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 4)

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 4 COURSES

GBMAT401

MATHEMATICS FOR ELECTRICAL SCIENCE–4

COURSE INFORMATION SHEET

PROGRAMME: ECE(UG)	**DEGREE: BTECH**
COURSE:MATHEMATICS FOR ELECTRICAL SCIENCE – 4	**SEMESTER: 4** **L-T-P CREDITS: 3:0:0:0**
COURSE CODE: GBMAT401 **REGULATION:2024**	**COURSE TYPE: THEORY**
COURSE AREA/DOMAIN:APPLIED MATHEMATICS	**CONTACT HOURS:36**
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME: NIL**

SYLLABUS

MODULE	DETAILS	HOURS
I	Random variables, Discrete random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Binomial distribution, Poisson distribution, Poisson distribution as a limit of the binomial distribution, Joint pmf of two discrete random variables,Marginal pmf, Independent random variables, Expected value of a function of two discrete variables. [Text 1: Relevant topics from sections 3.1 to 3.4, 3.6, 5.1, 5.2]	9
II	Continuous random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Uniform, Normal and Exponential distributions, Joint pdf of two Continuous random variables,Marginal pdf,Independent random variables, Expectation value of a function of two continuous variables. [Text 1: Relevant topics from sections 3.1,4.1, 4.2, 4.3, 4.4, 5.1, 5.2]	9

III	Confidence Intervals, Confidence Level, Confidence Intervals and One-side confidence intervals for a Population Mean for large and small samples(normal distribution and t-distribution), Hypotheses and Test Procedures, Type I and Type II error, z Tests for Hypotheses about a Population Mean (for large sample), t Test for Hypotheses about a Population Mean (for small sample), Tests concerning a population proportion for large and small samples. [Text 1: Relevant topics from 7.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.4]	9
IV	Random process concept, classification of process, Methods of Description of Random process, Special classes, Average Values of Random Process, Stationarity- SSS, WSS, Autocorrelation functions and its properties, Ergodicity, Mean-Ergodic Process, Mean-Ergodic Theorem, Correlation Ergodic Process, Distribution Ergodic Process. [Text 2: Relevant topics from Chapter 6]	9
Total hours		36

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Probability and Statistics for Engineering and the Sciences Devore J. L Cengage Learning 9th edition,2016
T2	Introductory Methods of Numerical Analysis S S Sastry PHI Learning Pvt Limited 5th edition,2012

R1	Probability, Random Variables and Stochastic Processes,Papoulis, A. & Pillai, S.U., McGraw Hill. 4th edition,2002
R2	Introduction to Probability and Statistics for Engineers and Scientists Ross, S. M. Academic Press 6th edition,2020
R3	Numerical methods for Engineers Steven C. Chapra,Raymond P. Canale McGraw Hill Education 8th edition,2021.

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
GBMAT401	**MATHEMATICS FOR ELECTRICAL SCIENCE – 4**	Basic calculus.	**S4**

COURSE OBJECTIVES:

1	To familiarize students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
2	To provide the students with the basics of various numerical methods to develop problem solving skills used in various engineering disciplines.

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
GBMAT401.1	Understand the concept, properties and important models of discrete random variables and to apply in suitable random phenomena..													
	3	**3**	**2**	**2**								**2**	**2**	**2**
	APPLY													
GBMAT401.2	Understand the concept, properties and important models of continuous random variables and to apply in suitable random phenomena.													
	3	**3**	**2**	**2**								**2**	**2**	**2**
	APPLY													
GBMAT401.3	Estimate population parameters, assess their certainty with confidence intervals, and test hypotheses about population means and proportions using z-tests and the one-sample t-test.													
	3	**3**	**2**	**2**								**2**	**2**	**2**
	APPLY													
GBMAT401.4	Apply numerical methods to find solutions of linear system of equations, ordinary differential equations and Laplace equations.													
	3	**3**	**2**	**2**								**2**	**2**	**2**
	APPLY													
MAPPING AVERAGE	**3**	**3**	**2**	**2**								**2**	**2**	**2**

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
GBMAT401.1	PO1	3	The course develops strong mathematical knowledge by introducing random variables, probability distributions, expectation, mean, variance, and standard discrete distributions like Binomial and Poisson.
	PO2	3	Students analyze probabilistic models such as Binomial and Poisson distributions, joint and marginal pmfs, and independence to solve and interpret random phenomena.
	PO3	2	The course helps students model real-world uncertainty using discrete probability distributions and joint distributions, which are useful in system modeling and performance analysis.
	PO4	2	Students investigate properties of random variables through expectation, variance, and joint distributions, enabling data interpretation and probabilistic reasoning.
	PO12	2	Learning probabilistic concepts such as new distributions, joint behavior, and expectations encourages students to continuously update their mathematical knowledge for advanced studies.

	PSO1	2	The course supports electronics and communication applications by providing probabilistic tools for modeling noise, traffic, reliability, and random signals using discrete distributions.
	PSO2	2	Understanding the random variables and probability distributions support the use of simulation tools and data analysis software for solving practical engineering problems
GBMAT401.2	PO1	3	Students apply the concepts of continuous random variables, probability density functions, expectation, mean and variance to solve engineering and scientific problems.
	PO2	3	Students analyze problems using cumulative distribution functions, joint and marginal pdfs, and test independence of continuous random variables.
	PO3	2	Students design mathematical models of real-life systems using Uniform, Normal and Exponential distributions.
	PO4	2	Students interpret probabilistic results and validate solutions using analytical methods and standard statistical techniques.
	PO12	2	Exposure to probabilistic modeling enhances students' ability to adapt to modern statistical tools and applications in data analysis.

	PSO1	2	The course strengthens program-specific analytical skills by applying probability concepts to engineering and applied science problems.
	PSO2	2	Students gain foundational knowledge useful for advanced studies and professional applications involving stochastic modeling and data analysis.
GBMAT401.3	PO1	3	Students apply fundamental knowledge of probability, statistics, and hypothesis testing to analyze population parameters and make data-driven decisions.
	PO2	3	The course enables students to analyze statistical problems involving confidence intervals and hypothesis testing for large and small samples.
	PO3	2	Students design basic statistical models and testing procedures to solve real-world problems related to population mean and proportion.
	PO4	2	Learners interpret statistical results using standard tables and computational tools to validate hypotheses.
	PO12	2	The course introduces modern statistical methods and encourages awareness of contemporary tools used in data analysis.
	PSO1	2	Students develop domain-specific problem-solving skills by applying statistical inference techniques in engineering and applied sciences.

	PSO2	2	The course enhances analytical ability required for higher studies and professional practice involving statistical decision-making.
GBMAT401.4	PO1	3	Students apply mathematical foundations to numerical methods such as Newton–Raphson, Gauss Elimination, and numerical solutions of differential equations.
	PO2	3	The course strengthens the ability to analyze numerical problems and obtain approximate solutions to complex mathematical models.
	PO3	2	Learners design numerical algorithms for solving algebraic equations, differential equations, and curve-fitting problems.
	PO4	2	Students use numerical techniques and computational approaches to investigate and validate mathematical models.
	PO12	2	Exposure to numerical methods equips students with skills needed to adapt to emerging computational technologies.
	PSO1	2	The course supports program-specific skills by applying numerical methods in engineering and scientific computations.
	PSO2	2	Students gain practical numerical analysis skills useful in research, simulations, and advanced problem-solving applications.

