The Bombay Salesian Society's

Don Bosco Institute of Technology, Mumbai

(An Autonomous Institute Affiliated to University of Mumbai)

CURRICULUM STRUCTURE FOR SECOND YEAR ENGINEERING

SEMESTER III

Department of Electronics and Telecommunication Engineering

(As per NEP 2020)

(Scheme: DB25-V1)

Effective from Academic Year 2025-2026

1. Preamble

Don Bosco Institute of Technology, Kurla, Mumbai, proudly celebrates the achievement of autonomous status—an academic milestone that reaffirms our steadfast commitment to excellence, holistic development, and student-centric learning. This autonomy empowers us to craft and implement a curriculum that is forward-looking, contextually relevant, and deeply rooted in our institutional values and the aspirations of our nation.

As an autonomous institution affiliated with the University of Mumbai, DBIT embraces the opportunity to restructure its academic framework in alignment with the University Grants Commission (UGC) guidelines and the National Education Policy (NEP) 2020. This curriculum framework outlines the undergraduate engineering programs for the EXTC, COMP, IT, and MECH branches. It reflects NEP's emphasis on multidisciplinary learning, flexibility, and outcome-based education, while staying true to the Don Bosco educational philosophy.

The curriculum adopts a top-down approach, beginning with the institutional Vision and Mission, which guides the definition of Program Educational Objectives (PEOs) and Program Outcomes (POs). These outcomes are used to shape Course Outcomes (COs) and the content and assessment methods of each course. This ensures that all academic efforts remain aligned with the broader goals of transforming learners into technically sound, ethically responsible, and socially aware citizens. Importantly, this curriculum has been shaped through extensive consultations with stakeholders, including industry experts, academic peers, alumni, and students—to ensure that it remains aligned with contemporary industry requirements and societal expectations. Their inputs have been instrumental in designing a framework that bridges the gap between academic learning and practical applicability.

Key Objectives in developing syllabus are:

1. **Develop Strong Technical Foundations:** Equip students with robust knowledge and skills in core engineering domains to solve real-world problems through design, analysis, and innovation.
2. **Foster Research, Innovation, and Entrepreneurship:** Cultivate a spirit of inquiry, critical thinking, and entrepreneurial mindset to promote research-based problem-solving and startup culture.
3. **Enhance Interdisciplinary and Industry-Ready Competencies:** Integrate emerging technologies, multidisciplinary learning, and practical exposure to prepare students for dynamic industry requirements and lifelong learning.
4. **Promote Ethical, Sustainable, and Socially Responsible Engineering Practice:** Inculcate ethics, human values, and environmental consciousness to enable students to contribute meaningfully to society and sustainable development.
5. **Empower Communication, Leadership, and Teamwork Abilities:** Strengthen students' soft skills, collaboration, and leadership to perform effectively in diverse professional and global environments.

Academic design includes:

- A Choice-Based Credit System (CBCS) for flexibility
- A range of Minor and Honors options to encourage specialization and research
- Opportunities for field engagement, internships, and experiential learning
- Emphasis on skill enhancement and future workforce needs
- Integration of ethical reasoning, social awareness, and environmental consciousness

As an institution inspired by the values of Saint John Bosco, we strive to create a joyful and inclusive learning environment that fosters creativity, curiosity, and compassion. Through this curriculum framework, we reaffirm our commitment to producing graduates who are not only professionally competent but also dedicated to the greater good of society.

2. Vision and Mission

Vision:

DBIT will be recognized for providing an innovative, enjoyable, and holistic learning environment that transforms individuals into socially conscious citizens, the Don Bosco way, and will lead in research and entrepreneurship in the field of sustainable technologies.

Mission:

1. To create future engineers who work with honesty and integrity and excel in the use of technology for the benefit of the underprivileged.
2. To train engineers to be innovative problem-solvers and entrepreneurs who engage in research and lifelong learning.
3. To provide a diverse and stimulating environment for staff and students to grow holistically.

3. Curriculum Design Philosophy

The curriculum is structured in alignment with the National Education Policy (NEP) 2020 and UGC guidelines. It follows a top-down approach, wherein the institutional Vision and Mission guide the Program Educational Objectives (PEOs) and Program Outcomes (POs). These shape the Course Outcomes (COs) and form the foundation for the course structure, delivery, and assessments.

Key design principles include:

- Emphasis on Outcome-Based Education (OBE) with clear mappings of COs to POs
- Integration of core technical knowledge with interdisciplinary electives
- Inclusion of vocational skills, internships, and community engagement
- Development of entrepreneurship and research aptitude through minor and honors pathways
- Encouragement of ethical, sustainable, and socially responsible engineering practices

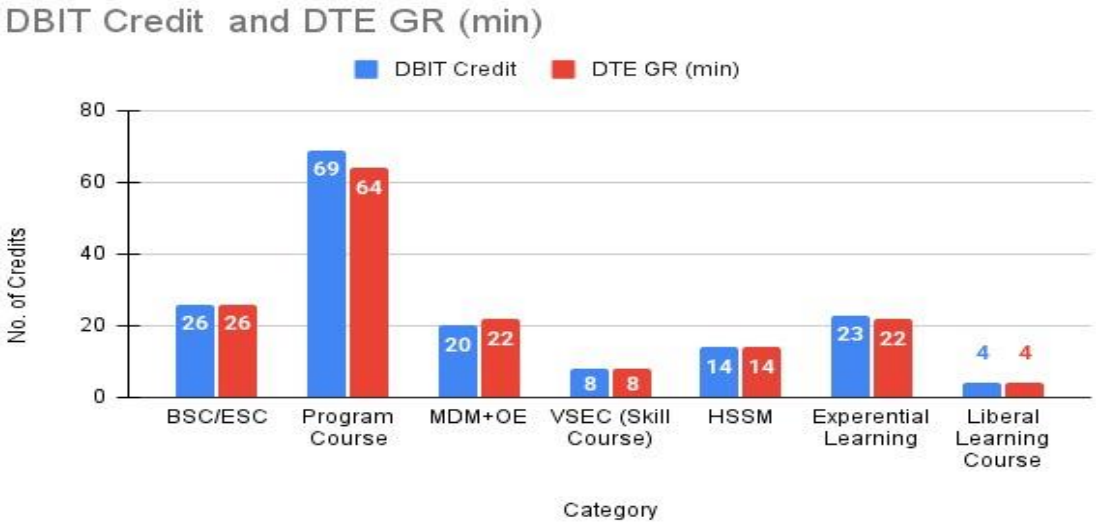
4. Credit Guidelines and Allocation

The curriculum is delivered through a structured credit system as follows:

Activity Type	Credit Definition
Theory Course	1 Credit = 15 Contact Hours
Laboratory / Studio / Workshop	1 Credit = 30 Contact Hours
Internship / Field Work	1 Credit = 40 Hours or 02 weeks
Seminar / Group Discussions	1 Credit = 15 Hours
Community Engagement / Field Project	1 Credit = 30 Hours

DBIT Overall Curriculum Credit Structure:

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits	DTE Credits
Basic Science Course	BSC/ESC	9	6							15	14-18
Engineering Science Course		7	4							11	12 - 16
Programme Core Course (PCC)	Program Courses		3	16	14	6	6	6		51	44-56
Programme Elective Course (PEC)						3	3	6	6	18	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses				3	4	4	3		14	14
Open Elective (OE) Other than a particular program					2	2		2		6	8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	3	3	2						8	8
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)		2			2				4	4
Entrepreneurship/Economics/ Management Courses					2		2			4	4
Indian Knowledge System (IKS)			2							2	2
Value Education Course (VEC)		2		2						4	4
Research Methodology	Experiential Learning Courses					2				2	4
Community. Engagement. Project (CEP)/ Field Project (FP) (Mini - Project)				1	1	1				3	2
Project							3	3		6	4
Internship/ OJT									12	12	12
Co-curricular Courses (CC)	Liberal Learning Courses		1		1		1		1	4	4
Total Credits (Major)		**21**	**21**	**21**	**23**	**20**	**19**	**20**	**19**	**164**	**160- 176**



5. Degree Options and Exit Pathways

Students are offered flexible learning pathways through the following options:

Undergraduate Degree Options:

- B.E. - 164 credits
- B.E. Minor/Honors - 182 credits
- B.E. Honors with Research - 182 credits

Multiple Entry-Exit Options (Aligned with NEP 2020):

Exit Options	Credits Structure
Certificate after Year 1:	42 Credits + 08 Credits (04 Credit Exit course + 04 Summer Internship).
Diploma after Year 2:	86 Credits + 08 Credits (04 Credit Exit course + 04 Summer Internship).
B Vocational Degree after Year 3:	125 Credits + 08 Credits (04 Credit Exit course + 04 Summer Internship).

