THIAGARAJAR COLLEGE OF ENGINEERING

(A Govt. Aided Autonomous Institution Affiliated to Anna University)

MADURAI – 625 015

CURRICULUM AND SYLLABI

for

B.TECH. DEGREE PROGRAMME

IN

ELECTRONICS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2026-2027 ONWARDS

Vision and Mission of the Department of ECE

Vision:

To empower the Electronics and Communication Engineering students with technological excellence, professional commitment and social responsibility.

Mission:

ME1 Attaining academic excellence in Electronics and Communication Engineering through dedication to duty, innovation in learning and research, state of the art laboratories and industry driven skill development.

ME2 Establishing suitable environment for the students to develop professionalism and face life challenges with ethical integrity.

ME3 Nurturing the students to understand the societal needs and equip them with technical expertise to provide appropriate solutions.

ME4 Providing breeding ground to obtain entrepreneurial skills and leadership qualities for self and social growth.

Program Educational Objectives (PEOs) of B.Tech. Electronics Engineering (VLSI Design and Technology) Programme

PEO	Statement
PEO 1	**Technical Excellence in VLSI and Semiconductor Domain** Graduates will exhibit sustained professional competence in electronics engineering with specialisation in VLSI design, testing, and semiconductor technology — applying their rigorous academic foundation, laboratory skills, and industry-driven knowledge to analyse, design, verify, test, and implement integrated circuits and electronic systems in the semiconductor and allied industries.
PEO 2	**Professional Practice with Ethical Integrity** Graduates will demonstrate professional commitment, ethical conduct, and responsible engineering practice in their careers — working with integrity in multidisciplinary teams in the semiconductor industry, research institutions, and public service, consistently upholding the norms of the engineering profession.
PEO 3	**Socially Responsive Engineering through VLSI Expertise** Graduates will apply their technical expertise in VLSI design and semiconductor technology to understand and address societal needs — developing electronic systems, products, and solutions in domains such as communications, healthcare, defence, clean energy, and digital infrastructure that benefit communities and the nation.
PEO 4	**Entrepreneurship, Leadership and Lifelong Learning** Graduates will leverage their entrepreneurial mindset and leadership qualities to create ventures, drive innovation, or pursue advanced education and research in the semiconductor ecosystem — continuously updating their knowledge of emerging VLSI technologies to sustain self and social growth.

Program Specific Outcomes (PSOs) of B.Tech. Electronics Engineering (VLSI Design and Technology) Programme

PSO	Statement
PSO 1	**Semiconductor Device and Process Understanding** Demonstrate an integrated understanding of semiconductor device physics, CMOS technology, semiconductor manufacturing processes, and packaging technologies to analyse device behaviour, assess process–design interactions, and evaluate emerging semiconductor materials and architectures for next-generation electronic products.
PSO 2	**VLSI Design, Verification and Testing** Apply knowledge of analog, digital, and mixed-signal circuit design to conceive, model, simulate, verify, test, and implement VLSI circuits and systems — employing design-for-testability (DFT), fault modelling, and automatic test pattern generation (ATPG) — using hardware description languages, industry-standard EDA tools, and ASIC/FPGA design-and-test flows for applications in communication, computing, and embedded domains.
PSO 3	**System-Level Design and Product Development** Design and implement electronic systems and SoC solutions by integrating processor architectures (RISC), signal processing algorithms, embedded software, and low-power/high-speed interface protocols — bridging hardware design and real-world product requirements in IoT, automotive, AI-at-the-edge, and wireless communication domains.

Program Outcomes

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PEO – Vision / Mission Mapping

S = Strong | M = Medium | L = Low

PEO \ V/M	Vision	ME 1	ME 2	ME 3	ME 4
PEO 1	S	S	M	M	L
PEO 2	S	M	S	M	M
PEO 3	M	M	L	S	M
PEO 4	M	M	M	M	S

TCE Proficiency Scale (CDIO Curriculum Framework)

TCE Proficiency Scale (TPS)	Proficiency	Cognitive	Affective	Psychomotor
TPS1	To have been exposed to	Remember	Receive	Perception, Set
TPS2	To be able to interpret and imitate	Understand	Respond	Guided Response
TPS3	To be skilled in the practice or implement	Apply	Value	Mechanism
TPS4	To be able to participate in and contribute	Analyse	Organise	Complex Overt Responses
TPS5	To be able to judge and adapt	Evaluate	Organise	Adaptation
TPS6	To be able to lead and innovate	Create	Characterize	Origination

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B. Tech. Electronics Engineering (VLSI Design and Technology) Degree Programme
CREDIT DISTRIBUTION

(For the students admitted from the Academic Year 2026-27 onwards)

