SRI VENKATESWARA
COLLEGE OF ENGINEERING AND TECHNOLOGY

Thirupachur-631203, Tiruvallur TK & DT

Approved by AICTE New Delhi & Affiliated to Anna University, Chennai

(A Telugu Minority Institution)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE INFORMATION

NAME OF THE COURSE FACULTY	: MRS. S.GEETHA
DESIGNATION	: ASSISTANT PROFESSOR
DEPARTMENT	: ELECTRICAL AND ELECTRONICS ENGINEERING
ACADEMIC YEAR	: 2022-2023
YEAR	: II
SEMESTER	: IV
TOTAL NO OF STUDENTS	: 54
SUBJECT CODE	: EE3402
SUBJECT NAME	: LINEAR INTEGRATED CIRCUITS

Faculty In charge

HOD

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

R-2021

EE3402 LINEAR INTEGRATED CIRCUITS L T P C 3 0 0 3

UNIT I IC FABRICATION

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, 85 resistances, FETs and PV Cell.

UNIT IICHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Voltage-shunt feedback and inverting amplifier - Voltage series feedback: and Non-Inverting Amplifier - Basic applications of op-amp –, summer, differentiator and Integrator-V/I & I/V converters.

UNIT IIIAPPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multi vibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using OP-AMPs.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs 10

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator-SMPS - ICL 8038 function generator
IC.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, Third Edition, 2011
2. D. Roy Chaudhary, Sheil B. Jani, 'Linear Integrated Circuits', , New Age, Fourth Edition, 2018.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, PHI 2021

REFERENCES

1. Fiore,"Opamps V& Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2nd Edition, 2017.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition, 2012.

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C0URSE INFORMATION

DEPARTMENT VISION AND MISION

VISION

To produce an Excellent and Proficient technologist in the field of Electrical and Electronics engineering. To provide the excellent standard of education in the field of Electrical and Electronics and to meet the global standard and inculcate the ethical and human values of the society.

MISSION

- To provide them the good knowledge in the engineering technologies.
- To enhance their knowledge and thoughts Research.
- To make them understand about the importance of the engineering technology in today world and to be a global competence.
- To educate them about the social and human values.
- To make them understand how to be a create and innovative engineers.

PROGRAM EDUCATIONAL OBJECTIVE (PEOS)

The Electrical Electronics Engineering Graduates will:

PEO 1. In order to facilitate the pursuit of research by graduates, as well as their successful career prospects in academia or enterprises related to Electrical Electronics Engineering, or as entrepreneurs.

PEO 2. To provide students with sophisticated tools and methodologies along with solid underlying principles so they may construct systems or solutions of various degrees of complexity.

PEO 3. To equip students with the skills necessary to conduct a critical analysis of the body of literature already written in a particular field and to propose creative, research-based solutions to problems in an ethical manner.

PROGRAM SPESIFIC OUTCOME (PSOs)

A graduate of the Electrical Electronics Engineering Program will have:

PSO 1: To utilize fundamental principles of Electrical Electronics Engineering to evaluate, design, and build solutions.

PSO 2: Applying best practices and design principles to the creation of high-quality products for use in business and science.

PSO 3: To adjust to new and developing information and communication technologies (ICT) in order to generate creative concepts and answers to old and new issues.

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PROGRAM OUTCOMES (POs)

At end of the program, a student can able to:

1. **Engineering Knowledge:** Solve complicated engineering problems by applying your understanding of science, math, engineering foundations, and your engineering expertise.
2. **Problem Analysis:** Utilizing fundamental concepts from mathematics, the natural sciences, and engineering sciences, identify, define, evaluate research material, and analyse difficult engineering problems to arrive at well-supported findings.
3. **Design Solution:** Create solutions for difficult technical issues and system or process designs that satisfy requirements while taking public health and safety, cultural, socioeconomic, and environmental factors into account.
4. **Conduct investigation of complex problem:** To arrive at reliable results, apply research-based knowledge and techniques, such as experiment design, data analysis and interpretation, and information synthesis.
5. **Morden tool usage:** With an awareness of the constraints, develop, pick, and apply suitable methods, materials, and cutting-edge engineering and IT technologies, such as modelling and prediction, to challenging engineering tasks.
6. **The engineer and society** In order to assess sociological, health, legal, and cultural challenges as well as the ensuing duties pertinent to professional engineering practice, apply seasoning that is informed by contextual knowledge.
7. **Environment and sustainability:** Recognize how professional engineering solutions affect society and the environment, and exhibit your understanding of and commitment to sustainable development.
8. **Ethics:** Adhere to professional ethics, duties, and engineering development norms while putting ethical concepts into practice.
9. **Individual and team work:** Perform well both on your own and as a leader or member of a variety of teams in interdisciplinary environments.
10. **Communication:** Effectively communicate complex engineering activities to the engineering community and the general public, including understanding and producing well-written reports and design documentation. Present ideas well and communicate instructions clearly to others.
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.

