COURSE HANDOUT

(B. Tech - Semester 5)

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 5 COURSES

A

ECT 301

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: ECT301 REGULATION:2019 SCHEME	COURSE TYPE: CORE
COURSE AREA/DOMAIN: CIRCUIT AND SYSTEMS	CONTACT HOURS: 4
CORRESPONDING LAB COURSE CODE (IF ANY): ECL331	LAB COURSE NAME: ANALOG INTEGRATED CIRCUITS AND SIMULATION LAB

SYLLABUS

MODULE	DETAILS	HOURS
I	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. 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-the two transistor current mirror, Wilson and Widlar current mirrors.	9
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 practical inverting and non-inverting amplifiers for closed loop gain, Input Resistance and Output Resistance. Op-amp applications: Summer, Voltage Follower-loading effects, Differential and Instrumentation Amplifiers, Voltage to current and Current to voltage converters, Integrator, Differentiator, Precision rectifiers,	11

	Comparators, Schmitt Triggers, Log and antilog amplifiers.	
III	Op-amp 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.	10
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 – Operation, Closed loop analysis, Lock and capture range, Basic building blocks, PLL IC 565, Applications of PLL.	9
V	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. 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.	**9**
Total hours		**48**

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, 3/e, 2010
R1	DFranco S., Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata McGraw Hill, 2008
R2	Gayakwad R. A., Op-Amps and Linear Integrated Circuits, Prentice Hall, 4/e,

	2010
R3	Salivahanan S. and V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008.
R4	Botkar K. R., Integrated Circuits, 10/e, Khanna Publishers, 2010
R5	C.G. Clayton, Operational Amplifiers, Butterworth & Company Publ. Ltd. Elsevier, 1971
R6	David A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition,2010
R7	R.F. Coughlin & Fredrick Driscoll, Operational Amplifiers & Linear Integrated Circuits,6th Edition, PHI,2001
R8	Sedra A. S. and K. C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2013.

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
ECT202	Analog Circuits		S4

COURSE OBJECTIVES:

1	This course aims to develop the skill to design circuits using operational amplifiers and other linear ICs 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
ECT301.1	Understand Op Amp fundamentals and differential amplifier configurations													

	3	**3**	**1**	**2**								**1**	**3**	**3**
	UNDERSTAND													
ECT301.2	Design operational amplifier circuits for various applications													
	3	**3**	**2**	**2**	**2**							**1**	**3**	**3**
	APPLY													
ECT301.3	Design Oscillators and active filters using op amps													
	3	**3**	**2**	**2**	**2**							**1**	**3**	**3**
	APPLY													
ECT301.4	Explain the working and applications of timer, VCO and PLL ICs													
	3	**3**	**1**	**2**	**2**							**1**	**3**	**3**
	UNDERSTAND													
ECT301.5	Outline the working of Voltage regulator IC’s and Data converters													
	3	**3**	**2**	**2**	**2**							**1**	**3**	**3**
	UNDERSTAND													
MAPPING AVERAGE	**3**	**3**	**1.6**	**2**	**2**							**1**	**3**	**3**

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
ECT301.1	PO1	3	Students apply engineering fundamentals to understand the internal working and parameters of op-amps and differential amplifiers.
	PO2	3	Analytical understanding of op-amp characteristics and configuration enhances problem-solving skills.
	PO3	1	Basic exposure to configuration design, though not extensive.
	PO4	2	Understanding includes simple analysis and interpretation of data related to amplifier behavior.
	PO12	1	Builds a base for continuous learning in analog

			electronics.
	PSO1	3	Directly relates to designing and analyzing signal processing circuits.
	PSO2	3	Op-amps are integral to communication systems, enhancing technology selection and implementation understanding.
ECT301.2	PO1	3	Applies engineering knowledge for practical circuit design.
	PO2	3	Involves analyzing requirements and choosing suitable configurations.
	PO3	2	Students design circuits (e.g., amplifier, integrator), addressing design criteria.
	PO4	2	Experimentation with design and testing of circuits promotes investigation skills.
	PO5	2	Requires use of simulation tools or lab equipment.
	PO12	1	Promotes adaptation to evolving design trends and continuous improvement.
	PSO1	3	Strongly aligned with the goal of implementing signal processing circuits.
	PSO2	3	Knowledge of op-amp applications supports modern communication system design.
ECT301.3	PO1	3	Builds on fundamental knowledge to design waveform generators and filters.
	PO2	3	Analytical skills are needed to derive and optimize oscillator and filter performance.
	PO3	2	Involves design of specific analog subsystems.
	PO4	2	Emphasizes investigation through circuit

			performance verification.
	PO5	2	Requires simulation or lab validation of oscillator/filter behavior.
	PO12	1	Encourages lifelong learning by linking theory to practical analog applications.
	PSO1	3	Core skill in analog signal processing.
	PSO2	3	Supports filtering and modulation in communication systems.
ECT301.4	PO1	3	Solidifies understanding of specialized analog ICs.
	PO2	3	Students analyze function and performance under different operating conditions.
	PO3	1	Involves minor design applications.
	PO4	2	Interpretation and functional analysis of ICs in lab/virtual experiments.
	PO5	2	Students use tools and equipment to test IC functionality.
	PO12	1	Adds to foundational knowledge for modern analog design, aiding lifelong learning.
	PSO1	3	Enhances skills in designing systems involving timing and frequency synthesis.
	PSO2	3	VCOs and PLLs are fundamental to frequency control in communication systems.
ECT301.5	PO1	3	Students learn critical concepts in power electronics and signal interfacing.
	PO2	3	Requires analysis of regulator behavior and ADC/DAC parameters.
	PO3	2	Basic design or selection based on performance

			specs is included.
	PO4	2	Functional testing and evaluation develop investigation skills.
	PO5	2	Use of data acquisition tools and simulators enhances learning.
	PO12	1	Exposure to evolving converter and regulation technologies.
	PSO1	3	Important for accurate signal conversion in electronic circuits.
	PSO2	3	ADC/DACs are vital in digital communication and signal processing.

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://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		**EVALUATIO N BY GUIDE**		**INTERIM EVALUATION**		**FINAL EVALUATIO N**	

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**
ECT301.1	S1,A1,T1	10	1
ECT301.2	S1,A2,T2	11	1
ECT301.3	S2,A2,T3	10	1
ECT301.4	S2,S3,A3,T4	9	1
ECT301.5	S3,A3,T5	8	1
		TOTAL HOURS OF INSTRUCTION	**53**

Prepared by **Approved by HOD**

Manu Thomas

ECT 303

DIGITAL SIGNAL PROCESSING

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: DIGITAL SIGNAL PROCESSING	**SEMESTER: S5** **L-T-P-CREDITS**: 3-1-0-4
COURSE CODE: **REGULATION**: **ECT 303 :2019**	**COURSE TYPE**: **CORE**
COURSE AREA/DOMAIN: **SIGNAL PROCESSING**	**CONTACT HOURS**: **6**
CORRESPONDING LAB COURSE CODE (IF ANY): ECL 333	**LAB COURSE NAME**: **DIGITAL SIGNAL PROCESSING LAB**

SYLLABUS

TEXT BOOKS/REFERENCE BOOKS:

MODULE	DETAILS	HOURS
I	Basic Elements of a DSP system, Typical DSP applications, Finite-length discrete transforms, Orthogonal transforms – The Discrete Fourier Transform: DFT as a linear transformation (Matrix relations), Relationship of the DFT to other transforms, IDFT, Properties of DFT and examples. Circular convolution, Linear Filtering methods based on the DFT, linear convolution using circular convolution, Filtering of long data sequences, overlap save and overlap add methods, Frequency Analysis of Signals using the DFT (concept only required)	9
II	Efficient Computation of DFT: Fast Fourier Transform Algorithms-Radix-2 Decimation in Time and Decimation in Frequency FFT Algorithms, IDFT computation using Radix-2 FFT Algorithms, Application of FFT Algorithms, Efficient computation of DFT of Two Real Sequences and a 2N-Point Real Sequence	8
III	Design of FIR Filters - Symmetric and Anti-symmetric FIR Filters, Design of linear phase FIR filters using Window methods, (rectangular, Hamming and Hanning) and frequency sampling	12

	method, Comparison of design methods for Linear Phase FIR Filters. Design of IIRDigital Filters from Analog Filters (Butterworth), IIR Filter Design by Impulse Invariance, and Bilinear Transformation, Frequency Transformations in the Analog and Digital Domain.	
IV	Structures for the realization of Discrete Time Systems - Block diagram and signal flow graph representations of filters, FIR Filter Structures: Linear structures, Direct Form, CascadeForm, IIR Filter Structures: Direct Form, Transposed Form, Cascade Form and Parallel Form, Computational Complexity of Digital filter structures. Multi-rate Digital Signal Processing: Decimation and Interpolation (Time domain and Frequency Domain Interpretation), Anti- aliasing and anti-imaging filter.	11
V	Computer architecture for signal processing: Harvard Architecture, pipelining, MAC, Introduction to TMS320C67xx digital signal processor, Functional Block Diagram. Finite word length effects in DSP systems: Introduction (analysis not required), fixed-point and floating-point DSP arithmetic, ADC quantization noise, Finite word length effects in IIR digital filters: coefficient quantization errors. Finite word length effects in FFT algorithms: Round off errors	**9**
Total hours		**49**

T/ R	**BOOK TITLE/AUTHORS/PUBLICATION**
T1	Proakis J. G. and Manolakis D. G., Digital Signal Processing, 4/e, Pearson Education, 2007
T2	Alan V Oppenheim, Ronald W. Schafer ,Discrete-Time Signal Processing, 3rd Edition , Pearson ,2010
R1	Ifeachor E.C. and Jervis B. W., Digital Signal Processing: A Practical Approach, 2/e Pearson Education, 2009.

R2	Lyons, Richard G., Understanding Digital Signal Processing, 3/e. Pearson Education India, 2004.
R3	Salivahanan S, Digital Signal Processing,4e, Mc Graw –Hill Education New Delhi, 2019
R4	Chassaing, Rulph., DSP applications using C and the TMS320C6x DSK. Vol. 13. John
R5	Chen, C.T., “Digital Signal Processing: Spectral Computation & Filter Design”, Oxford Univ. Press, 2001.
R6	Monson H Hayes, “Schaums outline: Digital Signal Processing”, McGraw HillProfessional, 1999

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
ECT 204	Signals and systems	Provides the foundational understanding of signal behavior and system response, enabling students to analyze, model, and interpret both continuous-time and discrete-time signals essential for advanced studies in communication, control, and digital signal processing.	S4

COURSE OBJECTIVES:

1	Aims to provide an understanding of the principles, algorithms and applications of DSP.

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
ECT303.1	State and prove the fundamental properties and relations relevant to DFT and solve basic problems involving DFT based filtering methods													
	3	3	2		2							2	3	3
	UNDERSTAND													
ECT303.2	Compute DFT and IDFT using DIT and DIF radix-2 FFT algorithms													

	3	3	3		3							2	3	3
	APPLY													
ECT303.3	Design linear phase FIR filters and IIR filters for a given specification													
	3	3	3		3							2	3	3
	APPLY													
ECT303.4	Illustrate the various FIR and IIR filter structures for the realization of the given system function													
	3	3	2		3							2	3	3
	APPLY													
ECT303.5	Explain the basic multi-rate DSP operations decimation and interpolation in both time and frequency domains using supported mathematical equations													
	2	2	2		2							2	3	3
	UNDERSTAND													
ECT303.6	Explain the architecture of DSP processor (TMS320C67xx) and the finite word length effects													
	2	2										2	3	3
	UNDERSTAND													
MAPPING AVERAGE	2.67	2.67	2.4		2.6							2	3.0	3.0

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
ECT303.1	PO1	3	Develops students' ability to apply knowledge of mathematics, science, and engineering fundamentals to analyze and solve complex problems in signal processing
	PO2	3	Enhances the ability to identify, formulate, and analyze complex engineering problems related to signal processing, using structured approaches and appropriate mathematical tools
	PO3	2	Equips students to design and develop signal processing systems and algorithms that meet specified requirements and performance criteria,
	PO5	2	Enables students to effectively use modern engineering tools, such as MATLAB or Python, for modeling, analyzing, and implementing signal processing systems
	PO12	2	Equips students with foundational skills in signal processing that are essential for adapting to evolving technologies and

			engaging in lifelong learning.
	PSO1	3	Enables students to define, design, implement, model, and test electronic systems that perform key signal processing functions such as filtering, spectrum analysis, and transformation.
	PSO2	3	Enables students to choose and apply frequency domain techniques essential in signal transmission and reception.
ECT303.2	PO1	3	Students apply mathematical and engineering principles to efficiently compute DFT/IDFT using FFT algorithms.
	PO2	3	Students analyze complex signal processing problems to choose appropriate FFT approaches for faster computation.
	PO3	3	Students develop efficient signal processing solutions by implementing radix-2 FFT algorithms.
	PO5	3	Students define, model, and implement FFT-based systems for real-time signal analysis and processing tasks.
	PO12	2	Understanding and applying FFT algorithms to compute DFT and IDFT fosters the ability to adapt to advanced signal processing techniques, encouraging continuous learning in evolving technological environments.
	PSO1	3	Computing DFT and IDFT using DIT and DIF radix-2 FFT algorithms enables students to design, implement, and test efficient signal processing systems
	PSO2	3	Helps students to implement **efficient algorithms** suitable for real-time and high-speed communication systems.
ECT303.3	PO1	3	Students apply mathematical and engineering principles to design filters that meet specific frequency and stability criteria. Students use tools like MATLAB, SciPy, or filter design software to model, analyze, and implement digital filters effectively.
	PO2	3	Students analyze system requirements and constraints to select and design appropriate FIR or IIR filters.
	PO3	3	Students design filter structures and optimize parameters to develop systems that fulfill real-world signal processing specifications.
	PO5	3	Students use tools like MATLAB, SciPy, or filter design software to model, analyze, and implement digital filters effectively.
	PO12	2	Understanding filter design techniques equips students to adapt to emerging signal processing methods and tools, fostering continuous professional development.
	PSO1	3	Designing FIR and IIR filters helps students implement and test

			practical signal processing systems that are essential in modern electronic applications.
	PSO2	3	Train students to design custom filters tailored to communication needs.
ECT303.4	PO1	3	Students apply core engineering concepts to understand and represent different filter structures for system realization.
	PO2	3	Students evaluate specifications and constraints to choose suitable FIR or IIR filter structures for accurate system implementation.
	PO3	2	Students design realizable systems by selecting and implementing appropriate filter structures based on performance needs.
	PO5	3	Students utilize simulation tools like MATLAB or Python to visualize and implement various filter realizations.
	PO12	2	Exploring multiple filter structures fosters adaptability and readiness to learn advanced system design techniques throughout their careers.
	PSO1	3	By illustrating FIR and IIR structures, students gain the ability to design, model, and test signal processing circuits and systems effectively.
	PSO2	3	Enables the selection of hardware-efficient or real-time viable filter structures in communication systems.
ECT303.5	PO1	2	Students apply mathematical and engineering fundamentals to understand and analyze multi-rate signal processing concepts.
	PO2	2	Students examine system requirements and challenges in sampling rate conversion to determine appropriate multi-rate operations.
	PO3	2	Students design efficient systems incorporating decimation and interpolation techniques to meet specific signal processing goals.
	PO5	2	Students use digital tools such as MATLAB or Python to simulate and validate the effects of multi-rate DSP operations.
	PO12	2	Learning advanced topics like multi-rate DSP cultivates adaptability and continuous learning to meet future technological demands.
	PSO1	3	Students gain the skills to model and implement multi-rate systems, essential for efficient signal processing applications.
	PSO2	3	Students learn to apply theoretical DSP knowledge in real-world applications involving sampling rate conversion and data

			compression.
ECT303.6	PO1	2	Students apply core concepts of digital systems and signal processing to understand DSP processor architecture and data representation constraints.
	PO2	2	Students analyze how finite word length affects accuracy, stability, and performance in DSP system implementations.
	PO12	2	Learning DSP processor architecture prepares students to adapt to evolving digital hardware platforms and pursue lifelong learning in embedded DSP systems.
	PSO1	3	Understanding DSP processor architecture enables students to model and implement efficient real-time signal processing systems.
	PSO2	3	Students learn to apply DSP concepts in hardware by understanding practical issues like quantization and overflow due to finite word length.