Sl. No.	Category	Credits	
		Regular	**Lateral Entry**
A.	Humanities and Social Sciences including Management Courses (HSMC)	11	8
B.	Basic Science Courses (BSC)	22	6
C.	Engineering Science Courses (ESC)	23	12
D.	Program Core Courses (PCC)	75	62
E.	Program Elective Courses (PEC)	21	21
F.	Open Elective Courses (OEC)	6	6
G.	Employability Enhancement Courses (EEC)	16	16
H.	Internship and Mandatory Audit Courses (AC) as per Regulatory authorities (Non-Credit and not included in CGPA)	-	-
	Minimum Credits to be earned for the award of the Degree	**174**	**131**
		From A to G and the successful completion of H	

B.Tech. Electronics Engineering (VLSI Design and Technology)-scheduling of courses for students admitted from academic year 2026-27 onwards										
Sem	Theory / Theory cum Practical / Practical							CDIO Courses	Audit Courses	Credit
I	26MASA0 Applied Calculus for Engineers (BSC-4)	26PHSA0 Physics (BSC-3)	26EGHA0 Technical English (TCP) (HSMC-3)	26ELCA0 Electric and Magnetic Circuits PCC-**3**		26ELEA0 Python Programming (TCP) (ESC-3)	26PHSB0 Physics Laboratory (BSC-1.5)	26CCEA0 Introduction to Engineering (TCP) (ESC-2)	26TAAA0 Heritage of Tamils 26CCAA0 Vision and Speed Maths	19.5
II	26ELSA0 Linear Algebra and Numerical Techniques (BSC-3)	26CHSB0 Applied Chemistry (BSC-3)	26ELCB0 Digital Logic Design -3 26ELCC0 Semiconductor Manufacturing and Packaging – 3 26ELCD0 Network Analysis and Synthesis – 3 26ELCE0 Digital Logic Design Laboratory - 1 PCC-10		26CCEB0 Biology for Engineers (ESC-3)	26ELEB0 Electronic Devices (ESC-3)	26CHSC0 Chemistry Laboratory (BSC-1.5)		26TAAB0 Tamils and Technology 26CCAB0 Foundations of Problem Solving-1	23.5
III	26ELSB0 Probability, Statistics and Optimization (BSC-3)	26ELCF0 Analog Circuit Design – 3 26ELCG0 AI and ML for Engineers- 2 26ELCH0 Computer Architecture and Organization (TCP) – 3 26ELCJ0 Modelling and Synthesis with Verilog HDL- (TCP) –3 26ELCK0 Analog Circuit Design Laboratory – 1 PCC-12				26ELEC0 C programming (TCP) (ESC-3)	26CCLA0 Building Communication Skills (EEC-1)	26CCEC0 Design Thinking (ESC-3)	26CCAC0 Constitution of India (AC-0)	22
IV	26ELSC0 Discrete Mathematics (BSC-3)	26ELCL0 Digital CMOS VLSI Design – 3 26ELCM0 Signal Processing and Digital Communication-4 26ELCN0 Control Systems -4 26ELCP0 Linear Integrated Circuit (TCP) -3 26ELCQ0 ASIC & FPGA Design		26CCED0 Environment and Sustainability (ESC-3)		26EGHB0 Professional Communication Lab (HSMC-2)	26CCLB0 Numerical Skills and Quantitative Problem Solving (EEC-1)	Object Oriented Programming (TCP) (ESC-3)	26CCAD0 Indian Knowledge System (AC-0)	31

		Methodologies –(TCP)- 4 26EVCR0 Digital CMOS VLSI Design Laboratory – 1 PCC-19								
V	26CCHA0 Project Management (HSMC-3)	26ELCS0 Analog and Mixed Signal Circuit Design – 3 26ELCT0 Data Structures and Algorithms (TCP) – 3 26ELCU0 Embedded Systems-(TCP)-3 26ELCV0 Design Verification – 2 26ELCW0 Low Power VLSI Designs – 3 26ELCX0 Standard Design Elements and Protocols for VLSI- 3 26ELCY0 Analog and Mixed Signal Circuit Design Laboratory - 1 PCC-18					26CCLC0 Aptitude Skills (EEC-2)	Basic Science Elective / Language Elective (OEC-3)	26ELLA0 Project-I (EEC-3)	26CCAE0 Universal Human Values and Ethics (AC-0)	29
VI	26CCHB0 Accounting and Finance (HSMC-3)	26ELCZ0 CAD for VLSI – 3 26ELDA0 RISC-V Processor and SoC Design -3 26ELDB0 Design for Testability - 3 26ELDC0 High-Speed Signal Integrity & Interfaces – 3 26ELDD0 RISC-V Processor and SoC Design Lab -1 PCC-13					Interdisciplinary Elective (OEC-3)		26ELLB0 Project-II (EEC-3)	26CCAF0 Disaster Management (AC-0)	22
VII	PEC-1 (3)	PEC-2 (3)	PEC-3 (3)	PEC-4 (3)	PEC-5 (3)	PEC-6 (3)	PEC-7 (3)		26ELLC0 Project-III (EEC-3)		24
VIII									26ELLD0 Project-IV (EEC-3)		3
Total Credits											174

