St. Thomas College of Engineering & Technology
Vellilode, Sivapuram PO. Mattanur. Kannur District, Kerala
Approved by AICTE New Delhi, Govt. Of Kerala and Affiliated to APJ Abdul Kalam Technological University

COURSE HANDOUT

(B. Tech - Semester 3)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COLLEGE VISION

To be an Institute of repute recognized for excellence in education, innovation, and social contribution.

COLLEGE MISSION

M1: Infrastructural Relevance - Develop, maintain and manage our campus for our stakeholders.
M2: Life-Long Learning - Encourage our stakeholders to participate in lifelong learning through industry and academic interactions.
M3: Social Connect - Organize socially relevant outreach programs for the benefit of humanity.

DEPARTMENT VISION

To produce professionally competent, ethically sound and socially responsible Electronics and Communication Engineers.

DEPARTMENT MISSION

M1: Provide excellent infrastructure and lab facilities for quality education.

M2: Promote industry-academic interactions to keep up with technological advancements.

M3: Develop interpersonal skills and social responsibility among students through project-based and team-based learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

Graduates of B. Tech ECE program after graduation will:

PEO1: Exemplify technical competence in designing, analyzing, testing and fabricating electronic circuits.

PEO2: Acquire leadership qualities, rapport, communication skills in the organization and adapt to changing professional and societal needs.

PEO3: Work effectively as individuals and as team members in multidisciplinary projects

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to:

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 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.

PO3 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, societal, and environmental considerations.

PO4 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.

PO5 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.

PO6 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.

PO7 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.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 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.

PO11 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.

PO12 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.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Define, design, implement, model, and test electronic circuits and systems that perform signal processing functions.

PSO2: Segregate and select appropriate technologies for implementation of a modern communication system.

CONTENTS

COURSE INFORMATION SHEETS OF SEMESTER 3 COURSES

C

PCECT303

ANALOG CIRCUITS

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: ANALOG CIRCUITS	**SEMESTER: 3** **L-T-P-CREDITS**: 3-1-0-4
COURSE CODE: **REGULATION**:2024	**COURSE TYPE**: CORE
COURSE AREA/DOMAIN: CIRCUITS AND SYSTEMS	**CONTACT HOURS**:4hrs/week
CORRESPONDING LAB COURSE CODE (IF ANY): PCECL307	**LAB COURSE NAME**: Analog Circuits Lab

SYLLABUS

MODULE	DETAILS	HOURS
I	Wave Shaping Circuits: RC differentiating and integrating circuits, Analysis of First order RC low pass and high pass filter for step input -rise time, bandwidth. Diode Clipping and clamping circuits. BJT/MOSFET Biasing: Need for biasing, DC load line, operating point, BJT biasing (CE configuration)– fixed bias & voltage divider bias (Design &analysis). MOSFET biasing,	10
II	BJT Amplifiers: Design of RC coupled CE amplifier - Small signal analysis of CE amplifier using hybrid- π model (low and mid frequency`). The high frequency hybrid-π model of BJT, Miller effect, High frequency response of single stage CE amplifier, short circuit current gain, cut-off frequency fβ& unity gain bandwidth fT . MOSFET Amplifiers: Design of CS amplifier, Small signal analysis using hybrid- π model (mid frequency only), Small signal voltage gain, input & output impedance, CS stage with current source load and diode connected load. Multistage BJT Amplifiers: Types of multistage amplifiers, Effect of cascading on gain and bandwidth. Small signal	12

	voltage gain, input & output impedance of BJT cascode amplifier using hybrid-π model.	
III	Feedback amplifiers: The general feedback structure, Effect of negative feedback on gain, bandwidth, noise reduction and distortion. The four basic feedback topologies, Analysis of discrete BJT circuits in voltage-series and voltage-shunt feedback topologies - voltage gain, input and output impedance. Oscillators: Classification, criterion for oscillation, Wien bridge oscillator, Hartley and Crystal oscillator. (working principle and design equations of the circuits; analysis of Wien bridge oscillator only required).	11
IV	Power amplifiers: Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers, complementary- symmetry class B and Class AB power amplifiers, class C and D power amplifier - efficiency and distortion (no analysis required) Linear Voltage Regulators: Types of voltage regulators- series and shunt -working and design, load & line regulation, short circuit protection and fold back protection.	11
Total hours		**44**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Electronic Devices and Circuit Theory. Robert Boylestad and L Nashelsky, Pearson11th edition,2015
T2	Microelectronic Circuits Sedra A. S. and K. C.Smith, Oxford University Press, 2013 6th edition,2013
T3	Electronic Circuits and Devices Theodore F. Bogart;Beasley, Jeffrey S.; Guillermo Rico Pearson Education India 6th edition
R1	Fundamentals of Microelectronics Razavi B. Wiley 2nd edition,2015
R2	Electronic Devices and Circuits David A Bell Oxford University Press 5th

	edition,2008
R3	Electronic Circuits Analysis and Design 1D. Meganathan Yes Dee Publishing 1st edition,2023
R4	Analysis and Design of Electronic Circuits K. Gopakumar OWL Books 1st edition,2023

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
BEE/ (GYEST104)	Basic Electrical Engineering	It provides foundational knowledge of electric circuits, laws, and components, serving as a prerequisite for understanding the behaviour and analysis of analog electronic circuits.	S1

COURSE OBJECTIVES:

1. To introduce and verify basic principles, operation and applications of the various analog electronic circuits and devices
2. To understand and analyze the design and working of amplifiers and their configurations.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

COs / CO-PO/PSO MAPPING. /BLOOM'S TAXONOMY LEVEL	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
PCECT303.1	Design wave shaping circuits using first order RC network and diodes													
	3	**3**	**2**		**2**							**2**	**3**	**2**
	APPLICATION													
PCECT303.2	Analyze single stage and multistage BJT amplifier circuits using equivalent models.													
	3	3										2	3	
	APPLICATION													
PCECT303.3	Apply the principles of feedback in the design of oscillators.													
	3	3	2		2							2	3	2

	APPLICATION													
PCECT303.4	Design power amplifiers and voltage regulator circuits.													
	3	3	2		2							2	3	2
	APPLICATION													
MAPPING AVERAGE	3	3	2		2							2	3	2

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
PCECT303.1	PO1	3	Involves core electronic engineering knowledge in RC circuits and diode behaviour.
	PO2	3	Requires problem analysis to determine the correct design approach.
	PO3	2	Involves circuit design but not full-fledged system development.
	PO5	2	Use of modern simulation tools (e.g., L T Spice) for circuit analysis/design.
	PO12	2	Students refer to evolving diode characteristics and modern simulation tools, promoting independent learning beyond the classroom.
	PSO1	3	Core skill: defining and implementing signal processing circuits.
	PSO2	2	Wave shaping is foundational for analog front-ends in communication systems, contributing to technology selection.
PCECT303.2	PO1	3	Deep understanding of transistor operation and amplifier characteristics is essential.
	PO2	3	Involves identifying circuit behavior under different bias and signal conditions, and analyzing gain, bandwidth, etc.
	PO5	2	
	PO12	2	Encourages continuous learning through comparison of

			classical models with current technologies and self-exploration using circuit simulation software.
	PSO1	3	Direct application in designing and modeling analog amplification circuits for signal processing.
	PSO2	2	Amplifier knowledge is vital in communication transmitters/receivers; helps in system-level design understanding.
PCECT303.3	PO1	3	Requires understanding feedback theory, circuit principles, and application to oscillator design.
	PO2	3	Analysis of loop gain, stability, and frequency determination requires critical thinking.
	PO3	2	Students design basic oscillator circuits like RC Phase Shift, Wien Bridge, etc., matching design specs.
	PO5	2	Circuit simulations using modern EDA tools aid in analysis and waveform verification.
	PO12	2	Introduces feedback concepts that students will revisit in control systems, communication circuits, etc.
	PSO1	3	Oscillators are fundamental signal sources in electronic systems – aligns with PSO1 objectives.
	PSO2	2	Used in transmitters and frequency synthesizers in communication systems.
PCECT303.4	PO1	3	Applies electronic fundamentals in power amplification and voltage control.
	PO2	3	Analyzing load conditions, efficiency, thermal stability, and line/load regulation involves problem-solving.
	PO3	2	Involves designing Class A/B/AB amplifiers and regulators using design specifications.
	PO5	2	Use of simulation tools to assess power dissipation, efficiency, and stability.
	PO12	2	Power electronics and regulators evolve; learning this gives students a base for industrial applications and newer technologies.
	PSO1	3	Core to implementing and testing practical analog

			systems.
	PSO2	2	Regulators and amplifiers are used in various blocks of communication systems, including base stations, modulators, etc.

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

GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	"Oscillator Phase Noise and Frequency Stability"	Assignment planned on the topic	PO1, PO2, PO4, PO5,PSO1, PSO2

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1.	Practical Design of Real Time Interfacing and Circuits	Workshop/Seminar	PO1.PO2,PO3,PO4, PO5,PO9,PO10,PO12,PSO1,PSO2

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	https://archive.nptel.ac.in/courses/108/106/108106188/

DELIVERY TECHNOLOGIES

CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD	▯	**ICT TOOLS**	
CLASSROOM WITH LCD PROJECTOR	▯	**ELECTRONIC CLASSROOM**	

INSTRUCTION METHODS

FACE TO FACE INSTRUCTION	Direct	▯	**FLIPPED CLASSROOM**	
	Project-based instruction		**BLENDED LEARNING**	
	Problem-based instruction		**ONLINE COURSES/MOOCs**	
	Technology enhanced learning	▯	**OTHERS (IF ANY)**	
	Experiential learning			
	Participative learning			

CO ASSESSMENT TOOLS-DIRECT

ASSIGNMENTS	▯	**TUTORIALS**	▯	**SERIES EXAMINATIONS**	▯	**UNIVERSITY EXAM**	▯
LAB PRACTICES		**VIVA**		**INTERNAL LAB EXAM**		**REPORT/ DOCUMENT PREPARATION**	
PRESENTATION		**EVALUATION BY GUIDE**		**INTERIM EVALUATION**		**FINAL EVALUATION**	

CO ASSESSMENT TOOLS -INDIRECT

ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)	▯

ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES

CO	**ASSESSMENT ITEMS**	**CLASS SESSIONS**	**LAB/FIELD/TUTORIAL HOURS**

PCECT303.1	S1, A1, T1	12	2
PCECT303.2	S2, A1, T2	14	2
PCECT303.3	S2, A2	12	-
PCECT303.4	S3, A3	12	-
		TOTAL HOURS OF INSTRUCTION	55

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Approved by HOD