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	Real-time and Embedded Implementation	A Case study on Real-Time Embedded DSP Implementation	PO1,PO2,PO3,PO5,PO12

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Analysis of different window methods	Matlab Simulations to be done for different windows	PO1,PO2,PO3,PO5,PSO1
2	Machine Learning for DSP Applications	An expert talk for introducing the concept can be given	PO1,PO2,PO3,PO4,PO9,

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION

1	https://www.educative.io/courses/fundamentals-of-digital-signal-processing
2	https://archive.nptel.ac.in/courses/108/106/108106151
3	https://www.youtube.com/watch?v=mo0ls9-hsiw

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
ECT303.1	S1,A1,T1	10	1
ECT303.2	S1,A2,T2	9	1
ECT303.3	S2,A2,T3	13	1
ECT303.4	S2,S3,A3,T4	8	1
ECT303.5	S2,A3,S3	3	1
ECT303.6	S3,A3,T5	10	1
		TOTAL HOURS OF INSTRUCTION	59

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

C

ECT 305

ANALOG &DIGITAL COMMUNICATION

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: ANALOG AND DIGITAL COMMUNICATION	**SEMESTER: S5** **L-T-P-CREDITS**: 3-1-0
COURSE CODE: **REGULATION**:ECT 305-2019	**COURSE TYPE**: CORE
COURSE AREA/DOMAIN: COMMUNICATION	**CONTACT HOURS**:5 HRS/WEEK
CORRESPONDING LAB COURSE CODE (IF ANY): ECL332	**LAB COURSE NAME**: COMMUNICATION LAB

SYLLABUS

MODULE	DETAILS	HOURS
I	Block diagram of a communication system. Need for analog modulation. Amplitude modulation. Equation and spectrum of AM signal. DSB-SC and SSB systems. Block diagram of SSB transmitter and receiver. Frequency and phase modulation. Narrow and wide band FM and their spectra. FM transmitter and receiver.	8
II	Block diagram of a communication system. Need for analog modulation. Amplitude modulation. Equation and spectrum of AM signal. DSB-SC and SSB systems. Block diagram of SSB transmitter and receiver. Frequency and phase modulation. Narrow and wide band FM and their spectra. FM transmitter and receiver.	9
III	Source coding theorems I and II (Statements only). Waveform coding. Sampling and Quantization. Pulse code modulation, Transmitter and receiver. Companding. Practical 15 level A and mu-law companders. DPCM transmitter and receiver. Design of	9

	linear predictor. Wiener-Hopf equation. Delta modulation. Slope overload.	
IV	Gram-Schmitt procedure. Signal space. Baseband transmission through AWGN channel. Mathematical model of ISI. Nyquit criterion for zero ISI. Signal modeling for ISI, Raised cosine and Square-root raised cosine spectrum, Partial response signalling and duobinary coding. Equalization. Design of zero forcing equalizer. Vector model of AWGN channel. Matched filter and correlation receivers. MAP receiver, Maximum likelihood receiver and probability of error. Capacity of an AWGN channel (Expression only) -- significance in the design of communication schemes.	16
V	Digital modulation schemes. Baseband BPSK system and the signal constellation. BPSK transmitter and receiver. Base band QPSK system and Signal constellations. Plots of BER Vs SNR with analysis. QPSK transmitter and receiver. Quadrature amplitude modulation and signal constellation.	**6**
Total hours		**48**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	“Communication Systems”, Simon Haykin, Wiley.
T2	“Digital Communications: Fundamentals and Applications”, Sklar, Pearson
R1	“Principles of Digital Communication,” R. Gallager, Oxford University Press
R2	Digital Communication”, John G Proakis, Wiley.

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
ECT 204	Signals and Systems	Communication is fundamentally about transmitting and processing signals. A strong understanding of signals and systems is essential to model, analyze, and process analog and digital signals.	S4
MAT 204	Probability, Random Process and Numerical Methods	Noise and randomness are inherent in all communication systems. Probability and random processes help in modeling, analysis, and performance evaluation of communication systems.	S4

COURSE OBJECTIVES:

ECT 305	This course aims to develop analog and digital communication systems

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
ECT305.1	Explain the existent analog communication systems.													
	3	3											1	3
	UNDERSTAND													
ECT305.2	Apply the concepts of random processes to LTI systems.													
	3	3	2	3										3
	APPLY													
ECT305.3	Apply waveform coding techniques in digital transmission													
	3	3	2	3	2							2		3
	APPLY													
ECT305.4	Apply GS procedure to develop digital receivers													
	3	3	2	3	2							2		3

	APPLY													
ECT305.5	Apply equalizer design to counteract ISI.													
	3	3	2	3	2							2	1	3
	APPLY													
ECT305.6	Apply digital modulation techniques in signal transmission.													
	3	3	2	3	2							2	2	3
	APPLY													
MAPPING AVERAGE	3.0	3.0	2.0	3.0	2.0							2.0	1.3	3

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
ECT305.1	PO1	3	Strong understanding of engineering fundamentals is required to grasp analog modulation and demodulation techniques.
	PO2	3	Effectively analyzes signal properties and system performance in analog systems.
	PSO1	1	Slight exposure to design aspects through block diagrams and system-level understanding.
	PSO2	3	Strong relevance to real-time analog communication technologies such as AM/FM radio..
ECT305.2	PO1	3	Strong mathematical foundation in probability and signals is essential.
	PO2	3	In-depth analysis of random processes in time/frequency domain.
	PO3	2	Moderate ability to apply theory for system modeling.
	PO4	3	Strong application in solving noise-influenced system behavior.
	PSO2	3	Strong application in solving noise-influenced system behavior.
ECT305.3	PO1	3	Strong grasp of PCM, DPCM, etc., needed for signal representation.
	PO2	3	Deep analysis of coding efficiency and noise performance.
	PO3	2	Moderate ability to design waveform coders.
	PO4	3	Effectively applies coding under bandwidth/power constraints..

	PO5	2	Moderate ability to select appropriate application specific waveform coding techniques.
	PO12	2	Moderately encourages students to stay updated with evolving waveform coding standards and technologies
	PSO2	3	Strong use of tools to implement and test coded transmission.
ECT305.4	PO1	3	Thorough understanding of orthogonal signal sets and vector spaces.
	PO2	3	Ability to analyze and classify signals using orthonormal bases.
	PO3	2	Moderately applies GS theory for receiver design.
	PO4	3	Strong ability to design optimal receivers using projections.
	PO5	2	Moderate skills acquired to visualize signal space and model receiver operation.
	PO12	2	Promotes independent learning of modern receiver design techniques used in advanced digital systems.
	PSO2	3	Strong design skills for modern receivers.
ECT305.5	PO1	3	Deep understanding of filter theory and AWGN channel models.
	PO2	3	Strong ability to analyze ISI impact and performance of equalizers.
	PO3	2	Applies basic design strategies like ZF and MMSE.
	PO4	3	Solves practical communication problems using equalizer design.
	PO5	2	Uses models for ISI mitigation techniques.
	PO12	2	Develops the ability to adapt to new equalization methods required in modern communication systems.
	PSO1	1	Slight knowledge on design of equalization stages in digital systems.
	PSO2	3	Strong alignment with real-time simulation and hardware-oriented testing.
ECT305.6	PO1	3	Strong understanding of modulation fundamentals like BPSK, QAM.
	PO2	3	Deep analysis of signal performance under channel impairments.
	PO3	2	Moderate design of digital modulators/demodulators.
	PO4	3	Solves BER, bandwidth, and complexity trade-offs.
	PO5	2	Moderate application of tools for constellation and BER analysis.
	PO12	2	Encourages awareness of evolving technologies and lifelong learning.
	PSO1	2	Moderate application to design communication blocks.
	PSO2	3	Strong real-time analysis skills in digital communication

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	Practical Exposure to Modern Tools	Simulation based tasks using MATLAB	PO5,PSO2

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1.	FM using SDR	Suggestion to watch the link https://www.youtube.com/watch?v=xQVm-YTKR9s&t=1065s	PO5,PSO2

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	https://www.youtube.com/watch?v=F3slBe2r8vA&list=PLq-Gm0yRYwTgX2FkPVcY6io003-tZd8Ru