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B. E. Electronics Engineering (VLSI Design and Technology) DEGREE PROGRAMME
COURSES OF STUDY
(For the students admitted from the Academic Year 2026-27 onwards)

FIRST SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			Credits
			L	T	P	
THEORY						
26MASA0	Applied Calculus for Engineers	BSC	3	1	-	4
26PHSA0	Physics	BSC	3	-	-	3
26ELCA0	Electric and Magnetic Circuits	PCC	2	1	-	3
THEORY CUM PRACTICAL						
26EGHA0	Technical English	HSMC	2	-	2	3
26ELEA0	Python Programming	ESC	2	-	2	3
26CCEA0	Introduction to Engineering	ESC	1	-	2	2
PRACTICAL						
26PHSB0	Physics Laboratory	BSC	-	-	3	1.5
AUDIT COURSE						
26TAAA0	Heritage of Tamils	AC	1	-	-	0
26CCAA0	Vision and Speed Maths	AC	-	-	2	0
Total						**19.5**

SECOND SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			Credits
			L	T	P	
THEORY						
26ELSA0	Linear Algebra and Numerical Techniques	BSC	2	1	-	3
26CHSB0	Applied Chemistry	BSC	3	-	-	3
26ELCB0	Digital Logic Design	PCC	3	-	-	3
26ELCC0	Semiconductor Manufacturing and Packaging	PCC	3	-	-	3
26ELCD0	Network Analysis and Synthesis	PCC	3	-	-	3
26CCEB0	Biology for Engineers	ESC	3	-	-	3
26ELEB0	Electronic Devices	ESC	3	-	-	3
THEORY CUM PRACTICAL						
-	-	-	-			-
PRACTICAL						
26ELCE0	Digital Logic Design Laboratory	PCC	-	-	2	1
26CHSC0	Chemistry Laboratory	BSC	-	-	3	1.5
AUDIT COURSE						
26TAAB0	Tamils and Technology	AC	-	-	1	0
26CCAB0	Foundations of Problem Solving-I	AC	-	-	1	0
Total						**23.5**

L : Lecture - 1 Hour Lecture is equivalent to 1 credit
T : Tutorial - 1 Hour Tutorial is equivalent to 1 credit
P : Practical - 1 Hours Practical is equivalent to 0.5 credit

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E Degree (ELECTRONICS AND COMMUNICATION)
Program SCHEME OF EXAMINATIONS
(For the candidates admitted from 2026-27 onwards)

FIRST SEMESTER

Course code	Name of the Course	Duration of End Semester Exam\ in Hrs.	Marks			Min. Marks for Pass	
			Continuous Assessment	Terminal Exam	Max. Marks	Terminal Exam	Total
THEORY							
26MASA0	Applied Calculus for Engineers	3	40	60	100	27	50
26PHSA0	Physics	3	40	60	100	27	50
26ELCA0	Electric and Magnetic Circuits	3	40	60	100	27	50
THEORY CUM PRACTICAL							
26EGHA0	Technical English	3	50	50	100	22.5	50
26ELEA0	Python Programming	3	50	50	100	22.5	50
26CCEA0	Introduction to Engineering	3	50	50	100	22.5	50
PRACTICAL							
26PHSB0	Physics Laboratory	3	60	40	100	18	50

SECOND SEMESTER

Course code	Name of the Course	Duration of End Semester Exam\ in Hrs.	Marks			Min. Marks for Pass	
			Continuous Assessment	Terminal Exam	Max. Marks	Terminal Exam	Total
THEORY							
26ELSA0	Linear Algebra and Numerical Techniques	3	40	60	100	27	50
26CHSB0	Applied Chemistry	3	40	60	100	27	50
26ELCB0	Digital Logic Design	3	40	60	100	27	50
26ELCC0	Semiconductor Manufacturing and Packaging	3	40	60	100	27	50
26ELCD0	Network Analysis and Synthesis	3	40	60	100	27	50
26CCEB0	Biology for Engineers	3	40	60	100	27	50
26ELEB0	Electronic Devices	3	40	60	100	27	50
PRACTICAL							
26ELCE0	Digital Logic Design Laboratory	3	60	40	100	18	50
26CHSC0	Chemistry Laboratory	3	60	40	100	18	50

CURRICULUM AND DETAILED SYLLABI

FOR

B. E. DEGREE PROGRAMME
(Electronics and Communication Engineering)

FIRST SEMESTER

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2026-27

THIAGARAJAR COLLEGE OF ENGINEERING
(A Government Aided Autonomous Institution Affiliated to Anna University)
MADURAI – 625 015, TAMILNADU

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26MASA0	APPLIED CALCULUS FOR ENGINEERS	Category	L	T	P	Credit
		BSC	3	1	0	4

1. Preamble

Applied calculus addresses the fundamental concepts of single and multivariable calculus with emphasis on engineering applications and problem solving. Focuses on modeling and analysis of engineering systems through derivatives and integrals. Develops analytical skills to analyze and solve real-world systems using derivatives and multiple integrals.