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

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS

SL NO:	DESCRIPTION

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
GBMAT401.1	S1,A1	14	
GBMAT401.2	S2,A2	14	
GBMAT401.3	S2, A2	12	
GBMAT401.4	S3,A3	12	
		TOTAL HOURS OF INSTRUCTION:52	

Prepared by :

ANN ROSE
AP,ASH

Approved by HOD

B

PCECT402

SIGNALS AND SYSTEMS

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: SIGNALS AND SYSTEMS	**SEMESTER: 4** **L-T-P-R 3-1-0 -0 CREDITS**: 4
COURSE CODE: PCECT402 **REGULATION**:2024	**COURSE TYPE**: CORE
COURSE AREA/DOMAIN: SIGNAL PROCESSING & COMMUNICATION	**CONTACT HOURS**:6 HRS/WEEK
CORRESPONDING LAB COURSE CODE (IF ANY):	**LAB COURSE NAME**

SYLLABUS

MODULE	DETAILS	HOURS
I	Introduction to signals and systems: Continuous time and discrete time signals - Elementary signals, Classification of signals, Basic signal operations. Continuous time and discrete time systems – Representation and Classification (memory, causal, stable, linear, time-invariant, invertible) Convolution integral and convolution sum operations. Continuous time and discrete time LTI systems-Stability and causality of LTI systems..	11
II	Frequency domain representation of continuous time signals: Continuous time Fourier series - Exponential Fourier series representation of periodic signals. Continuous time Fourier transform - Convergence and Gibbs phenomenon, Continuous time Fourier transform of standard signals, Properties of Continuous time Fourier transform, Inverse Transform. Bilateral Laplace Transform, Concept of ROC, Relation of Laplace transform to Fourier Transform. .	11
III	Sampling of continuous time signals to discrete signals and frequency domain representation of discrete time signals: Conversion of continuous time signal to discrete time signal, Sampling theorem for low pass signals, Nyquist criteria, Aliasing. Discrete time Fourier series for discrete periodic signals. Discrete time Fourier transform (DTFT)- Convergence condition, DTFT of standard signals, Properties of DTFT, Inverse transform. Z transform- ROC, Properties (Proof not needed), Inverse transform, Relation between DTFT and Z-Transform.	11

IV	Analysis of LTI systems using Transforms Concept of transfer function-Frequency response, Magnitude response and phase response. Analysis of Continuous time LTI systems using Laplace and Fourier transforms. Analysis of discrete time LTI systems using DTFT and Z transforms, Stability and causality using Z transform.	11
Total hours		**44**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Signals and Systems Alan V. Oppenheim and Alan Willsky Pearson 2/e, 2015
T2	Signals and Systems Simon Haykin John Wiley 2/e, 2021
R1	Signals and Systems Anand Kumar PHI 3/e, 2013
R2	Principles of Signal Processing & Linear systems B P. Lathi Oxford University Press 2/e, 2009
R3	Signals & Systems - Continuous and Discrete Rodger E. Ziemer Pearson 4/e, 2013
R4	Analog and Digital Signal Processing Ashok Ambardar Brooks/Cole Publishing Company 2/e, 2013
R5	Signals and systems - Principles and Applications Shaila Dinkar Apte Cambridge University Press 1/e, 2016

COURSE PREREQUISITES: Mathematics for Electrical and Physical Sciences (GYMAT101, GYMAT201)

COURSE OBJECTIVES:

1	To provide sufficient understanding of different types of signals and systems in time and frequency domain
2	Analyze LTI systems in time and frequency domain using different transforms

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

PCECT402.1	Classify continuous and discrete time signals and systems based on their properties and perform basic operations on signals.													
	3	**1**			**2**							**1**	**3**	**2**
	UNDERSTAND													
PCECT402.2	Determine the stability and causality of LTI systems using convolution operations.													
	3	**3**	**2**	**2**	**2**							**2**	**3**	**2**
	APPLY													
PCECT402.3	Analyze signals in frequency domain using various transforms and examine their properties.													
	3	**3**	**3**	**2**	**2**							**3**	**2**	**2**
	APPLY													
PCECT402.4	Interpret the use of various transforms to analyze continuous and discrete time LTI systems.													
	3	**3**	**3**	**3**	**2**							**3**	**3**	**2**
	APPLY													
MAPPING AVERAGE	**3**	**2.5**	**2.67**	**2.33**	**2**							**2.25**	**2.75**	**2**

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
PCECT402.1	PO1	3	Students apply fundamental engineering principles to classify signals and systems and carry out basic signal operations.
	PO2	1	Students perform essential analytical steps to identify signal and system properties based on given information
	PO5	2	Students use basic computational tools to visualize and verify operations on continuous and discrete signals when needed.
	PO12	1	Students gain foundational exposure to concepts that support continuous learning in advanced signal-processing and communication areas
	PSO1	3	Students build foundational signal-processing understanding that supports the modelling and testing of

			electronic circuits and systems used in signal-processing applications
	PSO2	2	Enables students to distinguish signal characteristics essential for selecting suitable technologies in modern communication system implementation.
PCECT402.2	PO1	3	Students a[[ply core mathematical fundamentals of LTI theory and convolution to determine system stability and causality, directly utilizing essential engineering knowledge
	PO2	3	Students analyze system behavior by interpreting impulse responses and systematically determining whether an LTI system meets stability and causality conditions.
	PO3	2	Students develop solution steps for convolution-based system evaluation, enabling them to formulate appropriate approaches for testing system properties.
	PO4	2	Students investigate system responses through convolution operations and interpret the outcomes to draw valid conclusions on system characteristics.
	PO5	2	Students utilize computational tools such as MATLAB to perform convolution operations and validate system stability and causality.
	PO12	2	Students gain analytical skills in system evaluation that form a foundation for continuous learning in advanced DSP, communication, and real-time system applications.
	PSO1	3	Students build the analytical ability needed to model and assess LTI system behaviors, which is essential for defining, designing, and testing signal-processing circuits and systems
	PSO2	2	Students gain the competence to evaluate system stability and causality, enabling informed selection of appropriate technologies for reliable modern communication system implementation

PCECT402.3	PO1	3	Students apply core mathematical and engineering fundamentals to compute and interpret frequency-domain representations using Fourier, Laplace, and other transforms.
	PO2	3	Students analyze signal behavior, identify spectral characteristics, and interpret frequency-domain problems to draw meaningful conclusions.
	PO3	3	Students evaluate transform-based methods and choose appropriate analytical approaches to solve system and signal-related design requirements.
	PO4	2	Students investigate signals using frequency-domain tools, compare transform results, and validate properties through systematic examination.
	PO5	2	Students use simulation tools such as MATLAB to compute transforms, visualize spectra, and verify analytical outcomes.
	PO12	3	Students gain foundational frequency-domain skills that prepare them for continuous learning in advanced areas such as DSP, communication, audio/image processing, and machine learning.
	PSO1	2	Students interpret frequency-domain behavior essential for designing, modeling, and testing electronic circuits and systems that perform signal-processing functions.
	PSO2	2	Students analyze spectral characteristics that guide the selection of appropriate modulation, filtering, and communication technologies in modern communication systems.
PCECT402.4	PO1	3	Students apply core mathematical and engineering principles to interpret Fourier, Laplace, and Z-transform methods for analyzing LTI system behavior.
	PO2	3	Students analyze system responses using different transform techniques, enabling them to identify system characteristics and solve related analytical problems.