Credits earned are banked in the **Academic Bank of Credits (ABC)** for lifelong learning flexibility.

Abbreviations Used:

AEC	Ability Enhancement Course
AEL	Ability Enhancement Laboratory
BSC	Basic Science Course
BSL	Basic Science Laboratory
CEP	Community Engagement Project
CC	Co-curricular Courses
CIE	Continuous Internal Evaluation
EEM	Entrepreneurship, Economics and Management
ELC	Experiential Learning Courses
ESC	Engineering Science Course
ESE	End Semester Examination
ESL	Engineering Science Laboratory
FP	Field Project
HSSM	Humanities Social Science and Management
IKS	Indian Knowledge System
L	Lecture
LLC	Liberal Learning Courses
MDM	Multidisciplinary Minor
MSE	Mid Semester Exam
OE	Open Elective
OJT	On Job Training
P	Practical
PCC	Program Core Course
PCL	Program Core Laboratory
PEC	Program Elective Course
T	Tutorial
VEC	Value Education Course
VSEC	Vocational and Skill Enhancement Course

UG Second Year EXTC Program

Curriculum Scheme and Structure: Semester III								
Course Code	**Course Vertical**	**Course Name**	**Teaching Scheme (Contact Hours)**			**Credits Assigned**		
			L	**P**	**T**	**L**	**P**	**T**	**TOTAL**
25ET3PCC01	PCC	Mathematics for Signal Processing	3	-	1	3	-	1	4
25ET3PCC02	PCC	Linear Integrated Circuits	3	2	-	3	1	-	4
25ET3PCC03	PCC	Digital System Design Using Verilog	3	2	-	3	1	-	4
25ET3PCC04	PCC	Analog and Digital Communication	3	2	-	3	1	-	4
25ET3VSEC01	VSEC	Java Programming	-	2*+2	-	-	2	-	2
25IL3VEC01	VEC	Sustainable Development	2	-	-	2	-	-	2
25ET3CEP01	CEP	Community Engagement Project 1	-	2	-	-	1	-	1
		Total	**14**	**12**	**1**	**14**	**6**	**1**	**21**

* Two hours of demo/discussion for entire class.

Examination and Assessment Structure

Examination Marking Scheme: Semester III								
Course Code	**Course Vertical**	**Course Name**	**Examination Marks**						
			CA	**MSE**	**ESE**	**TW**	**OR**	**PR**	**Total**
25ET3PCC01	PCC	Mathematics for Signal Processing	20	30	50	25	-	-	125
25ET3PCC02	PCC	Linear Integrated Circuits	20	30	50	25	-	25	150
25ET3PCC03	PCC	Digital System Design Using Verilog	20	30	50	25	-	-	125
25ET3PCC04	PCC	Analog and Digital Communication	20	30	50	25	25	-	150
25ET3VSEC01	VSEC	Java Programming	-	-	-	25	-	25	50
25IL3VEC01	VEC	Sustainable Development	50	-	-	-	-	-	50
25ET3CEP01	CEP	Community Engagement Project 1	-	-	-	25	25		50
		TOTAL	**130**	**120**	**200**	**150**	**50**	**50**	**700**

UG Second Year EXTC Program

Assessment Methodology

Type of Courses	Assessment Tools	Marks Distribution
Theory	**CA-20**	Certification: NPTEL (20 Marks) (Approved by Instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / Simulation of a course-based concept.
Theory (VEC)	**CA-50**	• Active Participation = 5 marks • MCQ /Class Test= 10 marks • Assessment of the activity carried out by student = 25 marks • Assignment = 10 marks
Workshop	**CA-50**	• Active Participation = 5 marks • Trade 1# = 15 marks • Trade 2# = 15 marks • Trade 3# = 15 marks # Based on the performance and satisfactory completion of trade wise tasks.
Liberal Learning Courses (LLC)	**CA-50**	• Active Participation = 5 marks • Assessment of the Activity carried out by student = 25 marks • Cultural Event Participation = 10 marks • Technical Event Participation = 10 marks
Theory	**MSE**	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • For each question, A and B should be based on the same CO. • MSE should be based on 50% syllabus. • Time: 90 minutes (1 hour 30 minutes) • Total Marks: 30
Theory	**ESE**	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • Q4 A or B - 10 marks • Q5 A or B - 10 marks

		• For each question, A and B should be based on the same CO. • ESE should be based on 30% syllabus of MSE & 70% syllabus after MSE. • Time: 120 minutes (2 hours) • Total Marks: 50
Course - Laboratory	**TW- 25**	• Active Participation (Lab) = 5 marks • Laboratory Report = 10 marks • Laboratory performance = 10 marks Based on the performance and satisfactory completion of assigned laboratory work.
Community Engagement Project (CEP)	**TW-25**	• Active Participation = 05 marks • Project Report = 10 marks • Progress Presentations (min 02) & Demonstration = 10 marks
Tutorial	**TW-25**	• Active Participation = 5 marks • Tutorial Submission = 20 marks Tutorials should cover the entire syllabus.
Laboratory	**OR-25**	Oral examination will be based on the entire syllabus.
Laboratory	**PR-25**	Practical examination will be based on the experiments performed by the students during laboratory sessions.

Weightage of COs across all Assessments:

Course Outcomes	Weightage (Percentage)
CO-1, CO-2	20-30
CO-3, CO-4	40-50
CO-5, CO-6	20-30

Note: Total weightage of all COs should be 100%.

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
		L	P	T	L	P	T	Total
		3	-	1	3	-	1	4
		Examination Scheme						
25ET3PCC01	Mathematics for Signal Processing		CA	MSE	ESE	TW	OR	PR	Total
		Theory	20	30	50	-	-	-	100
		Lab/Tut	-	-	-	25	-	-	25
		Total	125						

Pre-Requisite Courses:	25FE1BSC01 Fundamentals of Engineering Mathematics -I
	25FE2BSC02 Fundamentals of Engineering Mathematics -II

Course Objectives:

1. To introduce students to the idea of signal and system analysis and characterization in time and frequency domain.
2. To introduce the concepts of Laplace Transform, Fourier Transform, Z transform and its applications.
3. To familiarize with the concept of Random variable and Probability Distributions with its applications in engineering.
4. To provide foundation of signals and systems concepts to areas like communication, control and comprehend applications of signal processing in communication systems.

Course Outcomes	After successful completion of the course, the students will be able to	
	CO1	Know various types of Signals & Systems used in Signal Processing. (Remembering)
	CO2	Explain the Characteristics of various Signals and Systems in Time and Frequency domain. (Understanding)
	CO3	Apply Suitable Mathematical Transformation tools to extract useful information from Continuous and Discrete Time Signals. (Applying)
	CO4	Analyze Spectral Features of Signals and Systems using Convolution, Transforms and Statistics to determine System Response, Stability and Performance. (Analyzing)
	CO5	Compare and Evaluate Signal Processing Systems using Time, frequency, and Statistical methods against Critical Characteristics like Stability, Causality and Probabilistic behavior. (Evaluating)
	CO6	Create Simulation-based Models of Signal Processing Systems using Transformation Techniques to solve Real-Time Engineering Problems. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1	**Fundamentals of Signals and Systems**		07
	1.1	Elementary signals: Step, Ramp, Pulse, Impulse, Sinusoids & Exponential.	
	1.2	Classification of signals: Continuous-time & Discrete-time, Deterministic & Random, Periodic & Aperiodic, Symmetric & Anti-symmetric, Energy & Power	
	1.3	Signal Operations: Time shifting, Scaling, Folding. Sampling Theorem.	
	1.4	Classification of systems: Linear/Nonlinear, Time-invariant/Time-variant, Causal/Non-causal, Stable/ Unstable.	
	Self-Learning Topics: Real-world examples of analog and digital signals (e.g., ECG, audio, image sensors, biomedical).		
2	**Time Domain Analysis of Continuous-Time & Discrete time systems**		07
	2.1	Introduction to Linear Time Invariant Systems, LTI system modeling using differential/difference equations. Impulse and step response.	
	2.2	Convolution integral and sum: Computation and graphical interpretation, System properties: Stability, causality.	
	2.3	Correlation functions: Auto-correlation and cross-correlation	
	2.4	Energy Spectral Density& Power Spectral Density.	
	Self-Learning Topics: White Noise: Definition, statistical properties, and significance in signal analysis.		
3	**Fourier Series and Fourier Transforms**		06
	3.1	Significance of Fourier series and Fourier transforms in various fields of Electronics and Telecommunication engineering. Trigonometric and Exponential Fourier Series for periodic signals.	
	3.2	Continuous Time Fourier Transform (CTFT): definition, properties. Fourier transform of standard functions.	
	3.3	Discrete Time Fourier Transform (DTFT): definition, properties. Fourier Transform of standard functions.	
	3.4	Frequency Response: Computation of Magnitude and Phase Response, Limitations of Fourier Transform.	
	Self-Learning Topics: Study of Orthogonal and Orthonormal functions.		
4	**Laplace Transforms**		11
	4.1	Laplace Transform: Definition, Properties. Region of Convergence (ROC), Unilateral Laplace transform. Relation between CTFT and Laplace transforms.	
	4.2	Inverse Laplace Transform using Partial fraction method.	
	4.3	Analysis of LTI systems in S-domain: Causality, Stability, total response	

