCRIPTS

(Attached Separately)

10. UNIT WISE SUBJECT MATERIAL.

(Attached separately)

11. MID EXAM QUESTION PAPERS

MID-I Question Paper

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II.B.TECH- II-SEM -I MID EXAMINATIONS Date: 10-05-2023 Time: 10:00 AM to11:30

Subject: LINEAR IC APPLICATIONS Branch: ECE Marks: 25 M

Note: Question paper contains two parts, Part - A and Part - B.
Part-A is compulsory which carries 10 marks. Answer all questions in part-A.
Part-B consists of (2 1/2) units. Answer any one full question from each unit. Each question carries 5 marks and may have a, b, c sub questions.

PART A **5 x2=10**

1. What is an IC? Brief out the classifications of IC.(CO.1 [BTL1])
2. A differential dc amplifier has a differential mode gain of 100 and a common mode gain 0.01. What is its CMRR in dB.(CO.1([BTL2])
3. Compare ideal and practical characteristics of op amp. (CO.1 [BTL4])
4. Draw the circuit of log and antilog amplifier. (CO.2 [BTL3])
10. Derive the expression for I to V converter using op-amp with circuit diagram.(CO.2 [BTL3])

PART B

3 x5=15

11. Derive the expression for A_{CL} in practical inverting amplifier with circuit diagram.(CO.1 [BTL1])

(OR)

12. Describe the principle operation of an Integrator and obtain the necessary equations.(CO.2 [BTL3])

13. Draw the circuit of Instrumentation amplifier and derive its derivation.(CO.2 [BTL3])

(OR)

14. What is meant by frequency compensation and explain types of frequency compensation techniques.(CO.1 [BTL1])

15. Explain various AC and DC characteristics of an Op-Amp.(CO.1 [BTL2])

(OR)

16. Briefly explain the operation of Astable multivibrator using IC 741 and find the frequency of oscillation.(CO.2 [BTL2])

MID-II Question Paper

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II.B.TECH- II-SEM -II MID EXAMINATIONS Date:26-07-2023 Time: 10:00 AM TO 11:30 AM

Subject: LINEAR IC APPLICATIONS SET-III Branch: ECE Marks: 25 M

Note: Question paper contains two parts, Part - A and Part - B.

Part-A is compulsory which carries 10 marks. Answer all questions in part-A.

Part-B consists of (21/2) units. Answer any one full question from each unit. Each question carries 5 marks and may have a, b, c sub questions.

PART A **5 x2=10**

1. Compare dual slope A/D converter with successive approximation A/D converter. CO.5 [BTL2]
2. What is frequency scaling? CO.3 [BTL1]
3. Draw the circuit diagram of OP AMP all pass filters CO.3 [BTL2]
4. Design a monostable multivibrator using 555 timer to produce a pulse width of 100ms. CO.4 [BTL6]
5. List the important features of 555 timer. CO.4 [BTL1]

PART B **3 x5=15**

6. Explain in detail about the

   (i) Wide band rejection filter

   (ii) Narrow band rejection filter. CO.3 [BTL2]

(OR)

7. Explain the wein bridge oscillator with neat waveforms . CO.3 [BTL2]

8. Explain the operation of PLL and derive the expression for lock in range and capture range .

CO.4 [BTL2]

(OR)

9. Describe. CO.4 [BTL2]

(i) Pulse position modulation (PPM) and

(ii) FSK generator

Using 555 timer astable multivibnrator. [BTL2]

10. a) What are the limitations of Binary weighted resistor DAC ? CO.5 [BTL2]

b) What do you mean by quantization error in an ADC ?

(OR)

11. With a neat diagram explain the Dual slope ADC in detail CO.5 [BTL2]

12. SCHEME OF EVALUATION

MID-I

Branch:ECE Subject: LICA

Year: II-II sem Date: 10-05-2023

Total marks: 25 Time: 10 A.M To 11:30 A.M

Scheme of Evaluation

SCHEME OF EVALUATION

PART-A

S.NO	THEORY	MARKS	TOTAL
1	IC definition	1	2
	classifications	1	
2	Given data and formulae	1	2
	Calculation	1	

3	Comparisions of Ideal and practical characteristics of an op amp	2	2
4	Circuit diagram	2	2
5	Circuit design	2	2

PART-B

S.NO	THEORY	MARKS	TOTAL
6	Circuit Diagram	2	5
	Derivaton	3	
7	Circuit diagram	2	5
	Derivation	3	
8	Circuit Diagram and operation	2	5
	Derivation	3	

9	Explanation about frequency compensation	1	5
	Explaining types of frequency compensation techniques	3	
10	Explanation about AC and DC characteristics	5	5
11	Circuit diagram and operation	2	5
	Derivation	3	

MID-II

Branch:ECE Subject: LICA

Year: II-II sem Date: 26-07-2023

Total marks: 25 Time: 10 A.M To 11:10 A.M

Scheme of Evaluation

PART-A

Q.NO	THEORY	MARKS	TOTAL
1	Comparisions	2	2
2	Definitions	2	2
3	Circuit diagram	2	2
4	Problem solving	1	2
		1	
5	Features of 555 IC	2	2

PART-B

6	Explanation about	Wideband rejection filter=2.5	5
		Narrow band rejection filter=2.5	
7	Circuit diagram	2	5
	Derivation	3	
8	PLL block diagram	2	5
	derivation	3	
9	PPM	2.5	5
	FSK generation	2.5	
10	About binary weighted resistor DAC	3	5
	Quantization error	2	
11	Dual slope ADC	5	5

13. SAMPLE MID ANSWER SCRIPTS

(Attached Separately)

14. MATERIAL COLLECTED FROM INTERNET/WEBSITES

15. ICT MATERIALS

LICA PPTS.rar

16. UNIVERSITY PREVIOUS QUESTION PAPERS

LICA PREVIOUS QUESTION PAPERS.rar