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
ECT305.1	S1,A1,T1	9	1
ECT305.2	S1,A2,T2	10	1
ECT305.3	S2,A2,T3	8	1
ECT305.4	S2,S3,T4,A3	2	1
ECT305.5	S3	13	
ECT305.6	S3,A3	7	
		TOTAL HOURS OF	53

	INSTRUCTION	

Prepared by
Sreetha Sreedhar K

Approved by HOD
Nithin C

ECT 307

CONTROL SYSTEM

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE: BTECH**
COURSE: CONTROL SYSTEM	**SEMESTER: S5** **L-T-P-CREDITS: 3-1-0-4**
COURSE CODE: ECT307 **REGULATION:2019**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: **SIGNAL PROCESSING**	**CONTACT HOURS: 6 H/WEEK**
CORRESPONDING LAB COURSE CODE **(IF ANY):**	**LAB COURSE NAME:**

SYLLABUS

MODULE	DETAILS	HOURS
I	**Introduction:** Basic Components of a Control System, Open-Loop Control Systems and Closed-Loop Control Systems, Examples of control system **Feedback and its effects:** Types of Feedback Control Systems, Linear versus Nonlinear Control Systems, Time-Invariant versus Time-Varying Systems. **Mathematical modelling of control systems**: Electrical Systems and Mechanical systems. **Transfer Function from Block Diagrams and Signal Flow Graphs:** impulse response and its relation with transfer function of linear systems. Block diagram representation and reduction methods, Signal flow graph and Mason's gain formula.	10
II	**Time Domain Analysis of Control Systems:** Introduction-Standard Test signals, Time response specifications. Time response of first and second order systems to unit step input and ramp inputs, time domain specifications. Steady state error and static error coefficients. **Frequency domain analysis:** Frequency domain specifications, correlation between time and frequency responses.	9
III	**Stability of linear control systems:** Concept of BIBO stability, absolute stability, Routh Hurwitz Criterion, Effect of P, PI & PID controllers. **Root Locus Techniques:** Introduction, properties and its construction, Application to system stability studies. Illustration of the effect of addition of a zero and a pole.	9

IV	**Module 4:** **Nyquist stability criterion:** Fundamentals and analysis **Relative stability:** gain margin and phase margin. Stability analysis with Bode plot. **Design of Compensators:** Need of compensators, design of lag and lead compensators using Bode plots.	12
V	**State Variable Analysis of Linear Dynamic Systems**: State variables, state equations, state variable representation of electrical and mechanical systems, dynamic equations, merits for higher order differential equations and solution. Transfer function from State Variable Representation, Solutions of the state equations, state transition matrix. Concept of controllability and observability and techniques to test them - Kalman's Test.	**13**
Total hours		**53**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Farid Golnaraghi, Benjamin C. Kuo, Automatic Control Systems, 9/e, Wiley India.
T2	I.J. Nagarath, M.Gopal: Control Systems Engineering (5th-Edition) —New Age International Pub. Co., 2007.
T3	Ogata K., Discrete-time Control Systems, 2/e, Pearson Education.
R1	I.J. Nagarath, M.Gopal: Scilab Text Companion for Control Systems Engineering (3rd-Edition) —New Age International Pub. Co., 2007.
R2	Norman S. Nise, Control System Engineering, 5/e, Wiley India.
R3	M. Gopal, Digital Control and State Variable Method, 4/e, McGraw Hill Education India, 2012.
R4	Ogata K., Modern Control Engineering, Prentice Hall of India, 4/e, Pearson Education,2002.

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER
ECT202	Signals & Systems	It relies on concepts from signals and systems to model, analyze,	S4

		and predict how systems respond to inputs, ensuring they behave as desired.	

COURSE OBJECTIVES:

ECT307	This course aims to develop the skills for mathematical modelling of various control systems and stability analysis using time domain and frequency domain approaches.

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	P O 6	P O 7	P O 8	P	P O 10	P O 11	PO 12	PS O 1	PS O 2
ECT307.1	Analyse electromechanical systems by mathematical modelling and derive their transfer functions													
	3	3	2		1							2	3	2
	APPLY													
ECT307.2	Determine Transient and Steady State behaviour of systems using standard test signals													
	3	3	2		1							2	3	3
	UNDERSTAND													
ECT307.3	Determine absolute stability and relative stability of a system													
	3	3	3		1							2	2	2
	APPLY													
ECT307.4	Apply frequency domain techniques to assess the system performance and to design a control system with suitable compensation techniques													
	3	3	3		1							2	3	3
	APPLY													
ECT307.5	Analyse system Controllability and Observability using state space representation													
	3	3	3		1							2	2	2
	APPLY													
MAPPING AVERAGE	3.0	3.0	2.6		1.0							2.0	2.6	2.4

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPIN G LEVEL	Justification for Mapping
ECT307.1	PO1	3	Requires strong application of mathematics, science, and engineering fundamentals to model and derive transfer functions.
	PO2	3	Involves problem analysis of complex electromechanical systems to reach valid conclusions.
	PO3	2	Contributes partially to designing system models that aid in developing engineering solutions.
	PO5	1	Uses modern tools such as MATLAB/Simulink for mathematical modelling.
	PO12	2	Enhances self-learning ability in modelling techniques, supporting lifelong learning.
	PSO1	3	Directly contributes by enabling students to define, model, and analyse system behaviour through mathematical modelling and transfer functions, which are essential for designing and testing electronic circuits and systems.
	PSO2	2	Indirectly contributes by giving a foundation for selecting suitable technologies in modern communication systems, since understanding system models helps in evaluating performance before implementation.
ECT307.2	PO1	3	Applies fundamental mathematics and engineering knowledge to analyse system responses.
	PO2	3	Involves analysing and interpreting responses to standard test inputs.

	PO3	2	Partially supports designing systems/components that meet performance specifications.
	PO5	1	Uses simulation/analytical tools for transient and steady-state analysis.
	PO12	2	Encourages continuous learning of system behaviour under different inputs.
	PSO1	3	Strongly supports modelling and testing of electronic systems by analysing time-domain responses.
	PSO2	3	Directly helps in evaluating and selecting suitable technologies for communication systems based on system performance.
ECT307.3	PO1	3	Strongly depends on mathematical concepts and engineering fundamentals in stability analysis.
	PO2	3	Involves detailed problem analysis to assess absolute and relative stability.
	PO3	3	Helps in designing stable systems that meet performance requirements.
	PO5	1	Makes use of modern tools such as Nyquist, Bode, or simulation software.
	PO12	2	Promotes independent learning of advanced stability criteria.
	PSO1	2	Provides moderate contribution by analysing system stability, aiding in circuit/system modelling.
	PSO2	2	Partially supports technology selection by ensuring chosen systems meet stability requirements.
ECT307.4	PO1	3	Strong use of mathematics and engineering fundamentals in frequency domain analysis.
	PO2	3	Involves analysing complex engineering problems in frequency response.
	PO3	3	Directly supports design of control systems with compensation techniques.
	PO5	1	Employs modern tools like MATLAB for frequency domain design and simulations.
	PO12	2	Encourages self-learning of advanced

			design/compensation methods.
	PSO1	3	Strongly contributes to designing and testing systems through frequency-domain analysis and compensation design.
	PSO2	3	Directly helps in implementing modern communication/control systems by selecting appropriate compensation techniques.
ECT307.5	PO1	3	Requires advanced mathematical knowledge to derive state-space models.
	PO2	3	Involves analysis of system properties like controllability and observability.
	PO3	3	Supports design of state-space models for engineering solutions.
	PO5	1	Utilises computational tools for state-space modelling and analysis.
	PO12	2	Strengthens lifelong learning by adopting modern state-space techniques.
	PSO1	2	Provides moderate contribution by enabling modelling of systems in state-space form for analysis and testing.
	PSO2	1	Partially supports implementation in communication/control systems by analysing system properties before technology selection.