	PO3	3	Students use transform-domain insights to evaluate suitable analysis approaches for LTI systems, supporting informed decision-making in system modeling
	PO4	3	Students interpret transform-based representations to investigate time and frequency characteristics of signals and systems through systematic analysis.
	PO5	2	Students use computational tools such as MATLAB to visualize transform properties and evaluate system responses, though tool dependency
	PO12	3	Students build a strong conceptual foundation that prepares them for advanced courses and evolving signal-processing techniques that rely heavily on transform analysis.
	PSO1	3	Students interpret transform-based analysis to understand and evaluate signal-processing circuits and systems that operate in the frequency domain.
	PSO2	2	Students use transform techniques to recognize and choose appropriate analytical methods essential for understanding modulation, filtering, and spectral characteristics in modern communication systems.

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	Tool/Software Usage (Use of simulation tools (MATLAB)for signal/system analysis)	Hands on session//Tool based Assignment	PO1, PO2, PO3, PO4, PO5, PO9, , PO12, PSO1(3), PSO2(2)

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS

1	Advanced Signal Processing Concepts	Design Activities (Project/Assignment Ideas)	PO1, PO2, PO3, PO4, PO5, PO9, PO12.PSO1 (3), PSO2 (2)

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	https://nptel.ac.in/courses/117101055
2	https://nptel.ac.in/courses/117104074
3	https://nptel.ac.in/courses/108104100

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
PCECT402.1	S1, A1, T	11	
PCECT402.2	S1, A1, T	5	
PCECT402.3	S2, A2, T	32	
PCECT402.4	S3, A3, T	16	
		TOTAL HOURS OF INSTRUCTION	64

Prepared by
Dr.Anetha Mary Soman

Approved by HOD

C

PCECT403

LINEAR INTEGRATED CIRCUITS

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: LINEAR INTEGRATED CIRCUITS	**SEMESTER:** **L-T-P-CREDITS**: 3-1-0-4
COURSE CODE: PCECT403 **REGULATION**:2024 SCHEME	**COURSE TYPE**: CORE
COURSE AREA/DOMAIN: CIRCUIT AND SYSTEMS	**CONTACT HOURS**: 4
CORRESPONDING LAB COURSE CODE (IF ANY): PCECL407	**LAB COURSE NAME**: LINEAR INTEGRATED CIRCUITS LAB

SYLLABUS

MODULE	DETAILS	HOURS
I	Differential Amplifiers: Differential amplifier configurations using BJT, DC Analysis - transfer characteristics; AC analysis - differential and common mode gains, CMRR, input and output resistance, voltage gain, constant current bias, constant current source. Concept of current mirror: two-transistor current mirror, Wilson and Widlar current mirrors. Operational amplifiers (Op Amps): The 741 Op Amp, Block diagram, Ideal Op Amp parameters, typical parameter values for 741, equivalent circuit, open loop configurations, voltage transfer curve, frequency response curve	11
II	Op Amp with negative feedback: General concept of Voltage Series, Voltage Shunt, Current Series and Current Shunt negative feedback, Op Amp circuits with Voltage Series and Voltage Shunt feedback, Virtual ground concept. Analysis of inverting and non-inverting amplifier for closed loop gain, Input Resistance and Output Resistance. Op Amp applications: Summer, Voltage Follower, Differential and Instrumentation Amplifiers, Voltage to Current and Current to Voltage converters, Integrator, Differentiator, Precision Rectifiers, Comparators, Schmitt Triggers, Log and Antilog amplifiers.	11

III	Oscillators and Multivibrators: Phase Shift and Wien-bridge Oscillators, Triangular and Sawtooth waveform generators, Astable and Monostable multivibrators. Active filters: Comparison with passive filters, First and Second order Low pass, High pass, Band pass and Band Reject active filters, State Variable filters. Voltage Regulators: Fixed and Adjustable voltage regulators, IC 723 – Low voltage and High voltage configurations, Current boosting, Current limiting, Short circuit and Fold-back protection.	11
IV	Timer and VCO: Timer IC 555 - Functional diagram, Astable and monostable operations, Basic concepts of Voltage Controlled Oscillator and application of VCO IC LM566. Phase Locked Loop: Basic building block, Operation, Closed loop analysis, Lock and capture range, Applications of PLL, PLL IC565. Data Converters: Digital to Analog converters, Specifications, Weighted resistor type and R-2R Ladder type. Analog to Digital Converters: Specifications, Flash type and Successive approximation type.	11
Total hours		**44**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	1. Roy D. C. and S. B. Jain, Linear Integrated Circuits, New Age International, 5/e, 2018
R1	Design with Operational Amplifiers and Analog Integrated Circuits Sergio Franco Tata McGraw Hill 3/e, 2017
R2	Op-Amps and Linear Integrated Circuits Gayakwad R. A. Prentice Hall 4/e, 2015
R3	Integrated Circuits Botkar K. R. Khanna Publishers 10/e, 2013

R4	Operational Amplifiers C.G. Clayton Butterworth & Company Publ. Ltd. Elsevier 5/e, 2005
R5	Operational Amplifiers & Linear Integrated Circuits R.F. Coughlin & Fredrick Driscoll PHI 6/e, 2000
R6	Operational Amplifiers & Linear ICs David A. Bell Oxford University Press 3/e, 2011
R7	Microelectronic Circuits Sedra A. S. and K. C. Smith Oxford University Press 6/e, 2013

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
PCECT303	Analog Circuits		S3

COURSE OBJECTIVES:

1	To develop skills to design and analyze circuits using operational amplifiers for various applications.

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
PCECT403.1	Summarize the concepts of operational amplifiers and differential amplifier configurations													
	3	**2**										**1**	**3**	**3**
	UNDERSTAND													
PCECT403.2	Design operational amplifier circuits for various applications.													
	3	**2**	**3**	**3**	**2**							**2**	**3**	**3**
	APPLY													
PCECT403.3	Choose integrated circuit chips for various linear circuit applications.													
	3				**2**							**2**	**3**	**3**
	APPLY													
PCECT403.4	Implement various applications using specific integrated circuit chips													
	3	**2**	**2**	**2**	**2**							**2**	**3**	**3**
	UNDERSTAND													

MAPPING AVERAGE	**3**	**2**	**2.5**	**2.5**	**2**							**1.75**	**3**	**3**

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
PCECT403.1	PO1	3	Enables strong application of semiconductor theory and differential amplifier fundamentals
	PO2	2	Involves analytical evaluation of DC and AC characteristics of amplifier circuits.
	PO12	1	Introduces evolving concepts such as current mirrors, encouraging self-learning.
	PSO1	3	Differential amplifiers and current mirror circuits enable modeling and analysis of signal amplification stages.
	PSO2	3	Amplifier and biasing techniques form essential building blocks in communication front-end circuits.
PCECT403.2	PO1	3	Applies fundamental op-amp principles to analyze and design amplifier circuits.
	PO2	2	Emphasizes performance analysis of feedback-based op-amp configurations.
	PO3	3	Involves systematic design of practical op-amp applications.
	PO4	3	Supports experimental investigation and validation of circuit behavior.
	PO5	2	Utilizes simulation tools and IC datasheets for circuit analysis.
	PO12	2	Encourages continuous learning of modern analog IC applications.