	4.4	Transient Response of R-L, R-C and R-L-C circuits (series & parallel combinations) for DC excitation, initial conditions, Solution using differential equations and Laplace Transform method.	
	Self-Learning Topics: Initial value theorem and final value theorem		
5	**Z Transforms**		**08**
	5.1	Z-Transform: Definition for finite and infinite sequences, ROC, Properties, and standard Z-transform pairs.	
	5.2	Inverse Z-Transform using Partial fraction method, Relation between Z-transform and DTFT	
	5.3	System analysis using Z-domain: Poles and Zeros, Stability, Causality	
	Self-Learning Topics: Inverse Z-transform using Residue method or Complex inversion integral method		
6	**Probability, Random Variable & Probability Distribution**		**06**
	6.1	Definitions of Probability, Joint, Conditional Probability and Bayes' theorem	
	6.2	Discrete and Continuous random variables, Probability Mass Function and Density Function. Expectation & Variance.	
	6.3	Binomial, Gaussian distribution.	
	Self-Learning Topics: Poisson & Rayleigh Distributions		
		TOTAL	**45**

Suggested List of Tutorial Topics:

Tutorial No.	Topic of Tutorial
1	Classification of Continuous & Discrete Time Signals.
2	Classification of Continuous & Discrete Time Systems.
3	Operations on Continuous & Discrete Signals.
4	Perform Convolution of Continuous and Discrete Time Signals.
5	Fourier Transforms of Standard Signals.
6	Computation of magnitude and phase response of a system using Fourier Transform.
7	Response of RL, RC and RLC Networks when excited with DC.
8	Laplace Transform and Inverse Transform.
9	Z-Transform and Inverse Transform.
10	Analysis of continuous time LTI systems using Laplace transforms & Fourier Transforms.
11	Analysis of discrete time LTI systems using Z transforms & Fourier Transforms.
12	Probability and Statistics in Signals.
13	Construction of Standard Signals like Triangular, Sawtooth etc. by using Fourier series

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, Prentice-Hall of India, 2nd edition, 2002.
2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, 2nd edition, 2004.
3. Nagoor Kani, Signals and Systems, Tata McGraw Hill, 3rd edition, 2011.
4. T. Veerarajan, "Probability, Statistics and Random Process", Tata McGraw Hill Education, 3rd edition 2018.

Reference Books:

1. Hwei. P Hsu, Signals and Systems, Tata McGraw Hill, 3rd edition, 2010.
2. Michael J Roberts, Fundamentals of Signals and systems, Tata McGraw Hill, special Indian Economy edition, 2009.
3. Luis F. Chaparro, Signals and Systems Using MATLAB, Academic Press.

Useful Links:

1. Signals and Systems Laboratory: Virtual Laboratory http://ssl-iitg.vlabs.ac.in/
2. Course: Principles of Signals & Systems by Prof. Aditya K. Jagannatham (IIT Kanpur);https://swayam.gov.in/nd1_noc20_ee15/preview
3. MIT OpenCourseWare – Signals and Systems by Prof. Alan V. Oppenheim; https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/

Assessment Methodology:

Assessment Tools	Marks Distribution
Term Work (25 Marks)	• Active Participation (Tutorial) = 05 marks • Tutorial Submission = 20 marks Tutorials should cover the entire syllabus.
Continuous Assessment (CA) (20 Marks)	Certification: NPTEL (20 Marks) (Approved by Instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / Simulation of a course-based concept.
Mid Semester Examination (MSE) (30 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • For each question, A and B should be based on the same CO. • MSE should be based on 50% syllabus. • Time: 90 minutes (1 hour 30 minutes) • Total Marks: 30

End Semester Examination (ESE) (50 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • Q4 A or B - 10 marks • Q5 A or B - 10 marks • For each question, A and B should be based on the same CO. • ESE should be on 30% syllabus of MSE and 70% syllabus after MSE. • Time: 120 minutes (2 hrs) • Total Marks: 50

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
25ET3PCC02	Linear Integrated Circuits	**L**	**P**	**T**	**L**	**P**	**T**	**Total**
		3	2	-	3	1	-	**4**
		Examination Scheme						
			CA	**MSE**	**ESE**	**TW**	**OR**	**PR**	**Total**
		Theory	20	30	50	-	**-**	**-**	**100**
		Lab/Tut	-	**-**	**-**	25	-	25	**50**
		Total	**150**						

Pre-Requisite Courses:	25FE1ESC02 Basic Electrical and Digital Electronics
	25FE2PCC01 Analog and Digital Circuits

Course Objectives:

1. To introduce students to the fundamental concepts, characteristics, and limitations of linear integrated circuits.
2. To explain the working principles and applications of operational amplifiers, timers, voltage regulators, converters, and other LIC devices.
3. To develop students' ability to analyze, select, and evaluate LIC-based circuits for different applications.
4. To guide students in designing and implementing application-oriented circuits using suitable LIC components.

Course Outcomes	**After successful completion of the course, the students will be able to**	
	CO1	Know the various types of integrated circuits, their performance parameters, and applications. (Remembering)
	CO2	Explain the various performance parameters and working principles of the integrated circuits. (Understanding)
	CO3	Apply learned concepts to construct a functional circuit for a defined application using integrated circuits. (Applying)
	CO4	Analyze circuit behavior, performance metrics, and limitations of integrated circuits used in practical applications. (Analyzing)
	CO5	Assess different linear integrated circuit configurations to select the most suitable one for a given application. (Evaluating)
	CO6	Design and implement circuits using linear integrated circuits for specified applications. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1	**Introduction to Operational Amplifier**		07
	1.1	Block diagram of Op-Amp, Ideal and Practical Parameters, Voltage Transfer characteristics, Concept and types of feedback, Open loop and Closed loop configurations of Op-Amp	
	1.2	Inverting Amplifier, Non-inverting Amplifier, Voltage follower, Inverting and Non-Inverting Adders, Scaling and Averaging circuit, Subtractor, I-V and V-I Converter	
	1.3	Instrumentation amplifier: Need, Requirements, and application.	
	Self-Learning Topics: Application of Op-Amp in ECG signal amplification		
2	**Linear and Non-Linear Applications of Operational Amplifier**		12
	2.1	Integrator & Differentiator (Ideal & Practical), Active Filters: LPF, HPF, BPF, BRF First order and second order active low pass, high pass Filter,	
	2.2	Oscillators: Barkhausen's criteria, RC phase shift oscillator, Wien bridge oscillator, square wave generator, triangular wave generator	
	2.2	Comparators: Inverting and Non-inverting Comparator, Zero Crossing Detector, Schmitt Triggers: Inverting and Non-inverting Schmitt trigger, Window Comparator	
	2.3	Precision Rectifiers, Log, and Anti-log amplifiers	
	Self-Learning Topics: Application for communication systems.		
3	**Timer IC 555: Operation, Modes, and Applications**		06
	3.1	IC 555 Timer: Features, Functional Block Diagram, Various modes of operation - Astable, Monostable and Bi-stable	
	3.2	Design of Astable and Monostable multivibrator using IC555	
	3.3	Applications: Pulse Width Modulator, Pulse Position Modulator and Frequency divider using IC 555	
	Self-Learning Topics: Application of PWM for speed control of DC Motor		
4	**Voltage Regulators and Applications**		08
	4.1	Block diagram of regulated DC Power Supply, types of voltage regulators (Linear and SMPS), concept of line and load regulation	
	4.2	Fixed Voltage Regulator: Working and design of three terminal voltage regulators using IC 78XX, IC 79XX series, Dual Power supply using 78XX and 79XX series	
	4.3	IC723: Functional block diagram, working and design of general-purpose IC723 as LVLC, LVHC, HVLC and HVHC regulators, short circuit and foldback protection circuits.	
	4.4	Adjustable Voltage Regulator: Design of adjustable voltage regulator using IC LM 317	
	Self-Learning Topics: Design of voltage regulators for real life applications like mobile chargers, laptops etc.		