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	Lacks proficiency in MATLAB Simulink, LabVIEW, Python control libraries, FPGA-based simulation.	Strengthen lab assignments with Simulink, LabVIEW, Python control packages and FPGA/embedded tools.	PO1 PO2 PO3 PO5 PO12 PSO1 PSO2

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Embedded & Real-Time Control : Implementation of control algorithms on Arduino, Raspberry Pi, DSP, PLCs.	Introduce Control Systems Lab extension with hardware experiments.	PO1 PO2 PO3 PO4 PO5 PO9 PO12 PSO1 PSO2

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	https://youtube.com/playlist?list=PLU9qGTRXUDklIwccKB7lYIAz85Jjepq3w&feature=shared
2	https://youtube.com/playlist?list=PLyqSpQzTE6M8-wda5vbgHkMQTmu-21hRK&feature=shared

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
ECT307.1	S1,A1,T1	11	2
ECT307.2	S1,A2,T2	10	2
ECT307.3	S2,A2,T3	10	2
ECT307.4	S2,S3,A3,T4	10	2
ECT307.5	S3,A3,T5	13	2
		TOTAL HOURS OF INSTRUCTION	64

Prepared by Arya C **Approved by HOD**

E

HUT 310

MANAGEMENT FOR ENGINEERS

COURSE INFORMATION SHEET

PROGRAMME: *ECE (UG)*	DEGREE: BTECH
COURSE: MANAGEMENT FOR ENGINEERS	SEMESTER: S5 L-T-P-CREDITS: 3-0-0-3
COURSE CODE: HUT310 REGULATION:2024	COURSE TYPE: COMMON
COURSEAREA/DOMAIN: HUMANITIES	CONTACT HOURS:35
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME:

SYLLABUS

MODULE	DETAILS	HOURS
I	Introduction to management theory, Management Defined, Characteristic of Management, Management as an art-profession, System approaches to Management, Task and Responsibilities of a professional Manager, Levels of Manager and Skill required.	7
II	Management Process, Planning types, Mission, Goals, Strategy, Programmes, Procedures, Organising, Principles of Organisation, Delegation, Span of Control, Organisation Structures, Directing, Leadership, Motivation, Controlling.	5
III	Concept of productivity and its measurement; Competitiveness; Decision making process; decision making under certainty, risk and uncertainty; Decision trees; Models of decision making.	7
IV	Project Management, Network construction, Arrow diagram, Redundancy. CPM and PERT Networks, Scheduling computations, PERT time estimates, Probability of completion of project, Introduction to crashing.	8

V	Introduction to functional areas of management, Operations management, Human resources management, Marketing management, Financial management, Entrepreneurship, Business plans, Corporate social responsibility, Patents and Intellectual property rights.	**8**
Total hours		**35**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	H. Koontz and H. Weihrich, *Essentials of Management: An International Perspective*, 8th ed., McGraw-Hill, 2009
T2	P. C. Tripathi and P. N. Reddy, *Principles of Management*, TMH, 4th edition, 2008.
T3	P. Kotler, K. L. Keller, A. Koshy, and M. Jha, *Marketing Management: A South Asian Perspective, 14th ed., Pearson, 2012.*
T4	M. Y. Khan and P. K. Jain, *Financial Management*, Tata-McGraw Hill, 2008.
T5	R. D. Hisrich and M. P. Peters, *Entrepreneurship: Strategy, Developing, and Managing a New Enterprise*, 4th ed., McGraw-Hill Education, 1997.
R1	D. J. Sumanth, *Productivity Engineering and Management*, McGraw-Hill Education, 1985.
R2	K. Ashwathappa, *Human Resources and Personnel Management*, TMH, 3rd edition, 2005.
R3	R. B. Chase, Ravi Shankar and F. R. Jacobs, *Operations and Supply Chain Management*, 14th ed., McGraw Hill Education (India), 2015

COURSE PREREQUISITES:

COURS	COURSE NAME	DESCRIPTION	SEMESTER

E CODE			
NIL	NIL	NIL	-

COURSE OBJECTIVES:

HUT310	This course is intended to help the students learn the basic concepts and functions of management and its role in the performance of an organization, and to understand various decision-making approaches available for managers to achieve excellence. Learners will also gain a broad view of different functional areas of management such as operations, human resource, finance, marketing, and entrepreneurship.

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
HUT310.1	Explain the characteristics of management in the contemporary context													
	2				**1**	**2**	**2**	**2**		**2**	**1**	**1**	**1**	
	UNDERSTAND													
HUT310.2	Describe the functions of management.													
	2				1	1		2	1	2	1	1	1	
	UNDERSTAND													
HUT310.3	Demonstrate ability in decision making process and productivity analysis													
	2	2	2	2	1								1	
	UNDERSTAND													
HUT310.4	Illustrate project management technique and develop a project schedule.													
	2	2	2	2	1						2	1		
	APPLY													
HUT310.5	Summarize the functional areas of management													
	2					1	1		1	2	1			
	UNDERSTAND													
HUT310.6	**Comprehend the concept of entrepreneurship and create business plans**													

	0	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**		
	UNDERSTAND													
MAPPING AVERAGE	2	2	2	2	1	1.3	1.3	1.7	1	1.8	1.2	1	1	

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
HUT310.1	PO1	2	Requires understanding of basic principles, theories, and practices of management in an engineering context.
	PO2	1	Involves analyzing real-life organizational challenges.
	PO3	2	Understanding management enables designing effective organizational strategies.
	PO4	2	ncourages evaluating case studies to identify solutions.
	P05	2	Uses management software or analytical tools for planning/monitoring.
	PO6	2	Highlights social responsibilities of managers.
	PO7	1	Introduces sustainable management practices.
	PO8	1	Emphasizes ethical aspects of managerial decisions.
HUT310.2	PO1	2	Knowledge of core managerial functions like planning, organizing, directing, and controlling.
	PO2	2	Analyze business situations and identify appropriate management functions.
	PO3	1	Apply management principles to design organizational systems.
	PO4	2	Investigate how managerial roles impact performance.
	PO5	1	Use basic office productivity tools (e.g., MS Project) for planning.
	PO6	2	Understand social and cultural implications of

			management decisions.
	PO7	1	Awareness of sustainability while executing management functions.
	PO8	1	Recognize ethics in managerial practices.
HUT310.3	PO1	2	Apply engineering knowledge to productivity analysis.
	PO2	2	Analyze quantitative and qualitative data to support decisions.
	PO3	2	Use decision models to create effective solutions.
	PO4	2	Investigate alternative approaches through decision trees or productivity tools.
	PO5	1	Employ software for decision analysis or productivity calculations.
HUT310.4	PO1	2	Understand the theoretical background of project planning and control.
	PO2	2	Analyze project constraints and develop feasible schedules.
	PO3	2	Apply CPM/PERT to design schedules and identify critical paths.
	PO4	1	Investigate uncertainties through PERT probability analysis.
	PO5	1	Use modern tools like MS Project or Primavera.
	PO6	2	Address team coordination and societal needs in project execution.
	PO7	1	Recognize environmental concerns during project planning.
HUT310.5	PO1	2	Understand fundamentals of operations, HR, finance, and marketing.
	PO2	1	Analyze organizational requirements for each functional area.
	PO3	1	Suggest improvements in operations or HR through management principles.
	PO4	1	Investigate how cross-functional teams work together.

	PO5	2	Use MIS or ERP tools for functional management..
	PO6	1	Recognize social and legal aspects in HR and marketing.
HUT310.6	PO1	2	Understand entrepreneurial processes and financial planning.
	PO2	2	Analyze feasibility of business ideas.
	PO3	2	Develop innovative business plans.
	PO4	1	Investigate market data to support business strategies.
	PO5	1	Use business plan software or market analysis tools.
	PO6	1	Consider social responsibilities in entrepreneurship.
	PO7	1	Integrate sustainable practices into business planning.
	PO8	1	Evaluate ethical concerns in start-ups.
	PO9	1	Work in teams to develop business proposals.
	PO10	1	Communicate business ideas effectively.
	PO11	1	Understand project funding and financial planning.
	PO12	1	Support lifelong learning by exploring entrepreneurial trends

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	Minimal focus on leadership skills, conflict resolution, and communication in multicultural teams	Add role-play / group exercises for leadership and conflict management.	PO8, PO9, PO10
2	No coverage of current sustainability standards in management practices.	Add a seminar or case study on ESG (Environmental, Social & Governance) and sustainable management.	PO6, PO7, PO8, PSO1

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	Direct	✔	**FLIPPED**	✔

FACE INSTRUCTION			**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
HUT310.1	S1,A1	8	