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COURSE PLAN

SUBJECT NAME : EE3402 LINEAR INTEGRATED CIRCUITS

ACADEMIC YEAR : 2022-2023

SEMESTER : IV
DESIGNATION : ASSISTANT PROFESSOR
NAME OF THE COURSE FACULTY: MRS. S.GEETHA **TOTAL NO OF STUDENTS**: 54

COURSE OBJECTIVES:

To impart knowledge on the following topics
- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

COURSE OUTCOMES:
Upon successful completion of the course, the students will be able to:
CO1 Explain monolithic IC fabrication process
CO2 Explain the fabrication of diodes, capacitance, resistance, FETs and PV Cell.
CO3 Analyze the characteristics and basic applications (inverting/non-inverting amplifier, summer, differentiator, integrator, V/I and I/V converter) of Op-Amp
CO4 Explain circuit and applications of op-amp based instrumentation amplifier, log/antilog amplifier, analog multiplier /divider, active filters, comparators, waveform generators, A/D and D/A converters
CO5 Explain Functional blocks, characteristics and applications of Timer, PLL, analog multiplier ICs. CO6 Explain the applications of ICs in Instrumentation amplifier, fixed and variable voltage regulator, SMPS and function generator

CO PO MAPING MATRIX:

COs	POs												COs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS01	PS02	PS03
Co1	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
Co2	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
Co3	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
Co4	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
Co5	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
Avg	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1

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CO –PO Mapping Justification:

Low-L Medium-M HIGH-H	CO Mapping	Justification
H-3	PO3-CO1,CO2,CO3, CO4,CO5	CO1, CO2,CO3,CO4, and CO5 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, societal, and environmental considerations.
M-2	PO1-CO1,CO2,CO3, CO4,CO5	CO1, CO2, CO3, CO4 and CO5 applies the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2-CO1,CO2,CO3, CO4,CO5	CO1, CO2, CO3, CO4 and CO5 identifies, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
	PO4-CO1,CO2,CO3, CO4,CO5	CO1, CO2, CO3, CO4 and CO5 used research - based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5-CO1,CO2,CO3, CO4,CO5	CO1, CO2, CO3, CO4 and CO5 applies appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
L-1	PO8-CO1,CO2,CO3, CO4,CO5	CO1, CO2, CO3, CO4 and CO5 Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	PO12-CO1,CO2,CO3, CO4,CO5	CO1, CO2, CO3, CO4 and CO5 Recognizes the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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CO –PSO Mapping Justification:

Low-L Medium-M HIGH-H	CO Mapping	Justification
H-3	PS01 - CO1,CO2, CO3,CO4,CO5	CO1, CO2, CO3, CO4 and CO5 analyse, design and develop solutions by applying foundational concepts of Electrical and electronics engineering.
M-2	PS02 - CO1,CO2, CO3,CO4,CO5	CO1, CO2, CO3, CO4, CO5 applies design principles and best practices for developing quality products for scientific and business applications.
L-1	PS03 - CO1,CO2, CO3,CO4,CO5	CO1, CO2, CO3, CO4, CO5 Low Effect on the use of engineering analysis and data management tools for effective management of multidisciplinary projects

Note: Enter correlation level 1, 2, or 3 as defined bellow:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Along with the above the following activities are also to be planed and included:

Activity Name	No.of activities per semester
Assessment Test	02
Model Exam	01
Assignment	03
Mini Project	-
Quiz/Role play	-
Seminar/Experiment	-

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UNIT I IC FABRICATION

period	Topic to be Covered	Proposed Date	Actual Date	Delivery Method	Reference	Remark
1	IC classification	6.2.23	6.2.23	C&T	TBI	-
1	fundamental of monolithic IC technology	9 .2.23	9 .2.23	C&T	TBI	-
1	Epitaxial growth	10.2.23	10.2.23	C&T	TBI	-
1	masking and etching	20.2.23	20.2.23	C&T	TBI	-
1	diffusion of impurities	23.2.23	23.2.23	C&T	TBI	-
1	Isolation techniques	23.2.23	23.2.23	C&T	TBI	-
1	Metallisation	23.2.23	23.2.23	C&T	TBI	-
1	Assembly processing and Packaging	24.2.23	24.2.23	C&T	TBI	-
1	Realisation of monolithic ICs and packaging	27.2.23	27.2.23	C&T	TBI	-
1	Fabrication of BJT	2.3.23	2.3.23	C&T	TBI	-
1	Fabrication of Diode	3.3.23	3.3.23	C&T	TBI	-
1	Fabrication of capacitance	6.3.23	6.3.23	C&T	TBI	-
1	Fabrication of resistance	9.3.23	9.3.23	C&T	TBI	-
1	Fabrication of FET	10.03.23	10.03.23	C&T	TBI	-
1	Fabrication of PV Cell.	16.03.23	16.03.23	C&T	TBI	-
Total. no. of Hrs	**9**	**No.of Hours taken**	**15**			
		Signature of HOD				