	PSO1	3	Op-amp configurations support design, implementation, and testing of signal processing circuits such as amplifiers and converters.
	PSO2	3	Op-amp based signal conditioning circuits are crucial in communication system subsystems.
PCECT403.3	PO1	3	Applies principles of oscillators, filters, and voltage regulators.
	PO5	2	Uses software tools for analysis and design of active filters.
	PO12	2	Promotes awareness of advancements in analog power and signal circuits.
	PSO1	3	Oscillators, filters, and regulators facilitate signal generation, conditioning, and power management in electronic systems.
	PSO2	3	Oscillators and filters are key components in frequency selection and signal stabilization.
PCECT403.4	PO1	3	Applies core knowledge of timers, PLLs, and data converters.
	PO2	2	Applies core knowledge of timers, PLLs, and data converters.
	PO3	2	Designs basic timing, control, and conversion circuits.
	PO4	2	Evaluates system performance through analysis and experimentation.
	PO5	2	Employs modern ICs and simulation tools effectively.
	PO12	2	Encourages continuous learning in mixed-signal and VLSI systems.

	PSO1	3	Timers, PLLs, and data converters enable modeling and testing of timing and signal conversion blocks.
	PSO2	3	PLLs and data converters support synchronization and digital interfacing in modern communication systems.

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	No emphasis on EDA tools and simulation practices	Lab sessions on schematic entry, SPICE simulations	PO 3, PSO 1

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Design and simulation of any one application of Op-Amp	Simulation of Op-Amp application in PSPICE simulation tool	PO3, PO5,PSO1
2	Design of any one electronic application	Project based learning method to design any one application using 555 timer IC	PO3,PSO1

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	
	Instrumentation Amplifiers https://www.youtube.com/watch?v=VfJ2AHO2aHg
2	OPAmp ADDER Or Summing Amplifier https://www.youtube.com/watch?v=PzbdTfUatIY
3	https://www.youtube.com/watch?v=NdFYCe9bBXg&list=PL2UV2EJdMQmhPSXF3YBFTYP2Pw2YiEmUl
4	https://nptel.ac.in/courses/117101106
5	https://nptel.ac.in/courses/117101106
6	https://nptel.ac.in/courses/117101106
7	https://nptel.ac.in/courses/117101106

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
PCECT403.1	S1,A1,T1	12	1
PCECT403.2	S2,A1,T2	12	1
PCECT403.3	S2,A2,T3	12	1
PCECT403.4	S3,S3,A3,T4	12	1
		TOTAL HOURS OF INSTRUCTION	**52**

Prepared by **Approved by HOD**

Manu Thomas

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PBECT404

MICROCONTROLLERS

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: MICROCONTROLLERS	**SEMESTER: S4** **L-T-P-R-CREDITS**: 3:0:0:1:4
COURSE CODE: PBECT404 **REGULATION**:2024	**COURSE TYPE**: CORE
COURSE AREA/DOMAIN: ELECTRONICS AND COMMUNICATION ENGINEEERING	**CONTACT HOURS**:5 PERIODS/WEEK + 1 REMEDIAL HOUR
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME**: NIL

SYLLABUS

MODULE	DETAILS	HOURS
I	Microcontroller Architecture – General internal architecture, Address bus, Data bus, control bus. The Microcontroller 8051: Features of 8051 microcontroller, Block diagram of 8051- program status word (PSW), accumulator, program counter. Memory organization – RAM & ROM, register banks and stack, Special Function Registers (SFRs), I/O port organization, Interrupts.	9
II	Instruction Set of 8051 & Addressing modes: Classification of instruction set - Data transfer group, arithmetic group, logical group, and branching group. Addressing modes - Types. Accessing the data from internal and external memory.	9
III	Programming 8051 Using Assembly Language: Introduction to 8051 assembly language programming. Data types & directives, Concept of subroutine. Software delay programming. Programming 8051 Using Embedded C Language: Introduction to embedded C – advantages.	9
IV	Timer / Counter in 8051: Timer registers - Timer0, Timer1. Configuration of timer registers. Timer mode programming.	9

	Counter mode. Serial Communication in 8051: Serial communication – modes and protocols, RS-232 pin configuration and connection. Serial port programming – transmitting and receiving. Programming the interrupts: Use external, timer and serial port interrupts. Interrupt priority settings.	
Total hours		**36**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	The 8051 Microcontroller and Embedded Systems Using Assembly and C Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay Prentice Hall –Inc Second 2007
T2	The 8051 Microcontroller Architecture, Programming and Applications Kenneth J Ayala Dhananjay V Gadre Cengage Learning 2010
R1	8051 hardware Description Datasheet Intel Corporation 1992
R2	Microprocessors and Microcontrollers Lyla B. Das Pearson Education 2011

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
PBECT304	Logic Circuit Design	Students learned about the logic circuit fundamentals	S3

COURSE OBJECTIVES:

1	To learn Microcontroller architecture and its programming
2	To learn embedded system design to develop a product.

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
PBECT404.1	Outline Architecture of Microcontroller													
	3												1	1
	APPLY													
PBECT404.2	Develop Microcontroller programs													
	3	3	3	2	3			2				2	2	2
	APPLY													
PBECT404.3	Design various interfaces to Microcontroller													
	3	3	3	3	3			2				2	2	2
	APPLY													
PBECT404.4	Design and implement an Embedded System													
	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	UNDERSTAND													
MAPPING AVERAGE	**3**	**3**	**3**	**2.67**	**3**	**3**	**3**	**2.33**	**3**	**3**	**3**	**2.33**	**2**	**2**