5	**Signal Conditioning and Data Converters**		**06**
	5.1	Need of Signal conditioning, Data converters and their types. DAC and ADC specifications. Analog to Digital Converters (ADC): Working of Successive approximation ADC, Dual slope ADC, Flash type with block diagram and applications.	
	5.2	Digital to Analog Converters (DAC): Binary weighted DAC, Working of R-2R ladder, Weighted Resistor type with applications.	
	Self-Learning Topics: Applications of ADC and DAC in sensor interfacing and embedded systems.		
6	**Voltage Controlled Oscillators (VCO) and Phase Locked Loops (PLL)**		**06**
	6.1	Voltage Controlled Oscillator, (VCO) – Basic principle, characteristics, functional block diagram, IC 566 as Frequency Modulator	
	6.2	Phase Locked Loops, PLL – Block diagram, operation, capture range, lock range, applications in frequency multiplication, demodulation using IC 565.	
	Self-Learning Topics: Application of PLL in communication systems.		
		TOTAL	**45**

Suggested List of Experiments

Experiment Number	Title of the Experiment
1	Design of Inverting and Non-inverting amplifier using Op-Amp IC 741.
2	Design of Adder and observe output for different input combinations.
3	Design and analyze a differentiator and integrator using Op-Amp IC 741.
4	Design a low pass and high pass filter (first order) using Op-Amp IC 741.
5	Implement comparator circuits using Op-Amp IC 741.
6	Design a Schmitt trigger using Op-Amp IC 741.
7	Design a RC Phase Shift Oscillator using Op-Amp IC 741.
8	Design an Astable Multivibrator using Timer IC 555.
9	Design a Monostable Multivibrator using Timer IC 555.
10	Design PWM and PPM using Timer IC 555.
11	Design and test a regulated power supply using 78XX / 79XX series.
12	Design a variable power supply using LM317.
13	Demonstrate the working of ADC (Successive Approximation or Flash) using a block setup or kit.
14	Implement a DAC (R-2R Ladder or Weighted Resistor).
15	Study of IC 566 as Voltage Controlled Oscillator.

Text Books:

1. R. A. Gaikwad, *Op-Amps and Linear Integrated Circuits*, 4th edition, New Delhi, India: Pearson Prentice Hall.
2. D. Roy Choudhury and S. B. Jain, *Linear Integrated Circuits*, 4th edition, New Delhi, India: New Age International Publishers.
3. K. R. Botkar*, Integrated Circuits*, 10th edition, New Delhi, India: Khanna Publishers

Reference Books:

1. S. Salivahanan and N. Suresh Kumar*, Electronic Devices and Circuits,* 3rd edition, New Delhi, India: Tata McGraw-Hill.
2. K. Maini*, Electronic Devices and Circuits* ,2nd edition, New Delhi, India: Wiley India.
3. D. A. Bell*, Operational Amplifiers and Linear Integrated Circuits,* 3rd edition, New Delhi, India: Oxford University Press.

Useful Links:

1. https://nptel.ac.in/courses/108102096
2. https://onlinecourses.nptel.ac.in/noc23_ee43
3. https://www.coursera.org/learn/introduction-electronics

Assessment Methodology:

Assessment Tools	Marks Distribution
Continuous Assessment (CA) (20 Marks)	Certification: NPTEL (20 Marks) (Approved by Instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / Simulation of a course-based concept.
Mid Semester Examination (MSE) (30 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • For each question, A and B should be based on the same CO. • MSE should be based on 50% syllabus. • Time: 90 minutes (1 hour 30 minutes) • Total Marks: 30
End Semester Examination (ESE) (50 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B -10 marks • Q2 A or B -10 marks • Q3 A or B -10 marks

	• Q4 A or B -10 marks • Q5 A or B - 10 marks • For each question, A and B should be based on the same CO. • ESE should be based on 30% syllabus of MSE and 70% syllabus after MSE. • Time: 120 minutes (02 hours) • Total Marks: 50
Term Work (25 Marks)	• Active Participation (Lab) = 5 marks • Laboratory Report = 10 marks • Laboratory performance = 10 marks Based on the performance and satisfactory completion of assigned laboratory work.
Practical Examination (25 Marks)	Practical examination will be based on the experiments performed by the students during laboratory sessions.

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
25ET3PCC03	Digital System Design using Verilog	L	P	T	L	P	T	Total
		3	2	-	3	1	-	4
		Examination Scheme						
			CA	MSE	ESE	TW	OR	PR	Total
		Theory	20	30	50	-	-	-	100
		Lab/Tut	-	-	-	25	-	-	25
		Total	125						

Pre-Requisite Courses:	25FE1ESC02 Basic Electrical and Digital Electronics
	25FE2PCC01 Analog and Digital Circuits

Course Objectives:

1. To introduce the fundamentals of Verilog HDL and review of digital circuits.
2. To explain various modeling styles in Verilog and demonstrate their applications in designing digital circuits and systems.
3. To construct test benches to verify the functionality of digital circuits using Verilog HDL.
4. To enable students to synthesize, evaluate, and implement digital systems using FPGA tools, with emphasis on optimizing area, timing, and power.

Course Outcomes	After successful completion of the course, the students will be able to	
	CO1	Know the syntax, constructs, and fundamental concepts of Verilog HDL. (Remembering)
	CO2	Explain various hardware modeling styles in Verilog and their applications in designing digital circuits. (Understanding)
	CO3	Develop Verilog code using appropriate abstraction levels to model and test the digital circuits. (Applying)
	CO4	Analyze impact of digital design methodologies on circuit and system performance. (Analyzing)
	CO5	Evaluate and select suitable digital circuit implementation using synthesis reports for given application. (Evaluating)
	CO6	Design and implement digital systems for given specifications using Verilog HDL and FPGA. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1	**Introduction to Verilog HDL**		04
	1.1	Overview of India's Semiconductor Industry and GOI Policies, Semiconductor market trends and ecosystem, Government initiatives and policies for VLSI/FPGA development, Review of Digital Circuits and Systems. Introduction to HDL, Comparison between Verilog and VHDL, Need and advantages of Verilog HDL, Verilog Design Flow, EDA tools.	
	1.2	Hierarchical Modeling Concepts: Design methodologies (Top-down vs. Bottom-up), FPGA architecture fundamentals, Types of FPGAs available in the market and their applications.	
	Self -Learning Topics: Recent trends of design methodologies and implementation of digital circuits and systems.		
2	**Verilog Constructs & Modeling Styles**		12
	2.1	Verilog Language Constructs: Design hierarchy, components of a Verilog modules, Verilog simulation and synthesis concepts. Writing and simulating test benches, Lexical conventions, identifiers, operators, language constructs. Data types, ports, port declaration, variables & assignments,	
	2.2	Structural (Gate-Level) Modeling, Gate types, Gate delays, module instantiation.	
	2.3	Dataflow Modeling, Continuous assignment, Implicit Continuous assignment, Delays.	
	2.4	Behavioral Modeling, Structured procedures: initial and always blocks, Procedural assignments: blocking & non-blocking, Timing controls, conditional statements, multiway branching, case, casex and casez statements, Loop constructs, sequential & parallel blocks.	
	Self-Learning Topics: Gate delays and their impact on simulation accuracy.		
3	**Combinational Logic Design using Verilog**		10
	3.1	Arithmetic Circuits: Modeling of Half & Full Adder, Half & Full Subtractor, Ripple Carry Adder, Carry Look ahead Adder, Multiplexed adder-subtractor, Comparator, Parity Generator, Multiplier designs using different modeling styles.	
	3.2	Data Routing Circuits: Multiplexer, De-multiplexer, Encoder, Decoder, Priority Encoder using different modeling styles.	
	3.3	Code Converters: Binary to Gray, BCD to Seven Segment Converter.	
	Self-Learning Topics: Modeling of BCD adder, Parallel adder, Gray to Binary, Excess-3 converter.		
4	**Sequential Circuit Design using Verilog**		09
	4.1	Memory Elements: Latch, Flip-flops: SR, JK, D, T using Verilog with different modeling styles.	
	4.2	Counters: Asynchronous and Synchronous Counters, Up-Down Counter, Clocking, and timing constraints.	
	4.3	Shift Registers: SISO, PISO, Universal Shift Register.	
	Self-Learning Topics: Modeling of SIPO, PIPO shift registers.		