2. Prerequisite

- Nil

3. Course Outcome

After the successful completion of the course, students will be able to:

CO	Course Outcomes	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Use functions, limits, continuity, and derivatives to solve mathematical and technical problems.	TPS3	1.1.1	18%	SDG4	2
CO2	Apply derivatives to determine extrema and characterize behavior of single variable functions.	TPS3	1.1.1	18%	SDG4	2
CO3	Compute partial derivatives to determine extrema of multivariable functions.	TPS3	1.1.1	18%	SDG4	2
CO4	Apply techniques of double integrals to compute areas and volumes of bounded regions.	TPS3	1.1.1	16%	SDG4	2
CO5	Apply double integrals to determine physical quantities such as density,mass, moments, center of mass, and moments of inertia and Surface Area.	TPS3	1.1.1	12%	SDG4	2
CO6	Compute volumes using triple integrals in Cartesian, Cylindrical, and Spherical coordinates.	TPS3	1.1.1	18%	SDG4	2

4.Assessment Pattern

CO	CAT1	Assignment 1	CAT2	Assignment 2	Terminal Exam
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	33	33			18
CO2	33	33			18
CO3	34	34			18
CO4			38	38	16
CO5			24	24	12
CO6			38	38	18
Total	100	100	100	100	100

Activities are given for self-study using mathematical software. They can be tested through open ended assignments.

5.Syllabus

Foundations of Differential Calculus: New functions from old functions - Limit of a function and Continuity of a function - Limits at infinity - Derivative as a function.

Activities: Visualization of the functions, model and solve scientific and engineering phenomena using concept of function, limits, continuity, intermediate value theorem and derivatives. Solving Competitive Examination problems with emphasis to GATE

Applications of Differential Calculus: Maxima and Minima of functions of single variable - The Mean value theorem - Effect of derivatives on the shape of the graph of a function.

Activities: Model and solve scientific, engineering phenomena using concept of Maxima and Minima of a function, Rolle's Theorem and mean value theorem and derivatives. Solve Competitive Examination problems with emphasis to GATE

Partial Derivatives and its Applications: Partial derivatives - Chain rule - Maxima and minima of functions of two variables - Method of Lagrange's Multipliers for function with single constraint.

Activities: Model and solve scientific, engineering phenomena using concept Partial derivatives, Chain rule, Maxima and minima of functions of two variables, Method of Lagrange's Multipliers. Solve Competitive Examination problems with emphasis to GATE.

Double Integrals and its Applications: Iterated integrals and Fubini's theorem - Double integrals over general regions - Changing the order of integration - Properties of double integrals - Double integrals in polar coordinates – Applications of double integrals (Density, Mass, Moments & Moments of Inertia problems only) - Surface area.

Activities: Using the concept of Double integrals, model and solve scientific, engineering phenomena. Solve Competitive Examination problems with emphasis to GATE

Triple Integrals and its Applications: Triple integrals over rectangular boxes - Triple integrals over general regions - Triple integrals in cylindrical coordinates - Triple integrals in spherical coordinates.

Activities: Model and solve scientific, engineering phenomena using concept of Triple integrals in Cartesian, cylindrical and spherical coordinates. Solve Competitive Examination problems with emphasis to GATE.

6. Learning Resources

6.1 Text Book

1) James Stewart, Daniel Clegg and Saleem Watson, "Calculus Early Transcendentals", 9th edition, Cengage Learning, New Delhi, 2019.
   Foundations of Differential Calculus: [1.3, 2.2, 2.5, 2.6, 2.8]
   Applications of Differential Calculus: [4.1, 4.2, 4.3]
   Partial Derivatives and its Applications: [14.3, 14.5, 14.7, 14.8]
   Double Integrals and its Applications: [15.1, 15.2, 15.3, 15.4, 15.5]
   Triple Integrals and its Applications: [15.6, 15.7, 15.8]