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
PBECT404.1	PO1	3	Student gets fundamental knowledge of microcontrollers structures, architecture blocks and their functions
	PSO1	1	Architecture understanding is essential for system design
	PSO2	1	Knowledge of microcontroller architecture is required in communication system
PBECT404.2	PO1	3	Programming requires strong knowledge of instruction set, addressing modes and system hardware structure
	PO2	3	Requires strong analytical skills to analyse

			problems
	PO3	3	Strongly mapped as programs as ultimately developed for resolving problems
	PO4	2	Involves verification and debugging of problems
	PO5	3	Modern tools are used for simulation/hardware implementation
	PO8	2	Ethical coding is essential for embedded system design
	PO12	2	Requires ability to upgrade programming skills with the technology advancements
	PSO1	2	Programming helps in building and testing basic electronic and signal-processing systems.
	PSO2	2	Programming communication ports and protocols helps in creating simple communication systems.
PBECT404.3	PO1	3	Requires strong theoretical knowledge of digital/analog interfacing.
	PO2	3	Interfacing requires problem analysing skills
	PO3	3	Interfacing involves designing process
	PO4	3	Involves testing and validating interfaces
	PO5	3	Involves usage of modern software tools
	PO8	2	Ethical design is required
	PO12	2	Regular upgradation of design skills required
	PSO1	2	Interfacing sensors contributes to building electronic systems involving signal processing.
	PSO2	2	Interfacing is essential in communication systems
PBECT404.4	PO1	3	Requires strong knowledge in architecture
	PO2	3	Design and implementation of embedded system requires identification of user needs and problems
	PO3	3	Involves creating solutions to the identified problems
	PO4	3	Involves testing and validation process
	PO5	3	Involves usage of modern tools for programming testing and validation

	PO6	3	Designing and implementing an embedded system requires strong attention to safety
	PO7	3	Embedded systems must consider safety, sustainability, and societal impact in design.
	PO8	3	Ethical practices should be followed during design and implementation of embedded system
	PO9	3	Requires team work and coordination
	PO10	3	Requires ability to present the design and results
	PO11	3	Involves proper planning of tasks and managing resources.
	PO12	3	Involves continuous learning of evolving embedded tools and technologies.
	PSO1	3	Strongly aligned with modelling, implementing, and testing electronic systems.
	PSO2	3	Strongly related to modern communication systems or techniques

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	A foundational session on Embedded Systems, covering their basic functions, design principles, and real-world applications, can be introduced before progressing to programming.	Conduct an Introductory session on Embedded system	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PSO1, PSO2

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	I2C, SPI, CAN bus – basic working principles	Include a simple presentation or discussion	PO1, PO2, PO3, PO12, PSO2

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	Microprocessors and Microcontrollers - https://nptel.ac.in/courses/106108100
2	Microcontrollers and Applications - https://nptel.ac.in/courses/117104072

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
PBECT404.1	S1, PRJ	11	-
PBECT404.2	S2, PRJ	22	-
PBECT404.3	S3, PRJ	11	-
PBECT404.4	S3, PRJ		-
TOTAL HOURS OF INSTRUCTION			53

Prepared by **Approved by HOD**

Nithin C

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PEECT 412

POWER ELECTRONICS

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: POWER ELECTRONICS	**SEMESTER: S5** **L-T-P-CREDITS**: 3-0-0-0
COURSE CODE: **REGULATION**: PE**ECT 412::2024**	**COURSE TYPE**: **ELECTIVE**
COURSE AREA/DOMAIN: **ANALOG CIRCUITS**	**CONTACT HOURS**:5
CORRESPONDING LAB COURSE CODE (IF ANY):	**LAB COURSE NAME**:

SYLLABUS

TEXT BOOKS/REFERENCE BOOKS:

MODULE	DETAILS	HOURS
I	Introduction: Scope and applications of Power Electronics, Properties of an ideal switch. Structure and static characteristics: Power diodes, Power BJT, Power MOSFET & IGBT – comparison. Basic principles of wide band gap devices – SiC & GaN. Safe Operating Area: Power BJT, Power MOSFET & IGBT. Drive Circuits: Power BJT and Power MOSFET (any two example circuits – no analysis).	9
II	SCR: Structure, two transistor analogy, static characteristics. Rectifiers: Three phase diode bridge rectifiers, Single phase half-controlled rectifier with R load – Single phase fully controlled bridge rectifier (continuous conduction) – output voltage equation. Principle of three phase half wave controlled rectifier– (average output voltage equation for continuous load current) – related simple problems (1-phase & 3-phase).	9
III	DC – DC Switch Mode Converters: Buck, Boost and Buck-boost DC-DC converters. Waveforms and expression of DC-DC converters for output voltage, voltage and current ripple under continuous conduction mode. Isolated converters: Flyback, Forward, Push Pull, Half bridge and Full	9

	bridge converters – Waveforms and governing equations.	
IV	SDC-AC Switch Mode Inverters: Inverter topologies, Driven Inverters: Push-Pull, Half bridge and Full bridge configurations, Single phase PWM inverters (Single pulse width and sinusoidal pulse width modulation) – rms output voltage equation and output voltage waveforms.	9
Total hours		**36**

T/R	**Power Electronics Essentials & Applications**
T1	Power Electronics Essentials & Applications L Umanand Wiley InReprint Edition 2014
T2	Power Electronics Circuits,Devices, and Applications Muhammad H Rashid Pearson India Third Edition
R1	Power Electronics Converters,Applications, and Design Ned Mohan, Tore M Undeland, William P.Robbins Wiley India Third Edition
R2	Power Electronics Daniel W Hart McGraw-HILL 2011

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
PCECT303	Analog Circuits	To understand basic circuit analysis and semiconductor device behavior is essential to analyze, design, and control power electronic converters and switching devices.	S3

COURSE OBJECTIVES:

1	To study the characteristics of power electronic devices.
2	To study different power converter circuits.

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
PEECT412.1	Outline the operation of power semiconductor devices and its characteristics.													
	3											2	2	
	UNDERSTAND													
PEECT412.2	Design and analyze various rectifier circuits for power devices													
	3		3		3	3						2	3	
	APPLY													
PEECT412.3	Analyze different power converter circuits													
	3		3	3	3	3	3					2	3	
PEECT412..4	Illustrate different types of inverter circuits													
	3		3	3	3	3	3					2	2	
	UNDERSTAND													
MAPPING AVERAGE	3		3	3	3	3	3					2	2.5	

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
PEECT412 .1	PO1	3	Applies fundamental knowledge of semiconductor physics and electrical engineering to explain device operation and characteristics.
	PO12	2	Strengthens the ability to analyze and understand the operation of power electronic devices used in electronic circuits and systems.
	PSO1	2	Strengthens the ability to analyze and understand the operation of power electronic devices used in

			electronic circuits and systems.
PEECT412.2	PO1	3	Applies principles of circuit theory, power semiconductor devices, and electrical engineering to design rectifier circuits.
	PO3	3	Enables the design of appropriate rectifier configurations to meet specified performance requirements.
	PO5	3	involves the use of simulation and analysis tools to model, test, and optimize rectifier circuits.
	PO6	3	Considers safety, standards, and societal impact while designing rectifier systems for reliable power conversion.
	PO12	2	Develops the ability to analyze and design power electronic circuits using rectifier configurations.
	PSO1	3	Students define circuit requirements, design and analyze rectifier circuits, model their performance, and test output characteristics relevant to power and signal processing applications.
PEECT412.3	PO1	3	Applies fundamental principles of power electronics, circuit theory, and semiconductor devices to analyze converter circuits.
	PO3	3	Supports selection and modification of suitable converter topologies to meet required performance specifications.
	PO4	3	involves investigating converter behavior, efficiency, and losses under varying operating conditions.
	PO5	3	Utilizes simulation and analysis tools to study and validate power converter performance.
	PO6	3	Considers safety, reliability, and standards in the application of power converters in societal and industrial systems.
	PO7	3	Encourages energy-efficient converter analysis to minimize losses and environmental impact.
	PO12	2	Students engage in self-directed learning by studying different power converter topologies, updating their