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UNIT IICHARACTERISTICS OF OPAMP

period	Topic to be Covered	Proposed Date	Actual Date	Delivery Method	Reference	Remark
1	Introduction of op-amp symbol of terminals	17.03.23	17.03.23	C&T	TBI	-
3	Ideal OP AMP characteristics, DC characteristics,	20.03.23	20.03.23	C&T	TBI	-
3,4	Transistor differential amplifier with constant of source	23.03.23	23.03.23	C&T	TBI	-
1	Voltage level of saturation probability of op amp ideal opamp characteristics	24.03.23	24.03.23	C&T	TBI	-
3	Equlant circuit of op-amp slew rate.	27.03.23	27.03.23	C&T	TBI	-
3,4	Method of improving slew rate DC-characteristics	30.03.23	30.03.23	C&T	TBI	-
1	Configuration of op-amp application of op-amp	31.03.23	31.03.23	C&T	TBI	-
3	V to I , VI converters	3.04.23	3.04.23	C&T	TBI	-
3,4	summer, differentiator	6.04.23	6.04.23	C&T	TBI	-
3,4	Integrator-V/I & I/V converters.	10.04.23	10.04.23	C&T	TBI	-
Total. no. of Hrs	**9**	**No.of Hours taken**	**14**			
		Signature of HOD				

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UNIT IIIAPPLICATIONS OF OPAMP

period	Topic to be Covered	Proposed Date	Actual Date	Delivery Method	Reference	Remark
3,4	Instrumentation amplifier , Its applications for transducer Bridge, Log and Antilog Amplifiers	13.04.23	13.04.23	C&T	TBI	-
3	Analog multiplier & Divider	17.04.23	17.04.23	C&T	TBI	-
3,4	first and second order active filters	18.04.23	18.04.23	C&T	TBI	-
3,4	comparators, multi vibrators, waveform generators	20.04.23	20.04.23	C&T	TBI	-
3	clippers, clampers, peak detector	24.04.23	24.04.23	C&T	TBI	-
3,4	S/H circuit, D/A converter (R- 2Rladder and weighted resistor types)	27.04.23	27.04.23	C&T	TBI	-
3	A/D converters using OP-AMPs.	28.04.23	28.04.23	C&T	TBI	-
Total. no. of Hrs	9	No.of Hours taken	11			
		Signature of HOD				

UNIT IV SPECIAL ICs

period	Topic to be Covered	Proposed Date	Actual Date	Delivery Method	Reference	Remark
3,4	Functional block, characteristics of 555 Timer and its PWM application	4.05.23	4.05.23	C&T	TBI	-
1	IC-566 voltage controlled oscillator IC	5.05.23	5.05.23	C&T	TBI	-
3	565-phase locked loop IC, AD633 Analog multiplier ICs	08.05.23	08.05.23	C&T	TBI	-
Total. no. of Hrs	9	No.of Hours taken	06			
		Signature of HOD				

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UNIT V APPLICATION ICs

period	Topic to be Covered	Proposed Date	Actual Date	Delivery Method	Reference	Remark
3,4	AD623 Instrumentation Amplifier and its application as load cell weight measurement	09.05.23	09.05.23	C&T	TBI	-
3	IC voltage regulators	10.05.23	10.05.23	C&T	TBI	-
3,4	LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply	11.5.23	11.5.23	C&T	TBI	-
3,4,5	LM317, 723 Variability voltage regulators, switching regulation SMPS, ICL 8038 function generator IC	12.5.23	12.5.23	C&T	TBI	-
Total. no. of Hrs	9	No.of Hours taken	08			
		Signature of HOD				

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CONTENT BEYOND THE SYLLABUS

UNIT: I-IC FABRICATION

1. Design procedure to fabricate a Monolithic IC for the given circuit
2. Introduction and classification of IC's

UNIT: II -CHARACTERISTICS OF OPAMP

1. Introduction to OP-Amps
2. Open loop and Closed loop feedbacks
3. Equivalent circuit of OP-Amp
4. Pin diagram of OP-Amp
5. Voltage followers
6. Problems on Summer,Subtractor,differentiator,and Integrator

UNIT-III-APPLICATIONS OF OPAMP

1. Problems on multivibrators
2. Problems on filters
3. Design of comparators and Schmitt trigger circuits

UNIT-IV-SPECIAL ICs

1. Problems on IC555 timers

UNIT-V-APPLICATION ICs

1. Internal circuit diagram of IC8038- Function generator IC

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