HUT310.2	S1,A2	6	
HUT310.3	S2,A2	**9**	
HUT310.4	S2,S3,A3	**10**	
HUT310.5	S3,A3	**10**	
HUT310.6	S3,A3		
REVISION		**8**	
		TOTAL HOURS OF INSTRUCTION	51

Prepared by
ARSHA C DINESH

Approved byHOD

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MCN 301

DISASTER MANAGEMENT

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	DEGREE: BTECH
COURSE: DISASTER MANAGEMENT	**SEMESTER: 5** **L-T-P-CREDITS**: 2-0-0-0
COURSE CODE: **REGULATION**: MCN301: 2019 SCHEME	**COURSE TYPE**: NON- CORE
COURSE AREA/DOMAIN: ENVIRONMENTAL STUDIES	**CONTACT HOURS**: 2
CORRESPONDING LAB COURSE CODE **(IF ANY)**: NIL	**LAB COURSE NAME**: NIL

SYLLABUS

MODULE	DETAILS	HOURS
I	.Systems of earth Lithosphere- composition, rocks, soils; Atmosphere-layers, ozone layer, greenhouse effect, weather, cyclones, atmospheric circulations, Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs assessment.	5
II	Hazard types and hazard mapping; Vulnerability types and their assessment- physical, social, economic and environmental vulnerability.Disaster risk assessment –approaches, procedures	5
III	Disaster risk management -Core elements and phases of Disaster Risk Management Measures for Disaster Risk Reduction – prevention, mitigation, and preparedness. Disaster response- objectives, requirements; response planning; types of responses. Relief; international relief organizations.	5
IV	Participatory stakeholder engagement; Disaster communication-	5

	importance, methods, barriers; Crisis counselling Capacity Building: Concept – Structural and Non-structural Measures, Capacity Assessment; Strengthening Capacity for Reducing Risk	
V	Common disaster types in India; Legislations in India on disaster management; National disaster management policy; Institutional arrangements for disaster management in India. The Sendai Framework for Disaster Risk Reduction- targets, priorities for action, guiding principles	**5**
Total hours		**25**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	R. Subramanian, Disaster Management, Vikas Publishing House, 2018
T2	M. M. Sulphey, Disaster Management, PHI Learning, 2016
R1	UNDP, Disaster Risk Management Training Manual, 2016
R2	United Nations Office for Disaster Risk Reduction, Sendai Framework for Disaster Risk Reduction 2015-2030, 2015

COURSE PREREQUISITES: NIL

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER

COURSE OBJECTIVES:

1	The objective of this course is to introduce the fundamental concepts of hazards and disaster management.

COURSE OUTCOMES:

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

COs / CO-PO/PSO MAPPING. /BLOOM'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1	PO 1	PSO	PSO

TAXONOMY LEVEL											1	2	1	2
MCN301.1	Define and use various terminologies in use in disaster management parlance and organise each of these terms in relation to the disaster management cycle													
		2				**2**				**2**		**2**		
	UNDERSTAND													
MCN301.2	Distinguish between different hazard types and vulnerability types and do vulnerability assessment													
	2	**3**	**2**		**2**	**2**	**3**			**3**		**2**		
	UNDERSTAND													
MCN301.3	Identify the components and describe the process of risk assessment, and apply appropriate methodologies to assess risk													
	2	**3**	**2**	**2**	**2**	**2**	**3**			**3**		**2**		
	UNDERSTAND													
MCN301.4	Explain the core elements and phases of Disaster Risk Management and develop possible measures to reduce disaster risks across sector and community (Cognitive knowledge level)													
	3	**3**	**3**		**2**	**2**	**3**					**2**		
	APPLY													
MCN301.5	Identify factors that determine the nature of disaster response and discuss the various disaster response actions													
	3	**3**			**2**	**2**	**3**					**2**		
	UNDERSTAND													
MCN301.6	Explain the various legislations and best practices for disaster management and risk reduction at national and international level.													
	3					**2**	**3**	**3**				**2**		
	UNDERSTAND													
MAPPING AVERAGE	2.60	2.80	2.33	2.00	2.00	2.00	3.00	3.00		2.67		2.00	00	00

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
MCN301.1	PO2	**2**	Understand disaster management terminologies and their place in the DM cycle.

	PO6	**2**	Awareness of health, safety, legal, and societal issues related to disaster terminology.
	PO10	**2**	Communicate key disaster-related terms effectively.
	PO12	**2**	Lifelong learning via understanding evolving DM terminology.
MCN301.2	PO1	**2**	Applies foundational scientific and engineering principles to identify and differentiate hazard and vulnerability types.
	PO2	**3**	Demonstrates strong analytical skills in classifying hazards and performing vulnerability assessments using appropriate techniques.
	PO3	**2**	Uses conceptual design approaches and basic methodologies for vulnerability assessment in disaster scenarios.
	PO5	**2**	Employs tools (e.g., GIS, remote sensing) to assess and represent hazard-prone areas and vulnerabilities.
	PO6	**2**	Evaluates health, safety, and societal implications associated with various hazard vulnerabilities.
	PO7	**3**	Identifies and analyzes environmental consequences related to hazard vulnerabilities and risk exposure.
	PO10	**3**	Effectively communicates risk and vulnerability information through reports, maps, and technical presentations.
	PO12	**2**	Shows initiative for lifelong learning by staying informed about evolving hazard types and risk assessment techniques.
MCN301.3	PO1	**2**	Applies basic engineering and scientific principles to identify key elements in risk assessment.
	PO2	**3**	Demonstrates strong analytical skills in evaluating risks using qualitative and quantitative methods.
	PO3	**2**	Uses structured techniques and limited design methods to formulate and apply risk assessment models.
	PO4	**2**	Conducts investigations and interprets data to support evidence-based risk analysis.
	PO5	**2**	Utilizes modern tools (e.g., software simulations, GIS) to perform and visualize risk assessments.

	PO6	**2**	Considers societal, health, and safety aspects while performing risk evaluations.
	PO7	**3**	Analyzes environmental impacts and integrates sustainability into risk assessment strategies.
	PO10	**3**	Communicates risk findings effectively through technical reports, visual tools, and presentations.
	PO12	**2**	Engages in continuous learning to stay updated on advanced risk assessment methodologies and standards.
MCN301.4	PO1	**3**	Applies strong foundational engineering knowledge to develop technical solutions for disaster risk reduction.
	PO2	**3**	Analyzes disaster risk management phases and integrates planning methods for various sectors and communities.
	PO3	**3**	Designs and evaluates comprehensive DRM strategies to mitigate the impact of disasters.
	PO5	**2**	Utilizes appropriate tools and technology (e.g., simulation models, risk maps) in designing DRM measures.
	PO6	**2**	Assesses societal needs, health, safety, and legal implications while proposing DRM strategies.
	PO7	**3**	Considers sustainability and environmental preservation in disaster mitigation planning.
	PO12	**2**	Demonstrates readiness for lifelong learning in adapting to evolving DRM frameworks and policies.
MCN301.5	PO1	**3**	Applies engineering knowledge to understand technical aspects of disaster response mechanisms.
	PO2	**3**	Analyzes the conditions influencing response actions and evaluates various strategies based on severity and context.
	PO5	**2**	Uses appropriate tools and techniques (e.g., coordination systems, resource mapping) during disaster response.
	PO6	**2**	Considers health, safety, and societal needs when planning or analyzing disaster response actions.
	PO7	**3**	Integrates environmental considerations into emergency response efforts, such as minimizing ecological damage.
	PO12	**2**	Recognizes the importance of lifelong learning in improving disaster preparedness and response practices.

MCN301.6	PO1	**3**	Applies fundamental knowledge to understand the legal and institutional frameworks in disaster management.
	PO6	**2**	Evaluates the societal, legal, and ethical aspects of disaster laws and governance.
	PO7	**3**	Assesses environmental policies and their role in risk reduction and sustainable disaster recovery.
	PO8	**3**	Demonstrates awareness of professional ethics and responsibility in implementing national/international best practices.
	PO12	**2**	Shows commitment to lifelong learning by keeping pace with evolving global disaster policies and frameworks.