6.2 Reference Books & Web Resources

1) George B. Thomas, "Thomas Calculus: Early Transcendentals", 14th Edition, Pearson Publishers, New Delhi, 2018.
2) Howard Anton, Irl Bivens and Stephen Davis, "Calculus: Early Transcendentals",12thedition, John Wiley & Sons, 2021.
3) Kuldeep Singh, "Engineering Mathematics Through Applications", 2nd edition, Blooms berry publishing, 2019,
4) Kuldip S. Rattan, Nathan W. Klingbeil, Craig M. Baudendistel, "Introductory Mathematics for Engineering Applications", 2nd edition, John Wiley& Sons, 2021.
5) Ron Larson and David C. Falvo, "Calculus: an Applied Approach". 10th edition Cengage Learning 2015.
6) https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ma79
7) https://ocw.mit.edu/courses/18-01-calculus-i-single-variable-calculus-fall-2020/
8) https://in.mathworks.com/matlabcentral/fileexchange/?q=calculus+applications

7. Course Contents and Lecture Schedule

Module No.	Topic	Periods
1	**Foundations of Differential Calculus**	
1.1	New functions from old functions	1
1.2	The Limit of a function	1
1.3	Continuity of a function	1
	Tutorial	1
1.4	Limits at infinity	1
1.5	The Derivative as a function	2
	Tutorial	1
2	**Applications of Differential Calculus**	
2.1	Maxima and Minima of functions of single variable	3
	Tutorial	1
2.2	The Mean value theorem	1
2.3	Effect of derivatives on the shape of a graph of a function	2
	Tutorial	1
3	**Partial Derivatives and its Applications**	
3.1	Partial derivatives	1
3.2	Chain rule	2
	Tutorial	1

3.3	Maxima and minima of functions of two variables	1
3.4	Method of Lagrange's Multipliers for function with single constraint	2
	Tutorial	1
4	**Double Integrals**	
4.1	Iterated integrals and Fubini's theorem	1
4.2	Double integrals over general regions	2
	Tutorial	1
4.3	Changing the order of integration	2
4.4	Properties of double integrals (without proof), Change of Variables from Cartesian to Polar Coordinates	1
	Tutorial	1
4.5	Double Integrals in Polar coordinates	1
4.6	Applications of double integrals (Density, Mass, Moments)	1
4.7	Applications of double integrals (Moments of Inertia)	1
	Tutorial	1
4.8	Surface area	2
5	**Triple Integrals**	
5.1	Triple integrals over Rectangular Boxes	1
	Tutorial	1
5.2	Triple integrals over general regions	2
5.3	Change of Variables from Cartesian to Cylindrical and Spherical Coordinates	1
	Tutorial	1
5.4	Triple integrals in cylindrical coordinates	2
5.5	Triple integrals in spherical coordinates	1
	Tutorial	1
	Total	**48**

8.Course Designer(s):

1. Dr. B. Vellaikannan, Professor, Dept. of Mathematics, bvkmat@tce.edu
2. Dr. C. S.Senthilkumar , Assistant Professor, Dept. of Mathematics, kumarstays@tce.edu
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5. Dr. S. Saravanakumar, Assistant Professor, Dept. of Mathematics, sskmat@tce.edu
6. Dr. P. Balamanikandan, Assistant Professor, Dept. of Mathematics, pbmmat@tce.edu
7. Dr. Pradnya Gaonkar, Senior customer success engineer, math works pgaonkar@mathworks.com

26PHSA0	PHYSICS (COMMON TO ALL BRANCHES)

Category*	L	T	P	Credit
BSC	2	1	0	3

1. Preamble

Physics provides a strong foundation in classical and modern physics, including mechanics, wave phenomena, electrodynamics, electronic materials, and quantum theory, relevant to engineering applications. This course connects fundamental principles with modern technologies such as solar cells, electric vehicles, MRI scanners, scanning tunneling microscopes, and emerging quantum technologies.

2. Prerequisite

Physics and Mathematics at Higher Secondary Level (Class XII)

3. Course Outcomes

After the successful completion of the course, students will be able to:

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Apply the principles of mechanics of solids, including the work-energy theorem, central forces, conservation of angular momentum, and coordinate transformations, to solve problems on satellite maneuvers.	TPS3	1.2.1	15	SDG 9	1
CO2	Apply the equations of oscillatory and wave motion to solve problems on damped and forced oscillations, Q factor, impedance matching, phase and group velocity, and dispersive wave phenomena.	TPS3	1.2.1	15	SDG 11	1
CO3	Apply Maxwell's equations and Poynting's theorem to solve problems on electromagnetic wave propagation, polarization, and energy-momentum transport in vacuum and conducting media.	TPS3	1.2.1	18	SDG 3	1
CO4	Apply band theory, carrier transport equations, and Fermi level concepts to compute carrier concentration and solve problems related to the operation of solar cells, batteries, supercapacitors, and EV materials.	TPS3	1.2.1	18	SDG 7	2
CO5	Apply the Schrodinger wave equation and quantum mechanical principles to solve	TPS3	1.2.1	17	SDG 4	0

	problems on a particle in a 1D box, a quantum harmonic oscillator, and tunneling as realized in the scanning tunneling microscope.					
CO6	Apply the principles of superposition, entanglement, and quantum logic gates to solve problems, illustrating the fundamental operational differences between classical and quantum computing using qubit representations.	TPS3	1.4.1	17	SDG 9	1