5	**Finite State Machines (FSM) Design using Verilog**		**05**
	5.1	FSM Fundamentals: Mealy Vs Moore models, State encoding, state diagrams, state tables.	
	5.2	Data Routing Circuits: Design of Mealy and Moore Machine, Design of Traffic Signal Controller using FSM.	
	Self-Learning Topics: Sequence detector using both Mealy and Moore models.		
6	**Synthesis and Timing Analysis**		**05**
	6.1	RTL to Gate-Level Synthesis, synthesis flow, constraints and optimization (timing, area, power).	
	6.2	Static Timing Analysis (STA) basics, Reading and interpreting synthesis reports.	
	6.3	Introduction to Design for Test (DFT): Methods of DFT	
	Self-Learning Topics: RTL design & performance analysis of a digital circuit.		
		TOTAL	**45**

Suggested List of Experiments:

Experiment Number	Title of the Experiment
1	To verify functionality of Logic Gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) using Verilog HDL.
2	To implement given Boolean expression using different modeling styles.
3	To Realize Half Adder and Full Adder using different modelling styles.
4	To Realize multiplexed Adder/Subtractor using Verilog HDL.
5	To realize 4:1 and 8:1 multiplexer using Verilog Behavioral description.
6	To realize 1:4 using 1:8 De-multiplexer. Use different modeling styles.
7	To realize 8:3 encoder, Priority encoder using Verilog Behavioral description.
8	To realize 3:8 decoder using Verilog Behavioral description.
9	To realize 2-bit comparator using Verilog Behavioral description.
10	To realize using Verilog Behavioral description: Flip-flops: SR & JK flip-flops.
11	To realize using Verilog Behavioral description: D and T flip flops.
12	To design & simulate 4-bit Up/Down Counter using Verilog Behavioral description.
13	To design & simulate Moore and Mealy Finite State Machine (FSM) using Verilog HDL.
14	To design & simulate 4-bit Arithmetic Logic Unit (ALU) using Verilog HDL.
15	To design & simulate BCD to 7-Segment Display Decoder using Verilog HDL.

Text Books:

1. Verilog HDL: A Guide to Digital Design and Synthesis, 2nd edition, Samir Palnitkar, Pearson Education, 2009.
2. Advanced Digital Design with Verilog HDL, 2nd edition, Michel D. Ciletti, PHI, 2009.
3. Simon D Monk, "Programming FPGAs: Getting started with Verilog," 1s t edition, McGraw Hill Eduction-2016.
4. M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL," Pearson Prentice Hall, 2013.

Reference Books:

1. Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th edition, Michel D. Ciletti, Pearson Education, 2018.
2. Design through Verilog HDL, 2nd edition, Padmanabhan, Tripura Sundari, Wiley, 2016.
3. Z. Kohavi and N. Jha, Switching and Finite Automata Theory, 3rd edition, Cambridge University Press,2010.
4. Verilog HDL Primer, 3rd edition, Bhasker J, BSP, 2001.

Useful Links:

1. Hardware Modeling using Verilog, Prof. Indranil Sengupta, Department of Computer Science and Engineering, IIT Kharagpur https://nptel.ac.in/courses/106105165
2. System Design Through VERILOG By Prof. Shaik Rafi Ahamed- IIT Guwahati https://onlinecourses.nptel.ac.in/noc21_ee97/preview

Assessment Methodology:

Assessment Tools	Marks Distribution
Continuous Assessment (CA) (20 Marks)	Certification: NPTEL (20 Marks) (Approved by Instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / Simulation of a course-based concept.
Mid Semester Examination (MSE) (30 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • For each question, A and B should be based on the same CO. • MSE should be based on 50% syllabus. • Time: 90 minutes (1 hour 30 minutes) • Total Marks: 30

End Semester Examination (ESE) (50 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • Q4 A or B - 10 marks • Q5 A or B - 10 marks • For each question, A and B should be based on the same CO. • ESE should be based on 30% syllabus of MSE and 70% syllabus after MSE. • Time: 120 minutes (02 hours) • Total Marks: 50
Term Work (25 Marks)	• Active Participation (Lab) = 5 marks • Laboratory Report = 10 marks • Laboratory performance = 10 marks Based on the performance and satisfactory completion of assigned laboratory work.

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
25ET3PCC04	Analog and Digital Communication	L	P	T	L	P	T	Total
		3	2	-	3	1	-	4
		Examination Scheme						
			CA	MSE	ESE	TW	OR	PR	Total
		Theory	20	30	50	-	-	-	100
		Lab/Tut	-	-	-	25	25	-	50
		Total	150						

Pre-Requisite Courses:	25FE1BSC01 Fundamentals of Engineering Mathematics –I
	25FE1ESC02 Basic Electrical and Digital Electronics
	25FE2PCC01 Analog and Digital Circuits

Course Objectives:

1. To explain the key concepts of Analog and Digital Communication Systems.
2. To enable students to analyze and compare the different Modulation and coding techniques.
3. To illustrate various source and channel coding techniques.
4. To equip students with practical skills through hardware and simulation experiments.

Course Outcomes	**After successful completion of the course, the students will be able to**	
	CO1	Define the basic elements of Analog and Digital Communication Systems, including types of signals, modulation techniques, and coding principles. (Remembering)
	CO2	Explain the working principles of Analog and Digital Modulation Schemes and Multiplexing Techniques. (Understanding)
	CO3	Calculate the various performance parameters of the Communication Systems. (Applying)
	CO4	Analyze and differentiate between various line coding, modulation, and Multiplexing Techniques. (Analyzing)
	CO5	Evaluate the Performance of Analog and Digital Communication Systems and select the appropriate techniques for given applications. (Evaluating)
	CO6	Design/Implement Communication Circuits/Systems for the given specifications. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1	**Introduction to Electronic Communication System and Noise**		05
	1.1	Fundamentals of Communication Systems: Elements of Electronic Communication System, Types of Communication-Analog and Digital, Transmission Modes, Block diagrams of Analog and Digital Communication Systems.	
	1.2	Noise in Communication Systems: Definition and classification of noise (internal and external). Noise Parameters- Signal-to-noise ratio, Noise factor, Noise Figure, Noise Temperature. Friis Formula for noise in cascaded systems.	
	Self-Learning Topics: Electromagnetic Spectrum, Types of Noise		
2	**Analog Modulation and Demodulation**		13
	2.1	Amplitude Modulation and Demodulation: Need for Modulation, Amplitude Modulation – Definition and waveforms, Mathematical Representation of AM, modulation index. Types of AM, Frequency Spectrum and Bandwidth, Power Relations in AM Systems, Power-Saving Calculations in DSBSC and SSB.AM Demodulation– Need for Demodulation,Envelope Detector - Principle and Working.	
	2.2	Frequency Modulation and Demodulation: Definition and waveform of FM, Modulation Index, frequency deviation, deviation ratio, Bandwidth Requirement, Narrowband and Wideband FM, Pre-emphasis and De-emphasis, FM Generation- Direct Method -Varactor Diode modulator, Indirect Method- Armstrong method, FM Detection- Foster-Seeley Discriminator- Principle and Working.	
	2.3	Radio Receivers: Characteristics of Radio Receivers, Superheterodyne Receivers-Principle, Block Diagram, and Working Principles for AM and FM Receivers.Automatic Gain Control-Need, Types of AGC, Operation, and Significance.	
	Self-Learning Topics: Comparison of AM and FM, Homodyne receivers, Real Life Examples- AM/FM Radio**.**		
3	**Pulse Modulation and Multiplexing**		06
	3.1	Sampling Fundamentals: Sampling Theorem, Nyquist Criteria, Aliasing error.	
	3.2	Analog Pulse Modulation Techniques: PAM, PWM, and PPM- Principle, Waveforms, and Comparison of Various Pulse Modulation Techniques.	
	3.3	Digital Pulse Modulation Techniques: Concept and Digitization of Analog signals, Quantization, Working Principles of PCM, DPCM, DM, ADM.	
	3.4	Multiplexing: Definition, Need and Classification, Principle of TDM and FDM Systems. Comparison between TDM and FDM.	
	Self-Learning Topics: Sampling Techniques		