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

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	**Natural Hazards – Part-1 (Civil Engineering, NPTEL)** — covers disaster management topics : https://archive.nptel.ac.in/courses
2	**Disaster Recovery and Build Back Better (Architecture, NPTEL / Swayam)** — risk, preparedness, recovery etc. : https://archive.nptel.ac.in/courses
3	**Disaster Management (SWAYAM / NPTEL MOOC)** — general course on disaster

	management: https://archive.nptel.ac.in/courses

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
MCN301.1	S1,A1	**8**	NIL
MCN301.2	S1,A2	**8**	NIL
MCN301.3	S1,A2		NIL
MCN301.4	S2,A2	**8**	NIL
MCN301.5	S2,A3	**8**	NIL
MCN301.6	S3,A3	**8**	NIL
		TOTAL HOURS OF INSTRUCTION	**40**

Prepared by **Approved by HOD**

Rinija.G.N

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ECL 331

ANALOG INTEGRATED CIRCUITS & SIMULATION LAB

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE:	**SEMESTER: S5** **L-T-P-CREDITS**: 0-0-3-2
COURSE CODE: ECL 331 **REGULATION**:2019	**COURSE TYPE**: PRACTICAL
COURSE AREA/DOMAIN: CIRCUITS	**CONTACT HOURS**: 3 H/WEEK
CORRESPONDING LAB COURSE CODE **(IF ANY)**:	**LAB COURSE NAME**:

SYLLABUS

EERIMEN T NO.	NAME OF EXPERIMENT	HOURS
I	**Fundamentals of operational amplifiers and basic circuits [Minimum seven experiments are to be done]**	
1	Familiarization of Operational amplifiers - Inverting and Non inverting amplifiers, frequency response, Adder, Integrator, Comparators.	3
2	Measurement of Op-Amp parameters.	3
3	Difference Amplifier and Instrumentation amplifier.	3
4	Schmitt trigger circuit using Op–Amps.	3
5	Astable and Monostable multivibrator using Op-Amps.	3
6	Waveform generators using Op-Amps - Triangular and saw tooth	3
7	Wien bridge oscillator using Op-Amp - without & with amplitude stabilization.	3
8	RC Phase shift Oscillator.	3

9	Active second order filters using Op-Amp (LPF, HPF, BPF and BSF).	3
10	Notch filters to eliminate the 50Hz power line frequency.	3
11	Precision rectifiers using Op-Amp.	3
II	**Application circuits of 555 Timer/565 PLL/ Regulator(IC723) ICs [Minimum three experiments are to be done]**	
1	Astable and Monostable multivibrator using Timer IC NE555	3
2	DC power supply using IC 723: Low voltage and high voltage configurations, Short circuit and Fold-back protection.	3
3	A/D converters- counter ramp and flash type.	3
4	D/A Converters - R-2R ladder circuit	3
5	Study of PLL IC: free running frequency lock range capture range	3
III	**Simulation experiments [The experiments shall be conducted using SPICE]**	
1	Simulation of any three circuits from Experiments 3, 5, 6, 7, 8, 9, 10 and 11 of section I	4
2	Simulation of Experiments 3 or 4 from section II	2
Total hours		**36**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	D. Roy Choudhary, Shail B Jain, “Linear Integrated Circuits,”
T2	M. H. Rashid, “Introduction to Pspice Using Orcad for Circuits and Electronics”, Prentice Hall

COURSE PREREQUISITES:

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER

ECL20 2	Analog Circuits and Simulation Lab		S4

COURSE OBJECTIVES:

ECL3 31	This course aims to (i) familiarize students with the Analog Integrated Circuits and Design and implementation of application circuits using basic Analog Integrated Circuits (ii)familiarize students with simulation of basic Analog 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
ECL331.1	Use data sheets of basic Analog Integrated Circuits and design and implement application circuits using Analog ICs.													
	3	3	3						2			2	3	3
	APPLY													
ECL331.2	Design and simulate the application circuits with Analog Integrated Circuits using simulation tools.													
	3	3	3	2	3				2			2	3	3
	APPLY													
ECL331.3	Function effectively as an individual and in a team to accomplish the given task.													
	2	2	2		2				3	2		3		
	APPLY													
MAPPING AVERAGE	2.7	2.7	2.7	2	2.5				2.3	2		2.33	3	3

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/ PSO	MAPPING LEVEL	JUSTIFICATION
ECL331.1	PO1	3	Applies core electronic and circuit knowledge to interpret datasheets and design analog IC circuits.

	PO2	3	Analyzes circuit requirements and datasheet parameters to identify and solve design problems.
	PO3	3	Designs and implements application circuits that meet specifications using analog ICs.
	PO9	2	Involves working both individually and in teams during circuit design and testing.
	PO12	2	Builds self-learning skills to adapt to new ICs and technologies from datasheets.
	PSO1	3	Directly relates to defining, designing, implementing, and testing analog signal processing circuits.
	PSO2	3	Requires selecting suitable analog ICs for specific applications, relevant to modern communication systems.
ECL331.2	PO1	3	Requires applying fundamental engineering knowledge to design and simulate analog circuits.
	PO2	3	Involves analyzing circuit requirements and simulation results to solve design problems.
	PO3	3	Focuses on designing and developing circuits that meet performance specifications.
	PO4	2	Uses simulation tools to analyze, interpret data, and validate results.
	PO5	3	Uses simulation tools to analyze, interpret data, and validate results.
	PO9	2	Involves collaborative work and discussions in simulation-based design tasks.
	PO12	2	Encourages continuous learning of emerging simulation software and circuit design techniques
	PSO1	3	Strongly linked to defining, modeling, simulating, and testing electronic circuits.
	PSO2	3	Requires selecting appropriate ICs and simulation technologies relevant to communication systems.
ECL331.3	PO1	2	Applies basic engineering knowledge while

			performing tasks in lab/project activities.
	PO2	2	Analyzes problems collaboratively and contributes to group problem-solving.
	PO3	2	Participates in designing simple solutions as part of a team effort.
	PO5	2	Uses modern tools collectively for experiments and project tasks.
	PO9	3	Strongly emphasizes teamwork, leadership, and effective individual contribution.
	PO10	2	Involves effective communication and presentation of work within the team.
	PO12	3	Promotes lifelong learning skills through peer learning and shared experiences.

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	https://youtu.be/6R_cf-QdLYs?feature=shared

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
ECL331.1	CA,IE		30
ECL331.2	CA,IE		6
ECL331.3	CA,IE		30+6
		TOTAL HOURS OF INSTRUCTION	36

Prepared by Arya C **Approved by HOD**

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ECL333

DIGITAL SIGNAL PROCESSING LAB

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: DIGITAL SIGNAL PROCESSING LAB	**SEMESTER: V** **L-T-P-R 0:0:3:0 CREDITS**: 2
COURSE CODE: ECL333 **REGULATION**:2019	**COURSE TYPE**: LAB
COURSE AREA/DOMAIN: DIGITAL ELECTRONICS	**CONTACT HOURS**:3 HRS/WEEK
CORRESPONDING LAB COURSE CODE **(IF ANY)**:	**LAB COURSE NAME**:

SYLLABUS

EXPERIMENT NO:	EXPERIMENTS	HOURS
1	Simulation of Signals	3
2	Verification of the Properties of DFT	3
3	Familiarization of DSP Hardware	3
4	Linear convolution	3
5	FFT of signals	3
6	IFFT with FFT	3
7	FIR low pass filter	3
8	Overlap Save Block Convolution	3
9	Overlap Add Block Convolution	3
Total hours		27

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Vinay K. Ingle, John G. Proakis, “Digital Signal Processing Using MATLAB.”
T2	Allen B. Downey, “Think DSP: Digital Signal Processing using Python.”

	(Topics in Digital Signal Processing)”
T3	Rulph Chassaing, “DSP Applications Using C and the TMS320C6x.

COURSE PREREQUISITES:

1. ECT 303 Digital Signal Processing
2. EST 102 Programming in C

COURSE OBJECTIVES:

1	The experiments are designed to make the student do real time DSP computing.
2	Dedicated DSP hardware (such as TI or Analog Devices development/evaluation boards) will be used for realization.