			knowledge of evolving power electronic technologies, and applying this understanding to analyse converter operation and performance.
	PSO1	3	Ability to analyze and design power electronic circuits and systems using appropriate converter topologies.
PEECT412.4	PO1	3	Applies fundamental concepts of power electronics and semiconductor devices to explain inverter circuit operation.
	PO3	3	Enables design and selection of appropriate inverter topologies based on application requirements.
	PO4	3	Involves analysis and investigation of inverter performance parameters such as harmonics, efficiency, and losses.
	PO5	3	Uses simulation and design tools to model and illustrate inverter circuits and their characteristics.
	PO6	3	Considers safety, reliability, and standards in inverter applications for societal and industrial systems.
	PO7	3	Promotes efficient inverter designs to reduce energy losses and environmental impact.
	PO12	2	Encourages continuous learning to keep up with advances in inverter technologies and applications
	PSO1	2	Ability to analyze and explain the operation of inverter circuits used in power electronic systems.

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			

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1			
2			

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	https://www.youtube.com/watch?v=fOZ8bUrFJGk
2	https://archive.nptel.ac.in/courses/117/108/117108124/
3	https://www.youtube.com/watch?v=Dg5AIy0bY1A

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**
PEECT412.1	S1,A1	11	
PEECT412.2	S2,A1	11	
PEECT412.3	S2,A2	11	
PEECT412.4	S3,A3	11	
		TOTAL HOURS OF INSTRUCTION	44

Prepared by :Athira V **Approved by HOD:Nithin C**

G

UCHUT346 ECONOMICS FOR ENGINEERS

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: ECONOMICS FOR ENGINEERS	**SEMESTER: S3** **L-T-P-R-CREDITS**: 2-0-0-0-2
COURSE CODE: UCHUT346 **REGULATION**:2024	**COURSE TYPE**: THEORY
COURSE AREA/DOMAIN: HUMANITIES	**CONTACT HOURS**: 2
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME**: NIL

SYLLABUS

MODULE	DETAILS	HOURS
I	Basic economic problems – Production Possibility Curve – Utility – Law of diminishing marginal utility –Demand: Factors determining demand – Law of Demand – Demand curve- Price elasticity of demand- measurement of price elasticity and its applications – Supply: factors determining supply - Law of supply – Supply curve- Equilibrium price determination- Changes in demand and supply and its effects on equilibrium price and quantity Production: Production function - Law of variable proportion –Returns to scale- Cobb-Douglas Production Function	6
II	Cost: Cost concepts – Private cost and social cost – Sunk cost – Opportunity cost -Explicit and implicit cost –Short run cost curves –Long run average cost curve -Revenue concepts – Break-even point Market: Perfect Competition – Monopoly - Monopolistic Competition (features and equilibrium of a firm) - Oligopoly – Features – Kinked demand model	6

III	National income: Concepts (GDP, GNP and NNP)– Final goods and Intermediate goods - Methods of Estimation – output method – expenditure method-- Difficulties in the measurement of national income. Inflation: Causes and Effects – Measures to Control Inflation - Monetary and Fiscal policies – Repo and reverse repo rate	6
IV	Value Analysis and value Engineering: Cost Value, Exchange Value, Use Value, Esteem Value - Aims, Advantages and Application areas of Value Engineering - Value Engineering Procedure Capital Budgeting: Time value of money - Net Present Value Method - Benefit Cost Ratio – Internal Rate of Return -– Payback – Accounting Rate of Return.	6
Total hours		**24**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Managerial Economics,Geetika, Piyali Ghosh and Chodhury,Tata McGraw Hill,2015
T2	Engineering Economy H. G. Thuesen, W. J. Fabrycky PHI 1966
T3	Engineering Economics R. Paneerselvam PHI 2012
T4	Financial Management I M Pandey Vikas Publishing House 2015
R1	Engineering Economy Leland Blank P.E, Anthony Tarquin P. E. Mc Graw Hill 7TH Edition
R2	Indian Financial System Khan M. Y. Tata McGraw Hill 2011
R3	Engineering Economics and analysis Donald G. Newman, Jerome P. Lavelle Engg. Press, Texas 2002
R4	Contemporary Engineering Economics Chan S. Park Prentice Hall of India Ltd 2001
R5	Financial Management: Theory and Practice Prasanna Chandra McGraw Hill 2007

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
-	-	-	-

COURSE OBJECTIVES:

1	To provide students with an understanding of fundamental economic principles essential for effective decision-making in engineering contexts.
2	To enable students to apply economic analysis to production decisions, cost management, and market strategies in engineering practice.
3	To equip students with the ability to evaluate macroeconomic scenarios, financial methods, and investment decisions relevant to engineering projects.

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
UCHUT346.1	Understand the fundamentals of various economic issues using laws and learn the concepts of demand, supply, elasticity and production function													
						1					1			2
	UNDERSTAND													
UCHUT346.2	Develop decision making capability by applying concepts relating to costs and revenue, and acquire knowledge regarding the functioning of firms in different market situations.													
						1	1				1			2
	APPLY													
UCHUT346.3	Outline the macroeconomic principles of monetary and fiscal systems and national income.													
					1						2			2
	UNDERSTAND													
UCHUT346.4	Make use of the possibilities of value analysis and engineering, and take investment decisions through capital budgeting techniques.													
					1	1					2			2
	APPLY													
MAPPING AVERAGE					1	1	1				1.5			2

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
UCHUT346.1	PO6	1	Understanding economic principles helps assess societal impacts of engineering decisions.
	PO11	1	Economic concepts support effective project planning, resource allocation, and financial decision-making.
	PSO2	2	Knowledge of demand–supply analysis and production economics helps students evaluate market requirements and cost implications of different communication technologies. This understanding supports informed selection of suitable technologies, contributing **indirectly** to PSO2.
UCHUT346.2	PO6	1	Understanding cost and market structures helps assess the societal and ethical implications of pricing and production decisions.
	PO7	1	Knowledge of cost, revenue, and market behavior promotes sustainable economic practices in engineering solutions.
	PO11	1	Cost and market analysis equips engineers with financial insights essential for strategic project and business decision-making.
	PSO2	2	Cost–revenue analysis and market structure concepts enable students to compare alternative technology options based on economic feasibility. These decision-making skills aid in selecting appropriate communication technologies, contribute to PSO2.
UCHUT346.3	PO5	1	Understanding national income and inflation supports the creation of sustainable and economically viable engineering solutions.
	PO11	2	In-depth knowledge of national income estimation and inflation control enhances financial planning and strategic management in engineering projects.
	PSO2	2	Macroeconomic awareness helps students understand economic conditions, government policies, and investment climate that influence large-scale communication infrastructure decisions. This

			provides contextual support to technology selection,contributing to PSO2.
UCHUT346.4	PO5	1	Value analysis and capital budgeting promote sustainable and resource-efficient engineering solutions.
	PO6	1	Applying value engineering helps address societal needs through cost-effective and high-value designs.
	PO11	2	Capital budgeting techniques enhance project planning and financial decision-making in multidisciplinary engineering environments.
	PSO2	2	Value engineering and capital budgeting techniques are directly useful in evaluating and selecting cost-effective communication technologies. These tools support technology segregation and selection based on economic viability, giving a contribution to PSO2.