4	**Information Theory and Coding**		**08**
	4.1	Fundamentals of Information Theory: Introduction to Information Theory, importance and relevance in communication systems, Amount of Information, Entropy, Information Rate.	
	4.2	Source Coding Techniques: Purpose and Need of Source Coding, Source Coding Theorem, Huffman Coding Algorithm-construction and Performance Evaluation.	
	4.3	Channel Coding Techniques: Fundamentals of Channel Coding, Concepts of LinearBlock Codes- Systematic and Non-Systematic forms, Encoding using a generator matrix, Hamming Weight and Hamming Distance, Error Detection and Correction capabilities. Decoding using Syndrome Calculation and Parity Check Matrix.	
	Self-Learning Topics: Applications of Source Coding and Channel Coding Techniques.		
5	**Baseband Transmission and Reception**		**05**
	5.1	Overview of Baseband Transmission Systems: Definition and Concept of Baseband Transmission, Block diagram of Baseband Transmitter-Receiver System-Functional blocks and their roles.	
	5.2	Line Coding Techniques: Need for line coding, Properties of line codes, Types of Line codes – RZ and NRZ Unipolar formats, RZ and NRZ Polar formats, RZ and NRZ Bipolar format (AMI format), Split phase Manchester Format. Quaternary Polar format. Comparison of Line Codes.	
	5.3	Inter Symbol Interference: Definition and causes of Inter Symbol Interference, effect of ISI on system performance.	
	Self-learning: Concept of Optimum filters (matched filter), need for equalization.		
6	**Digital Modulation Techniques**		**08**
	6.1	Overview of Digital Modulation: Classification of Digital Modulation Techniques, Concept of Coherent and Non-coherent Detection. Power spectra and Bandwidth Efficiency	
	6.2	Binary Digital Modulation Schemes: Principle, Generation, Detection, Signal Space Representation, and Bandwidth of Digital Modulation Schemes: BASK, BFSK, and BPSK. Comparison and Performance Metrics.	
	Self-Learning Topics: M-ary Modulation Schemes - Concept, advantages, and their applications in modern communication systems.		
		TOTAL	**45**

Suggested List of Experiments:

Experiment Number	Title of the Experiment
1	Generation/Detection of Amplitude Modulation.
2	Generation/Detection of Frequency Modulation.
3	Verification of Sampling Theorem.
4	Generation of PAM Modulation/Demodulation.
5	Generation of PWM Modulation/Demodulation.
6	Generation of PPM Modulation/Demodulation.
7	Demonstration of Digital Pulse Code Modulation Technique (PCM).
8	Time Division Multiplexing and De-Multiplexing of Signals.
9	Frequency Division Multiplexingand De-Multiplexingof Signals.
10	Computation and Analysis of Information Content and Entropy for a Discrete Memoryless Source.
11	Simulate Linear block code and find error detection capability.
12	Generation/Simulation and Comparisonof Line Codes.
13	Modulation/Demodulation of Binary ASK.
14	Modulation/Demodulation of Binary FSK.
15	Modulation/Demodulation of Binary PSK.

Assessment Methodology:

Assessment Tools	Marks Distribution
Continuous Assessment (CA) (20 Marks)	Certification: NPTEL (20 Marks) (Approved by Instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / Simulation of a course-based concept.
Mid Semester Examination (MSE) (30 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B -10 marks • Q2 A or B -10 marks • Q3 A or B -10 marks • For each question, A and B should be based on the same CO.

	• MSE should be based on 50% syllabus. • Time: 90 minutes (1 hour30 minutes) • Total Marks:30
End Semester Examination (ESE) (50 Marks)	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B -10 marks • Q2 A or B -10 marks • Q3 A or B -10 marks • Q4 A or B -10 marks • Q5 A or B - 10 marks • For each question, A and B should be based on the same CO. • ESE should be based on 30% syllabus of MSE and 70% syllabus after MSE. • Time: 120 minutes (02 hours) • Total Marks: 50
Term Work (25 Marks)	• Active Participation (Lab) = 05 marks • Laboratory Report / Journal = 10 marks • Laboratory Performance = 10 marks • Based on the performance & satisfactory completion of minimum 8 experiments.
Oral (25 Marks)	Oral examination will be based on the entire syllabus

Text Books:

1. Wayne Tomasi, "Electronics Communication Systems" Pearson Education, 5th edition.
2. Kennedy and Davis "Electronics Communication System," Tata McGraw Hill
3. Sklar B, and Ray P. K., "Digital Communication: Fundamentals and Applications," Pearson, Dorling Kindersley (India), Delhi, 2nd edition.
4. T. L. Singal, "Analog and Digital Communication," Tata Mc-Graw Hill, New Delhi, 1st edition.

Reference Books:

1. Herbert Taub, Donald L Schilling, Goutam Saha, "Principles of Communication Systems," Tata McGraw Hill, 3rd edition.
2. Simon Haykin, "Communication System," John Wiley and Sons, 4th edition.
3. B P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University, 4th edition.

Online References:

Sr. No.	Website Name
1.	Analog communication- https://swayam.gov.in/nd1_noc20_ee69/preview
2.	Principles of Digital Communication- https://nptel.ac.in/courses/108101113
3.	Principles of Digital Communication- https://nptel.ac.in/courses/108102120

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
25ET3VSEC01	Java Programming	L	P	T	L	P	T	Total
		-	2*+2	-	-	2	-	2
		Examination Scheme						
			CA	MSE	ESE	TW	OR	PR	Total
		Theory	-	-	-	-	-	-	-
		Lab/Tut	-	-	-	25	-	25	50
		Total	50						

* Two hours of demo/discussion for entire class.

Pre-requisite Course:	25FE1VSEC02 Problem Solving using C programming

Course Objectives:

1. To understand object-oriented programming using Java.
2. To develop Java programs using classes, inheritance, and interfaces.
3. To implement concepts such as exception handling, multithreading, and applets.
4. To familiarize students with Java I/O, collections, and basic GUI components.
5. To encourage the application of Java programming in real-world embedded and communication system contexts.

Course Outcomes	After successful completion of the course, the students will be able to	
	CO1	Know the Java programming environment, syntax, and tools. (Remembering)
	CO2	Explain the object-oriented principles such as encapsulation, inheritance, and polymorphism in Java. (Understanding)
	CO3	Apply the programming concepts to implement exception handling and multithreading mechanisms. (Applying)
	CO4	Teach efficient data handling using the Java Collections Framework and file input/output operations. (Analyzing)
	CO5	Create interactive GUI applications and connect them with databases using JDBC. (Evaluating)
	CO6	Design and develop Java applications suitable for communication and embedded system domains. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1	**Introduction to Java and Programming Paradigms**		04
	1.1	Introduction to Java and Programming Paradigms	
	1.2	Introduction to Programming Paradigms: Procedural, Object-Oriented, Functional, Logic & Rule-Based	
	1.3	Java: History, Features, JDK, JVM, JRE	
	1.4	Java Program Structure, Data Types, Operators, Control Flow Statements	
	Self-Learning Topics: Structure of a Java Program, Setup of JDK and IDE, Comparison with C/C++ Syntax.		
2	**Classes, Objects and Methods**		05
	2.1	Class Fundamentals, Declaring Objects, Constructors	
	2.2	Method Overloading, Argument Passing, this, static, Finalizer	
	2.3	Access Modifiers, Scope Rules	
	2.4	Nested, Inner, Anonymous Classes	
	Self-Learning Topics: Code Reusability in OOP, Best Practices in Class Design		
3	**Inheritance, Polymorphism, Interfaces and Packages**		06
	3.1	Inheritance: Types, super, Constructor Chaining	
	3.2	Method Overriding, Dynamic Dispatch, Abstract Classes, instanceof	
	3.3	Interfaces: Declaration, Implementation, Functional Interfaces	
	3.4	Packages: Definition, Access Protection, Import, Classpath	
	Self-Learning Topics: Understand FIFO principle, real-world examples		
4	**Arrays, Strings, Exception Handling, and Multithreading**		06
	4.1	Arrays, ArrayList, Wrapper Classes	
	4.2	String Handling: String, StringBuilder, StringBuffer, Regex	
	4.3	Exception Handling: try-catch-finally, custom exceptions	
	4.4	Multithreading: Lifecycle, Runnable, Synchronization	
	Self-Learning Topics: Checked vs Unchecked Exceptions, Thread Communication, Sleep/Yield/Join Methods.		
5	**Java I/O and Collections Framework**		05
	5.1	File I/O: Reader/Writer, BufferedReader, Serialization	
	5.2	Collections: ArrayList, HashMap, HashSet, TreeMap, Iterators	
	5.3	Generics and Wrapper Classes	
	5.4	Utility Classes: Scanner, Math, Date, Calendar	
	Self-Learning Topics: Stream-based I/O vs Reader/Writer I/O, Java 8 Stream API Basics.		
6	**GUI Programming and JDBC Basics**		04
	6.1	Introduction to AWT and Swing components, JavaFX	
	6.2	Event handling, Layout managers, JDBC architecture	
	6.3	Connecting Java with MySQL	
	Self-Learning Topics: Loading JDBC driver manually vs using connection pool.		
		TOTAL	**30**