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
ECL333.1	Simulate digital signals.													
	3	**3**	**1**	**2**	**3**				**3**			**1**	**3**	**3**
	APPLY													
ECL333.2	verify the properties of DFT computationally													
	3	**3**	**1**	**2**	**3**				**3**			**1**	3	3
	APPLY													
ECL333.3	Familiarize the DSP hardware and interface with computer													
	3	**3**	**3**	**2**	**3**				**3**	**1**		**1**	3	3
	APPLY													
ECL333.4	Implement LTI systems with linear convolution.													
	3	**3**	**1**	**2**	**3**				**3**			**1**	3	3
	UNDERSTAND													
ECL333.5	Implement FFT and IFFT and use it on real time signals.													

	3	**3**	**1**	**1**	**3**							**1**	3	3
	UNDERSTAND													
ECL333.6	Implement FIR low pass filter.													
	3	**3**	**1**	**1**	**3**							**1**	3	3
	UNDERSTAND													
ECL333.7	Implement real time LTI systems with block convolution and FFT.													
	3	**3**	**1**	**3**	**3**				**3**	**3**			3	3
	UNDERSTAND													

MAPPING AVERAGE	3.0	3.0	1.3	1.9	3.0				3.0	2.0		1.0	3.00	3.00

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
ECL333.1	PO1	3	Students apply foundational knowledge of mathematics and signal processing to accurately simulate digital signals.
	PO2	3	Students analyze signal characteristics and system behavior to select suitable simulation approaches and parameters.
	PO3	1	Students design and implement simulation models that replicate real-world signal processing scenarios.
	PO4	2	Simulation of digital signals allows students to investigate, interpret, and validate signal behavior under various conditions.
	PO5	3	Students use software tools such as MATLAB or Python to model, simulate, and analyze digital signals efficiently.
	PO9	3	Simulation tasks often involve collaborative

			coding and result analysis, promoting both individual contribution and teamwork.
	PO12	1	Developing signal simulation skills encourages continuous learning and adaptability in the face of evolving signal processing technologies.
	PSO1	3	Allows students to apply signal processing principles for analyzing and interpreting system behavior through computational methods.
	PSO2	3	Builds foundational skills in modeling and simulating signals used in communication systems.
ECL333.2	PO1	3	Students use mathematical and engineering principles to understand and validate DFT properties through computation..
	PO2	3	Students analyze signal behavior and transformations to verify DFT properties such as linearity, time-shifting, and convolution.
	PO3	1	Students implement DFT-based algorithms to computationally demonstrate theoretical signal processing concepts.
	PO4	2	Students explore and interpret results of computational DFT property verification under various input scenarios.
	PO5	3	Students use modern simulation tools (e.g., MATLAB, Python) to model, compute, and visualize DFT operations.
	PO9	3	DFT property verification tasks can be performed in collaborative settings, enhancing team coordination and individual responsibility.
	PO12	1	Engaging in computational verification builds foundational DSP skills that students can expand upon throughout their careers.
	PSO1	3	Helps students apply signal processing concepts to analyze and interpret frequency-domain

			behavior.
	PSO2	3	Enables practical understanding of DFT properties for frequency domain signal analysis in communication.
ECL333.3	PO1	3	Students apply engineering fundamentals to understand the architecture and functioning of DSP hardware and its computer interfacing.
	PO2	3	Students analyze practical challenges in hardware interfacing and data communication between DSP boards and computers.
	PO3	3	Students configure and develop simple DSP-based systems by integrating hardware with software for real-time signal processing.
	PO4	2	Students test and troubleshoot hardware-software interactions to evaluate performance and resolve interfacing issues.
	PO5	3	Students utilize development tools, coding platforms, and interfacing software to operate and test DSP hardware.
	PO9	3	Hands-on interfacing tasks encourage both independent exploration and collaborative project-based learning.
	PO10	1	Students will be able to effectively communicate technical information related to DSP hardware configuration, interfacing methods, and experimental results .
	PO12	3	Familiarity with DSP hardware prepares students to adapt to evolving embedded systems and hardware platforms, supporting continuous learning.
	PSO1	3	Enables students to apply domain knowledge for analyzing and solving real-time signal processing problems.
	PSO2	3	Provides hands-on experience with hardware

			platforms used in communication equipment.
ECL333.4	PO1	3	Students apply core concepts of signals and systems to implement and understand the behavior of LTI systems through linear convolution.
	PO2	3	Students analyze input-output relationships and system characteristics to correctly model and solve convolution-based problems.
	PO3	1	Students develop accurate and efficient implementations of LTI systems using linear convolution techniques.
	PO4	2	Students will develop the ability to design and implement experiments to realize LTI systems using linear convolution, analyze the results, and interpret system behavior.
	PO5	3	Students use simulation tools like MATLAB or Python to perform and visualize linear convolution for LTI systems.
	PO9	3	Convolution-based implementation tasks promote collaborati problem-solving. both independently and as a group member.
	PO12	1	Understanding convolution as a fundamental DSP operation fosters adaptability to advanced signal processing techniques and encourages continuous learning.
	PSO1	3	Enables students to apply theoretical signal processing concepts for analyzing and realizing practical systems.
	PSO2	3	Enables practical implementation of channel models and digital filters in communication systems.
ECL333.5	PO1	3	Applies mathematical (Fourier) concepts and

			ECE fundamentals to implement FFT & IFFT.
	PO2	3	Identifies the need for frequency-domain analysis to solve signal-related problems
	PO3	1	Designs algorithms to transform signals between time and frequency domains
	PO4	1	Analyzes spectral components of real-time signals for noise/signal characterization.
	PO5	3	Uses MATLAB/DSP tools to implement FFT and IFFT efficiently.
	PO12	1	Builds foundation for advanced DSP, wireless communication, and AI signal analysis.
	PSO1	3	Strengthens MATLAB programming skills while applying FFT in telecom, biomedical, and environmental signals.
	PSO2	3	Students understand efficient, real-time spectral techniques used in communication technologies.
ECL333.6	PO1	3	Applies mathematical foundations (convolution, Fourier analysis) and DSP principles to design the filter.
	PO2	3	Identifies the need for filtering (removing noise/unwanted frequencies) in signal processing.
	PO3	1	Designs FIR filter using window methods (Hamming, Blackman, etc.) for required specifications.
	PO4	1	Validates performance by analyzing magnitude & phase response of the filter.
	PO5	3	Uses MATLAB/DSP processors for design, simulation, and implementation.
	PO12	1	Builds foundation for advanced courses in DSP, VLSI, wireless communication, and biomedical signal processing.
	PSO1	3	Strengthens MATLAB/Python coding skills while solving socially relevant problems like

			noise reduction in audio/biomedical signals
	PSO2	3	Implements filters for signal conditioning in transmit/receive chains
ECL333.7	PO1	3	Applies fundamentals of LTI systems, convolution, and DSP mathematics.
	PO2	3	Identifies the challenge of handling long signals with direct convolution and uses efficient methods (block/FFT).
	PO3	1	Designs efficient real-time filtering algorithms using block convolution and FFT.
	PO4	3	Compares performance of block vs FFT convolution, validates responses, and optimizes for real-time systems.
	PO5	3	Uses MATLAB/Python/DSP kits for implementing and testing real-time convolution.
	PO9	3	Students perform coding individually and work in teams for analysis and result discussion.
	PO10	3	Enhances students' ability to document, present, and communicate technical results effectively.
	PSO1	3	Enables students to design and analyze efficient real-time electronic systems for signal processing using block convolution and FFT techniques.
	PSO2	3	Applies efficient filtering used in real-time 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	Advanced filter design techniques, including IIR filters, and multirate filtering not present.	To include a case study regarding the implementation of the same.	PO1,PO2,PO3,PO4, PO5,PSO1,PSO2

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	FIR filter Design and Comparison with various Window methods	To implement FIR filters using different window techniques using MATLAB can be done and to compare between them.	PO1,PO2,PO3,PO4, PO5,PSO1,PSO2

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	https://onlinecourses.nptel.ac.in/noc25_ee52/announcements
2	https://onlinecourses-archive.nptel.ac.in/noc18_ee30/preview
3	https://onlinecourses.nptel.ac.in/noc23_ee31/announcements

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
ECL333.1	CE,IE		3
ECL333.2	CE,IE		3
ECL333.3	CE,IE		3
ECL333.4	CE,IE		3
ECL333.5	CE,IE		6
ECL333.6	CE,IE		3
ECL333.7	CE,IE		6
		TOTAL HOURS OF INSTRUCTION	27

Prepared by : ATHIRA V **Approved by HOD**