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	RELEVAN
1	Recent Advancements in Economics	Students will be asked to find out the recent advancements in the field of economics.	PO6,PO12

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	
2	

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
UCHUT346.1	S1,A1	8	-
UCHUT346.2	S2,A1	8	-
UCHUT346.3	S2,A2	8	-
UCHUT346.4	S3,A3	8	-
		TOTAL HOURS OF INSTRUCTION	32

Prepared by **Approved by HOD**

PCECL407

LINEAR INTEGRATED CIRCUITS LAB

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: LINEAR INTEGRATED CIRCUITS LAB	**SEMESTER:** **L-T-P-CREDITS**: 0-0-3-2
COURSE CODE: PCECL407 **REGULATION**:2024	**COURSE TYPE**: CORE
COURSE AREA/DOMAIN: COMMUNICATION	**CONTACT HOURS**: 6
CORRESPONDING LAB COURSE CODE (IF ANY):	**LAB COURSE NAME**:

SYLLABUS

MODULE	DETAILS	HOURS
I	Part A – List of Experiments using Op Amps (Minimum seven experiments mandatory) 1Familiarization of Operational amplifiers - Inverting and Non inverting amplifiers, Integrator, Differentiator – frequency response, Adder, Comparators 2 Measurement of Op-Amp parameters 3 Difference Amplifier and Instrumentation amplifier 4 Schmitt trigger circuit 5 Astable and Monostable multivibrators 6 Waveform generators using Op Amps - Triangular and Sawtooth 7 Wien bridge oscillator - without & with amplitude stabilization 8 RC Phase shift Oscillator 9 Active first and second order filters (LPF, HPF, BPF and BRF) 10 Active Notch filter to eliminate the 50Hz power line frequency 11 Precision rectifiers	21
II	Part B – Application circuits using ICs [Minimum three experiments are to be done] 1 Astable and Monostable multivibrator using Timer IC NE555 2 DC power supply using IC 723: Low voltage and high voltage configurations, Short circuit and Fold-back protection. 3 A/D converters- counter ramp and flash type. 4 D/A Converters - R-2R ladder circuit 5 Study of PLL IC: free running, frequency lock range and capture range	6

III	Part C – Simulation experiments [The experiments shall be conducted using open tools such as QUCS, KiCad or variants of SPICE] 1.Simulation of any three circuits from experiments 3, 5, 6, 7, 8, 9, 10 and 11 of section I 2. Simulation of experiments 3 or 4 from section II	6
Total hours		**33**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Linear Integrated Circuits D. Roy Choudhary and Shail B Jain New Age International Private Limited 6th edition, 2021
T2	Introduction to Pspice Using Orcad for Circuits and Electronics M. H. Rashid Pearson 3rd edition, 2015
R1	Op-Amps And Linear Integrated Circuits: Business Management Gayakwad PHI 2002
R2	Linear Integrated Circuits D Roy Choudhury, Shail Bala Jain New Age International (2018)

COURSE PREREQUISITES: NIL

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
PCECT303	Analog Circuits		

COURSE OBJECTIVES:

1	To study the design and implementation of various Linear Integrated Circuits.
2	To familiarize the simulation of basic Linear Integrated Circuits.

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
PCECL407.1	Design and implement basic linear integrated circuits using Op Amps.													
	3	**3**	**2**						**3**			**3**	**3**	**3**
	ANALYSE													
PCECL407.2	Design and implement basic linear integrated circuits using linear ICs.													
	3	**3**	**2**						**3**			**3**	**3**	**3**
	ANALYSE													
PCECL407.3	Design and simulate the functioning of basic linear integrated circuits and linear ICs. using simulation tools.													
	3	**3**	**2**		**3**				**3**			**3**	**3**	**3**
	ANALYSE													
PCECL407.4	Effectively troubleshoot a given circuit and analyze it													
	3	**3**	**2**						**3**			**3**	**3**	**3**
	ANALYSE													
MAPPING AVERAGE	**3**	**3**	**2**		**3**				**3**			**3**	**3**	**3**

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
PCECL407.1	PO1	3	Applies core engineering knowledge of op-amps to design and implement linear IC circuits.
	PO2	3	Analyzes circuit behavior, parameters, and frequency response using first principles.
	PO3	2	Designs op-amp based circuits such as amplifiers, filters, and oscillators to meet specifications.
	PO9	3	Performs laboratory experiments effectively as an individual and in teams.
	PO12	3	Encourages independent learning through circuit implementation and performance analysis.
	PSO1	3	Enables design, implementation, and testing of signal processing circuits using op-amps.
	PSO2	3	Supports selection of op-amp technologies relevant to communication subsystems.
PCECL407.2	PO1	3	Applies engineering fundamentals to design circuits using linear ICs such as timers and regulators.
	PO2	3	Analyzes operational characteristics of linear IC-based circuits.
	PO3	2	Develops functional IC-based solutions like multivibrators and power supplies.
	PO9	3	Encourages teamwork during laboratory design and implementation tasks.
	PO12	3	Promotes continuous learning of emerging linear IC technologies.
	PSO1	3	Facilitates implementation and testing of electronic systems for signal processing.
	PSO2	3	Aids in selecting suitable IC technologies for modern communication applications.

PCECL407.3	PO1	3	Applies theoretical knowledge to model and simulate electronic circuits.
	PO2	3	Analyzes simulation results to validate circuit functionality and performance.
	PO3	2	Designs circuit models using simulation platforms to meet design objectives.
	PO5	3	Uses modern simulation tools such as SPICE, QUCS, or KiCad effectively.
	PO9	3	Works collaboratively during simulation-based experiments and analysis.
	PO12	3	Encourages self-learning of modern tools and simulation techniques.
	PSO1	3	Supports modeling and testing of signal processing circuits through simulation.
	PSO2	3	Enables technology evaluation and selection for communication system blocks.
PCECL407.4	PO1	3	Applies engineering knowledge to understand and diagnose circuit faults.
	PO2	3	Systematically analyzes circuit behavior to identify and resolve issues.
	PO3	2	Develops corrective solutions to improve circuit performance.
	PO9	3	Encourages effective collaboration during troubleshooting activities.
	PO12	3	Builds problem-solving mindset and lifelong learning skills.
	PSO1	3	Enhances testing and validation skills for signal processing circuits.
	PSO2	3	Supports selection and evaluation of suitable technologies in communication systems.