Suggested List of Experiments:

Experiment Number	Title of the Experiment
1	Write a Java program to demonstrate basic I/O, data types, and control structures (if-else, for-loop, switch-case).
2	Develop a Java program using classes, constructors (default/parameterized), method overloading, and this keyword.
3	Implement a Java program that simulates the working of an object-oriented system using inheritance and method overriding.
4	Create a Java application that demonstrates the use of interfaces and packages for component reusability.
5	Develop a program using arrays, ArrayList, and StringBuilder to simulate a student record management system.
6	Write a Java program demonstrating exception handling using try-catch-finally, with custom exceptions.
7	Implement a multithreading example simulating sensor data acquisition and real-time printing (use Thread, Runnable).
8	Design a basic AWT/Swing-based GUI application for a temperature monitoring dashboard.
9	Write a Java program to create a simple calculator using java AWT elements. Use a grid layout to arrange buttons for the digits and basic operation +, -, /, *. Add a text felid to display the results.
10	Implement file reading and writing operations to store and retrieve EXTC lab attendance records using FileReader, BufferedWriter.
11	Create a Java program using HashMap and ArrayList to simulate a component inventory system (e.g., resistors, ICs, sensors).
12	Mini Project: Combine multithreading, GUI, and file handling to simulate a serial data reception tool with logging features.
13	Write Java program to draw various shapes on Canvas using JavaFX.
14	Implement sorting algorithms: Quick sort, Merge sort.
15	Design a Java Application to Store and Retrieve Sensor Data Using JDBC.

Text Books:

1. Herbert Schildt, “Java: The Complete Reference”, McGraw Hill Education, 11th Edition.
2. E. Balagurusamy, “Programming with Java: A Primer”, Tata McGraw-Hill Education.
3. Kathy Sierra, Bert Bates, “Head First Java”, O’Reilly Media, 2nd Edition.
4. Y. Daniel Liang, “Introduction to Java Programming”, Pearson Education, 10th Edition.

Reference Books:

1. Cay S. Horstmann, “Core Java Volume I – Fundamentals”, Pearson Education.
2. Dr. R. Nageswara Rao, “Core Java: An Integrated Approach”, Dreamtech Press.
3. Paul Deitel, Harvey Deitel, “Java How to Program”, Pearson Education, 11th Edition

Useful Links:

1. https://nptel.ac.in/courses/106/105/106105191/
2. Java Programming - Course (swayam.gov.in)
3. https://www.javatpoint.com/java-tutorial
4. https://www.geeksforgeeks.org/java/

Assessment Methodology:

Assessment Tools	Marks Distribution
Term Work (25 Marks)	• Active Participation (Lab) = 05 marks • Laboratory Report / Journal = 10 marks • Laboratory Performance = 10 marks Based on the performance & satisfactory completion of minimum 8 experiments.
Practical Examination (25 Marks)	Practical examination will be based on the experiments performed by the students during laboratory sessions.

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
25IL3VEC01	Sustainable Development	L	P	T	L	P	T	Total
		2	-	-	2	-	-	2
		Examination Scheme						
			CA	MSE	ESE	TW	OR	PR	Total
		Theory	50	-	-	-	-	-	50
		Lab/Tut	-	-	-	-	-	-	-
		Total	50						

Course Objectives

1. To introduce students to the role of AI, IoT, and ICT in solving India's pressing socio-economic and environmental challenges.
2. To enable learners to understand and apply these technologies for achieving the UN Sustainable Development Goals (SDGs) in the Indian context.
3. To encourage innovative thinking, problem-solving, and use-case development for sustainable growth.

Course Outcomes	After successful completion of the course, the students will be able to:	
	CO1	Understand fundamental concepts of AI, IoT, and ICT for sustainable development. (Remembering)
	CO2	Identify key areas of sustainable development in India that can benefit from technology. (Understanding)
	CO3	Work collaboratively on an activity to address a societal or environmental issue. (Applying)
	CO4	Analyse real-world case studies and technology-led development models. (Analysis)
	CO5	Evaluate the ethical, environmental, and policy implications of digital interventions. (Evaluating)
	CO6	Propose innovative solutions to local and national challenges using AI, IoT, and ICT. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1	**Introduction to Sustainable Development in India.**		5
	1.1	Overview of UN SDGs and India's priorities (poverty, health, education, environment), National Missions: Digital India, Smart Cities, Startup India, Skill India.	
	1.2	Technology as an enabler of sustainable growth, Tools for sustainability assessment.	
	Self-Learning Topics: Study the progress and challenges of India in achieving each UN Sustainable Development Goal (SDG).		
2	**Fundamentals of AI, IoT, and ICT**		5
	2.1	Sustainability enablers using AI: ML, Deep Learning, NLP, IoT: Sensors, connectivity, cloud platforms.	
	2.2	ICT: Communication Networks, Mobile platforms, Data systems, Synergy between AI, IoT, and ICT.	
	Self-Learning Topics: Watch beginner-level videos on Machine Learning, Deep Learning, and NLP (e.g., by Google AI, Fast.ai).		
3	**Sectoral Applications in Indian Context**		5
	3.1	Agriculture: Smart Farming, Crop Prediction, Irrigation Management, Healthcare: Telemedicine, Diagnostics, Health Surveillance	
	3.2	Education: Personalized Learning, Digital Classrooms, Case studies: eNAM, eSanjeevani, DIKSHA	
	Self-Learning Topics: Explore eSanjeevani and how telemedicine reached rural India during COVID-19. Case Research: Choose a state and explore how AI/ICT helped during a health crisis.		
4	**Environment, Energy and Urban Development**		5
	4.1	AI and IoT in waste management and pollution control, Smart grids, and renewable energy systems	
	4.2	ICT in climate action and disaster management, Case studies: Smart Cities Mission, Jal Shakti, PM-KUSUM	
	Self-Learning Topics: Study how smart bins work using IoT and AI (e.g., Swachh Bharat implementations).		
5	**Innovation, Startups, and Ethical Concerns**		5
	5.1	Role of innovation hubs and social enterprises, Frugal innovation for rural and tribal India	
	5.2	Data privacy, algorithmic bias, digital inclusion, Policy frameworks: NDCP, India AI Strategy, Data Protection Bill	
	Self-Learning Topics: Analyze the impact of the Digital Personal Data Protection Act 2023 on startups and citizens.		

6	**Sustainable Solutions in India (Case India)**		5
	6.1	Students identify a sustainable development challenge Discuss an AI/IoT/ICT-based solutions	
	6.2	Review of Digital Transformation initiatives by Government of India	
	Self-Learning Topics: Explore past Smart India Hackathon or Toycathon Projects for inspiration. Watch a tutorial on how to build a simple AI/IoT prototype (e.g., Smart Dustbin, Health Monitor). Learn how to use Canva, Figma, or PowerPoint for visualizing your project idea. Practice a pitch using a simple template: Problem → Solution → Impact → Tech Used.		
		TOTAL	**30**

Text Books:

1. Niti Aayog SDG India Index 2023-24: Towards Viksit Bharat, NITI Aayog, 2023–24, Government of India Publication.
2. Ahlawat, Ajay. Sustainable Development Goals: Directive Principles for Sustainable India by 2030. 8 October 2019, E-Book.
3. Mishra, Ankita, Banerjee, Sourik, & Singh, Brijendra. Deep Learning Techniques for Smart Agriculture Applications. Publishing 26 August 2025, IGI Global Publication.
4. Acharya, Biswaranjan (Ed.), Dey, Satarupa (Ed.), & Zidan, Mohammed (Ed.). IoT-based Smart Waste Management for Environmental Sustainability. 26 August 2024, CRC Press, Taylor & Francis Group.
5. Satsangi, Prem Saran. Role of Communities in Achieving Sustainable Development. 16 May 2024, Academic Foundation India.