4. Assessment Pattern

CO	CAT1	Assignment 1	CAT2	Assignment 2	Terminal Exam
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	35	35	—	—	15
CO2	35	35	—	—	15
CO3	30	30	—	—	18
CO4	—	—	35	35	18
CO5	—	—	35	35	17
CO6	—	—	30	30	17
Total	**100**	**100**	**100**	**100**	**100**

Note: CO-wise assessment must align with CO weightage.

5. Syllabus

Module 1: Mechanics of Solids (6 hrs)
Scalars and Vectors Under Rotation Transformation – Work-Energy Theorem – Central Forces – Energy in Conservative and Non-Conservative Forces – Conservation of Angular Momentum – Coordinate Systems: Cartesian, Polar, Cylindrical – Satellite Maneuvers.

Module 2: Oscillations and Waves (6 hrs)
Oscillatory Motion – Damped Oscillations – Forced Oscillations (Qualitative only): Differential Equation and its Solution – Q Factor – Impedance Matching – Group Velocity and Phase Velocity – Non-Dispersive Transverse and Longitudinal Waves in a String – Dispersive Waves – Seismic Waves – Water Waves and Tsunamis.

Module 3: Electrodynamics (6 hrs)
Maxwell's Equations of Electromagnetism – Equation of Continuity – Poynting's Theorem – Electromagnetic Waves – Polarization – EM Waves in Vacuum and Conductors – Energy and Momentum in EM Waves – Application: CT/MRI Scan.

Module 4: Physics of Electronic Materials (6 hrs)
Band Theory of Solids – Kronig-Penney Model (Qualitative only) – Bloch's Theorem – Intrinsic and Extrinsic Semiconductors – Carrier Concentration and Fermi Level – Electron and Hole Transport – Solar Cells – Charge Storage in Batteries and Supercapacitors – Materials for Electric Vehicles (EV) – 2D Materials, Flexible Electronic Materials, and Quantum Materials.

pModule 5: Quantum Mechanics (6 hrs)
Wave Nature of Particles – Wave Function – Expectation Values – Schrodinger Wave Equations – Uncertainty Principle – Particle in a 1D Box – Quantum Harmonic Oscillator – Quantum Tunnelling (Qualitative only) – Scanning Tunneling Microscope.

Module 6: Quantum Computing (6 hrs)
Quantum Computing – Classical and Quantum Computing: Key Differences – Bloch Sphere Representation of Qubits – Types of Qubits – Superposition – Quantum Entanglement – Quantum Logic Gates.

6. Learning Resources

6.1 Text Book

1. H. D. Young and R. A. Freedman, "University Physics with Modern Physics", Pearson Education, 15th Edition, 2023.
2. D. J. Griffiths, "Introduction to Electrodynamics", Cambridge University Press, 4th Edition, 2017.
3. M. Mahendran, M. Tamilelakkiya, S. Karthickprabhu, P. Sivakumar, “Engineering Physics” , Shanlax Publications, 1st edition, 2026.

6.2 Reference Books & Web resources

1. S. O. Pillai, "Solid State Physics", New Age International Publishers, 8th Edition, 2018.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.
3. R. P. Feynman, R. B. Leighton and M. Sands, "The Feynman Lectures on Physics – Vol. I, II & III", Addison-Wesley, 2011.
4. NPTEL Course: "Engineering Physics" – https://nptel.ac.in
5. MIT OpenCourseWare: "Physics II: Electricity and Magnetism" – https://ocw.mit.edu

7. Course Contents and Lecture Schedule

Module	Topics	Periods
1	Scalars and Vectors Under Rotation Transformation	1
	Work-Energy Theorem; Central Forces	1
	Energy in Conservative and Non-Conservative Forces; Conservation of Angular Momentum	1
	Coordinate Systems: Cartesian, Polar, Cylindrical	2
	Satellite Maneuvers	1
2	Oscillatory Motion; Damped Oscillations	1
	Forced Oscillations – Differential Equation and Solution; Q Factor; Impedance Matching	2
	Group Velocity and Phase Velocity; Non-Dispersive Waves in a String	1
	Dispersive Waves; Seismic Waves; Water Waves and Tsunamis	2
3	Maxwell's Equations, Equation of Continuity	2
	Poynting's Theorem; Electromagnetic Waves; Polarization	1