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			

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1			

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	https://onlinecourses.nptel.ac.in/noc24_ee73/preview
2	https://archive.nptel.ac.in/courses/108/108/108108111/

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
ECL411.1	CE, IE		21
ECL411.2	CE, IE		6
ECL411.3	CE, IE		6
		TOTAL HOURS OF INSTRUCTION	33

Prepared by
Manu Thomas

Approved by HOD

S

PCECL408

MICROCONTROLLER LAB

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE:	**SEMESTER: S4** **L-T-P-CREDITS**: 0-0-3-2
COURSE CODE: PCECL408 **REGULATION**:2024	**COURSE TYPE**: PRACTICAL
COURSE AREA/DOMAIN:	**CONTACT HOURS**: 3 H/WEEK
CORRESPONDING LAB COURSE CODE (IF ANY):	**LAB COURSE NAME**:

SYLLABUS

EERIMENT NO.	NAME OF EXPERIMENT	HOURS
A	**Data manipulation experiments using Assembly language(Min 4 has to be completed)**	
1	Multiplication of two 16-bit numbers.	3
2	Largest/smallest from a series.	3
3	Sorting (Ascending/Descending) of data.	3
4	Matrix addition.	3
5	LCM and HCF of two 8-bit numbers.	3
6	Code conversion – Hex to Decimal/ASCII to Decimal and vice versa.	3
B	**PART B - Interface to Microcontroller Assembly/C language (Min 3 has to be completed)**	
1	Time delay generation and relay interface.	3
2	Display (LED/Seven segments/LCD) and keyboard interface.	3

3	ADC interface.	3
4	DAC interface with waveform generation.	3
5	Stepper motor and DC motor interface.	3
C	**- Interface with Advanced Microcontroller using C language (Min 3 has to be completed)**	
1	PWM generation for DC motor control.	3
2	Object/Visitor Counter.	3
3	UART interface to Bluetooth.	
4	SPI/I2C interface to display.	
5	Real-time clock.	3
Total hours		**27**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	The 8051 Microcontroller and Embedded Systems Using Assembly and C by Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay
T2	The 8051 Microcontroller Architecture, Programming and Applications by Kenneth J Ayala, Dhananjay V Gadre

COURSE OBJECTIVES:

PCECL 408	1. To learn Microcontroller Programming using Assembly and C language 2. To learn Microcontroller interfaces to various modules 3. To learn any advanced microcontrollers like ARM or higher. 4. To learn Embedded System Design

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
PCECL408.1	Develop 8051 Microcontroller programs													
	3	2	2	2								2	2	2
	Analyse													
PCECL408.2	Design and implement various interfaces to the 8051 Microcontroller													
	3	3	3	2	3			2				2	2	2
	Analyse													
PCECL408.3	Design and implement an Embedded System using a 8051 microcontroller													
	3	3	3	3	3	3	3	3	3	3	3	3	2	2
	Analyse													
PCECL40844	Design and implement an Embedded System using an ARM processor													
	3	3	3	3	3	3	3	3	3	3	3	3	2	2

	Analyse													
Mapping Average	3	2.75	2.75	2.5	3	3	3	2.66	3	3	3	3	2	2

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
PCECL408.1	PO1	3	Requires strong application of engineering fundamentals and programming knowledge to develop 8051 microcontroller programs.
	PO2	2	Moderately involves problem analysis to design and debug microcontroller-based programs.
	PO3	2	Moderately applies design concepts to develop functional embedded programs.
	PO4	2	Involves investigation and testing of program behaviour through experiments and debugging.
	PO12	2	Encourages continuous learning to adapt to evolving embedded programming practices.
	PSO1	2	Moderately supports PSO1 by enabling implementation and testing of microcontroller-based electronic systems.
	PSO2	2	Moderately supports PSO2 by introducing appropriate embedded technologies used in modern communication systems.
PCECL408.2	PO1	3	Requires strong application of engineering fundamentals to design and implement interfaces with the 8051 microcontroller.
	PO2	3	Involves detailed problem analysis to select and integrate suitable interfacing techniques.
	PO3	3	Strongly applies design and development skills to create effective hardware–software interface solutions.
	PO4	2	Moderately involves testing and evaluation of

			interface performance through experimentation.
	PO5	3	Requires extensive use of modern tools and development platforms for interfacing and implementation.
	PO8	2	Moderately considers ethical and professional practices in system design and implementation.
	PO12	2	Encourages continuous learning to adapt to emerging interfacing technologies.
	PSO1	2	Moderately supports PSO1 by enabling design and implementation of interfaced electronic circuits and systems.
	PSO2	2	Moderately supports PSO2 by selecting suitable interfacing technologies for embedded communication applications.
PCECL408.3	PO1	3	Requires strong application of engineering fundamentals to design and implement a complete embedded system using the 8051 microcontroller.
	PO2	3	Involves comprehensive analysis of system requirements to develop effective embedded solutions.
	PO3	3	Strongly applies design and development skills to create reliable embedded system architectures.
	PO4	3	Requires detailed investigation, testing, and validation of embedded system performance.
	PO5	3	Extensively uses modern development tools and platforms for embedded system design and implementation.
	PO6	3	Considers societal and safety aspects while developing practical embedded solutions.
	PO7	3	Integrates sustainability considerations in system design and implementation.
	PO8	3	Emphasizes ethical and professional responsibility in engineering practice.

	PO9	3	Promotes effective teamwork in the development of embedded systems.
	PO10	3	Develops strong communication skills through documentation and presentation of system design.
	PO11	3	Applies project planning and management principles during embedded system development.
	PO12	3	Encourages lifelong learning to keep pace with advances in embedded technologies.
	PSO1	2	Moderately supported by enabling design and testing of embedded electronic systems.
	PSO2	2	Moderately supported by applying suitable embedded technologies in system implementation.
PCECL408.4	PO1	3	Requires strong application of engineering fundamentals to design and implement embedded systems using an ARM processor.
	PO2	3	Involves comprehensive analysis of system requirements to develop efficient ARM-based embedded solutions.
	PO3	3	Strongly applies design and development skills to create advanced embedded system architectures.
	PO4	3	Requires detailed investigation, testing, and performance evaluation of ARM-based systems.
	PO5	3	Extensively uses modern development tools and platforms for ARM system design and implementation.
	PO6	3	Considers societal and safety aspects in the deployment of embedded technologies.
	PO7	3	Integrates sustainability considerations in embedded system design.
	PO8	3	Emphasizes ethical and professional responsibility in engineering practice.
	PO9	3	Promotes teamwork in the collaborative development of embedded systems.

	PO10	3	Develops strong communication skills through technical documentation and presentations.
	PO11	3	Applies project management principles during embedded system development.
	PO12	3	Encourages lifelong learning to keep pace with advances in ARM and embedded technologies.
	PSO1	2	Moderately supports the design, implementation, and testing of embedded electronic systems using ARM-based platforms.
	PSO2	2	Moderately contributes to selecting and applying modern processor technologies for implementing communication systems.

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			

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	

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**

PCECL408.1	CA,IE		15
PCECL408.2	CA,IE		12
PCECL408.3	CA,IE		3
PCECL408.4			
		TOTAL HOURS OF INSTRUCTION	36

Prepared by Arya C **Approved by HOD**