Reference Books:

1. Frugal Innovation: How to Do More with Less – Navi Radjou, Jaideep Prabhu.
2. Artificial Intelligence: A Guide for Thinking Humans – Melanie Mitchell
3. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things – David Hanes et al.
4. Information and Communication Technology for Development (ICT4D) – Tim Unwin
5. AI and the Future of Humanity – Rajan Gupta (NIT Rourkela)
6. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia – Anthony M.

Useful Links:

- **AI / IoT Learning Platforms:**

1. Teachable Machine by Google – Train simple AI models visually.
2. ThingSpeak IoT Platform – IoT data collection and analysis.
3. Arduino Project Hub – DIY IoT projects for beginners.
4. Google AI Hub – Demos, guides, and tools.

- **Sustainability and Indian Development Data:**

1. NITI Aayog SDG India Index – Dashboard for India's SDG progress.
2. India Smart Cities Dashboard – Real-time data and initiatives.
3. PM-KUSUM – Renewable energy for farmers.

- **Case Study Portals:**

1. Digital India Case Studies – Real examples of tech-enabled development.
2. eSanjeevani – India's official telemedicine platform.
3. DIKSHA Portal – Digital Infrastructure for Knowledge Sharing (Education).

- **Educational Videos:**

1. Fast.ai YouTube Channel – Friendly introductions to ML & Deep Learning.
2. NPTEL AI & ICT Courses – Free government-certified video courses (search: AI, ICT4D, IoT).
3. AI for Social Good by Google – Examples of AI for environmental and humanitarian use.

Assessment Methodology:

Assessment Tools	Marks Distribution
Continuous Assessment (CA) (50 Marks)	• Active Participation = 5 marks • MCQ /Class Test= 10 marks • Assessment of the activity carried out by student = 25 marks • Assignment = 10 marks

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
25ET3CEP01	Community Engagement Project 1	L	P	T	L	P	T	Total
		-	2	-	-	1	-	1
		Examination Scheme						
			CA	MSE	ESE	TW	OR	PR	Total
		Theory	-	-	-	-	-	-	-
		Lab/Tut	-	-	-	25	25	-	50
		Total	50						

Pre-Requisites Courses	25FE1BSC02 Applied Physics
	25FE1ESC02 Basic Electrical and Digital Electronics
	25FE2PCC01 Analog and Digital Circuits

Learning Objectives

1. To guide students to identify real-world problems through brainstorming, surveys, interactions, or domain research and define a problem statement relevant to industry or society/community.
2. To enable students to plan resource-feasible projects for societal needs by preparing basic block diagrams, sketches, or flowcharts.
3. To facilitate hardware circuit designing, PCB making, simulation, prototype development, testing and assemble simple circuits or systems using available lab components.
4. To mentor students in troubleshooting, field testing, and feedback collection to address societal issues by analyzing practical challenges and making incremental refinements to their prototypes.
5. To train students to document and present projects effectively through concise reports, presentations, and demonstrations highlighting community impact.

Course Outcomes	After successful completion of the course, the students will be able to:	
	CO1	Recall and explain the principles of community engagement and identify societal needs suitable for engineering interventions. (Remembering)
	CO2	Interpret community problems to understand their context and requirements. (Understanding)
	CO3	Apply fundamental Electronics & Telecommunication concepts to design practical solutions addressing community needs. (Applying)
	CO4	Examine the performance of prototypes and analyze feedback to identify improvements. (Analyzing)
	CO5	Evaluate the effectiveness, feasibility, and impact of solutions implemented in real-world community settings. (Evaluating)
	CO6	Design, develop, and demonstrate innovative solutions for community problems. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1	**Introduction & Project Ideation**		05
	1.1	Introduction to community engagement and its importance and examples of simple engineering projects for societal benefit.	
	1.2	Brainstorming session: identifying community issues in local area and selection of 1-2 feasible projects per team. Preparing a simple project plan (objectives, resources, timeline), define expected community impact and success criteria.	
2	**Assessment & Planning**		05
	2.1	Conducting simple surveys or interviews with local community and understanding specific problems and requirements.	
	2.2	Mapping community needs to possible solutions and formulating a basic block diagram or flowchart for the project, identify potential risks or constraints that may affect project feasibility.	
3	**Design & Preparation**		05
	3.1	Preparing a list of tasks and assigning responsibilities within the team, discussion on materials, components, and tools required, preparing sketches or simulation if applicable.	
	3.2	Identifying sensors, microcontrollers, or communication modules if required, designing simple circuits, systems, or software solutions.	
4	**Prototype Development**		05
	4.1	Building basic hardware or software prototype. Testing functionality in the lab, analyze results.	
	4.2	Troubleshooting common issues and making minor modifications. Maintaining a project log or diary.	
5	**Field Testing and Data Collection**		05
	5.1	Taking the prototype to community/site for testing (local school, society, NGO, etc.). Collecting feedback or simple data on prototype performance.	
	5.2	Observe practical challenges, document findings, and prioritize modifications based on feedback.	
6	**Reporting & Presentation**		05
	6.1	Preparing a project report with observations and results.	
	6.2	Creating presentation slides or demonstration boards.	
	6.3	Final demonstration of the project to faculty and peers. Reflection on learning experiences and societal impact.	
		TOTAL	**30**

Suggested Software tools:

1. LTspice: https://www.analog.com/en/design-center/design-tools-and- calculators/ltspice-simulator.html#
2. Eagle: https://www.autodesk.in/products/eagle/overview
3. OrCAD: https://www.orcad.com/
4. Multisim: https://www.multisim.com/
5. Webbench: http://www.ti.com/design-resources/design-tools-simulation/webench- power-designer.html
6. Tinker cad: https://www.tinkercad.com/

Suggested Online References:

1. AICTE Activity Points for Students – Community Service Guidelines.
2. IEEE Humanitarian Activities Committee (HAC) Projects.
3. National Service Scheme (NSS) – Student Engagement Models.
4. Engineering for Change – Community Projects.
5. MIT D-Lab: Development through Engineering Projects.

Available Online Repository:

1. https://www.electronicsforu.com
2. https://circuitdigest.com
3. https://www.electronicshub.org

Assessment Methodology:

Assessment Tools	Marks Distribution
Term Work (25 Marks)	• Active Participation = 5 marks • Project Report = 10 marks Progress Presentations (min 02) & Demonstration = 10 marks
Oral (25 Marks)	Oral examination will be based on the design, implementation, and demonstration of the project.

Course Guidelines

1. Students shall form groups of 04 members. A group shall not consist of fewer than three or more than four students.
2. Students should conduct a survey and identify real-world needs/issues to engage in community-based project ideas based on the syllabus contents of Program Core Courses. Project Idea must be converted into a clear problem statement for the mini project, in consultation with the Faculty Supervisor, Head of Department, or Internal Faculty Committee.
3. Students shall submit an implementation plan in the form of a Gantt chart, outlining the weekly activities of the mini project.
4. Each group must maintain a logbook to record weekly progress. The faculty supervisor shall verify the entries and may provide notes/comments as required.
5. While faculty supervisors may provide guidance during the mini project, the emphasis should be on self-learning and student-driven innovation.
6. Students in each group shall understand the problem thoroughly, propose multiple solutions, and, in consultation with the supervisor, select the best possible solution.
7. The selected solution shall be converted into a working model and demonstrate the solution effectively.
8. The solution must be validated with justification, and the final project report shall be compiled in the standard format prescribed by the institute.
9. With an emphasis on self-learning, innovation, societal impact, and entrepreneurship development, it is preferable that each group undertakes a single mini project of appropriate scope and quality spanning two semesters.
10. However, based on the capabilities of the students or group, and with the mentor's recommendation, if the mini project (adhering to all qualitative expectations) is completed in the odd semester, the group may work on an extension of the same project with further improvements/modifications, to be continued in the subsequent higher semesters.