	EM Waves in Vacuum and Conductors; Energy and Momentum in EM Waves	2
	Application: CT/MRI Scan	1
4	Band Theory of Solids; Kronig-Penney Model (Qualitative); Bloch's Theorem	1
	Intrinsic and Extrinsic Semiconductors; Carrier Concentration and Fermi Level	2
	Electron and Hole Transport; Solar Cells	1
	Charge Storage in Batteries and Supercapacitors; EV Materials, Flexible Electronic Materials, 2D and Quantum Materials	1
5	Wave Nature of Particles; Wave Function; Expectation Values	1
	Schrodinger Wave Equation (Time-dependent and Time-independent)	2
	Uncertainty Principle; Particle in a 1D Box	2
	Quantum Harmonic Oscillator; Quantum Tunnelling (Qualitative); Scanning Tunneling Microscope	1
6	Classical vs Quantum Computing: Qubit – Definition and Types	1
	Bloch Sphere Representation; Superposition	2
	Quantum Entanglement; Quantum Logic Gates	2
	Case Study: Quantum Computing Applications	1
	Total Periods	36

SDG-Aligned Academic Activities

CO	SDG	Activity	Linkage to Module	TPS	Level
CO1	SDG 9	Compute orbital velocity, period, and energy for a satellite executing a Hohmann transfer between circular orbits using conservation of angular momentum and the work-energy theorem.	Module 1 – Satellite Maneuvers	TPS 3	1
CO2	SDG 11	Use the forced-oscillation model to compute the resonant frequency and Q-factor for a seismic sensor and relate impedance matching to signal fidelity in earthquake early-warning systems.	Module 2 – Forced Oscillations, Seismic Waves	TPS 3	1

CO3	SDG 3	Apply Poynting's theorem to compute the power density of EM waves used in MRI and CT imaging and use polarization principles to explain contrast differentiation in medical scans.	Module 3 – Poynting's Theorem, CT/MRI Scan	TPS 3	1
CO4	SDG 7	Compute the efficiency of a p-n junction solar cell using given carrier concentration and Fermi level data and solve charge storage problems for a supercapacitor in an EV energy management scenario.	Module 4 – Solar Cells, EV Materials, Supercapacitors	TPS 3	2
CO5	SDG 4	Solve the particle-in-a-1D-box problem for a quantum dot of given dimensions, compute allowed energy levels and use the tunneling probability formula to explain STM tip-sample distance sensitivity.	Module 5 – Particle in 1D Box, Quantum Tunnelling, STM	TPS 3	0
CO6	SDG 9	Apply Hadamard and CNOT gate matrices to given qubit input states, trace the state on the Bloch sphere, and demonstrate the creation of entangled Bell states using quantum logic gate sequences.	Module 6 – Quantum Logic Gates, Entanglement	TPS 3	1

8.Course Designer(s):

Dr. M. Mahendran manickam-mahendran@tce.edu
Dr. M. Tamilelakkiya mtphy@tce.edu
Dr. S. Karthickprabhu skphy@tce.edu

26ELCA0	ELECTRIC AND MAGNETIC CIRCUITS	Category	L	T	P	Credits
		PCC	2	1	0	3

Preamble

This course introduces basic electrical circuit concepts, including voltage, current, power, and Kirchhoff's laws. It covers DC and AC circuit analysis using network theorems and phasor techniques, along with time-domain analysis of first-order RL and RC circuits. The course also includes resonance and an introduction to magnetically coupled circuits and transformers.

Prerequisite

NIL

Course Outcomes

After the successful completion of the course, students will be able to:

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Apply fundamental electrical quantities and circuit laws (KCL, KVL) to DC circuits.	TPS3	1.2.1	10	SDG 9	2
CO2	Solve DC circuits using Node and Mesh analysis	TPS3	1.3.1	10	SDG 9	2
CO3	Apply network theorems to simplify electrical circuits.	TPS3	1.3.2	20	SDG 9	2
CO4	Demonstrate phasor representation and impedance concepts to AC circuits and compute power parameters.	TPS3	2.1.1	20	SDG 9	2
CO5	Apply transient analysis techniques to determine the response of RL and RC circuits with initial conditions.	TPS3	3.1.2	20	SDG 9	2
CO6	Apply resonance and coupled circuit concepts to analyze frequency response and magnetically coupled networks.	TPS3	5.1.1	20	SDG 9	2

Assessment Pattern

CO	CAT1	Assignment 1	CAT2	Assignment 2	Terminal Exam
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	30	30			10
CO2	30	30			10
CO3	40	40			20
CO4			30	30	20
CO5			30	30	20
CO6			40	40	20
Total	**100**	**100**	**100**	**100**	**100**

Syllabus

Basic electrical quantities: Charge – current – voltage – power - Independent and dependent sources - Ohm's law - Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) - Series and parallel circuits; Voltage and current divider rules.

Solution Methods:

Node voltage method - Mesh current method - Supernode and supermesh analysis - Systematic formulation and solution of circuit equations for DC networks.

Network Theorems:

Source transformation - Superposition theorem - Thévenin's and Norton's equivalent circuits - Maximum power transfer theorem - Δ–Y and Y–Δ transformations - Simplification of complex networks using theorems.

AC Analysis:

Sinusoidal signals and phasor representation - Complex impedance of R, L and C elements - Analysis of RL, RC and RLC series and parallel circuits - Active, reactive and apparent power - Power factor - Basic introduction to three-phase systems.

Transient Analysis:

Analysis of first-order RL and RC circuits using differential equation approach - Determination of initial and steady-state conditions - Natural and forced responses - Time constant and transient behavior under DC excitation - Evaluation of current and voltage responses

Resonance:

Series and parallel resonance - Resonant frequency - Quality factor bandwidth and half-power frequencies

Magnetic Circuits:

Mutual inductance and coefficient of coupling - Dot convention - Energy considerations - Basic analysis of coupled circuits - Ideal transformer and impedance matching (introductory level).

6. Learning Resources

6.1 Text Book

- Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, 10th Edition, McGraw Hill, 2025.
- Fundamentals of Electric Circuits, Charles K. Alexander and Matthew N. O. Sadiku, Fundamentals of Electric Circuits, 7th Edition, McGraw Hill, 2022.

6.2 Reference Books & Web resources

- Abhijit Chakrabarthi, Sudipta Debnath, chandan kumar chanda, "Basic Electrical Engineering", 2nd edition, Mcgraw Hill, 2021
- Electric Circuits, James W. Nilsson and Susan Riedel, Electric Circuits, 11th Edition, Pearson Education, 2019.
- Circuits and Networks: Analysis and Synthesis, A. Sudhakar and Shyammohan S. Palli, Circuits and Networks: Analysis and Synthesis, 6th Edition, McGraw Hill, 2025.

NPTEL Courses

A Basic Course on Electric and Magnetic Circuits; Prof. Ashok Kumar Pradhan; IIT Kharagpur;

- Basic Electrical Circuits ; By Prof. Gajendranath Chowdary|IIT Hyderabad
- Basic Electrical Circuits Nagendra Krishnapura ; IIT Madras

7. Course Contents and Lecture Schedule

Module No	Topics	No of Periods
1	**Basic electrical quantities:** charge, current, voltage, power, Independent and dependent sources	1
1	Ohm's law; Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL);	2
1	Series and parallel circuits; Voltage and current divider rules	2
2	**Solution Methods:** Node voltage method	1
2	Mesh current method	1
2	Supernode and supermesh analysis	2
2	Systematic formulation and solution of circuit equations for DC networks	1
3	**Network Theorems:** Source transformation; Superposition theorem	1
3	Thévenin's and Norton's equivalent circuits	2
3	Maximum power transfer theorem	1
3	Δ–Y and Y–Δ transformations	1
3	Simplification of complex networks using theorems	1
4	**AC Analysis:** Sinusoidal signals and phasor representation; Complex impedance of R, L and C elements	2
4	Analysis of RL, RC and RLC series and parallel circuits	2
4	Active, reactive and apparent power; Power factor	1
4	Basic introduction to three-phase systems	1
5	**Transient Analysis:** Analysis of first-order RL and RC circuits using differential equation approach	2
5	Determination of initial and steady-state conditions	2
5	Natural and forced responses	1
5	Time constant and transient behavior under DC excitation; Evaluation of current and voltage responses	2
6	**Resonance:** Series and parallel resonance	1
6	Resonant frequency; Quality factor bandwidth and half-power frequencies	2
7	**Magnetic Circuits:** Mutual inductance and coefficient of coupling	2
7	Dot convention; Energy considerations; Basic analysis of coupled circuits	1
7	Ideal transformer and impedance matching (introductory level).	1
Total Periods		**36**

8. Course Designer(s):

Dr. B. Sathya Bama, sbece@tce.edu

26EGHA0	TECHNICAL ENGLISH	CATEGORY	L	T	P	CREDITS	TE TYPE
		HSMC	2	0	2	3	TCP-T

1. Preamble

Technical English is a course that develops essential communication skills for academic and engineering professional contexts. The course integrates listening, speaking, reading, and writing through practical technical and workplace-based activities.

2. Prerequisite

Nil

3. Course Outcomes

After the successful completion of the course, students will be able to:

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Interpret technical texts, engineering manuals, and academic articles, extracting key information and inferring meaning from the context.	TPS3	9.1.1	20%	4	1
CO2	Use context-appropriate vocabulary and grammatical accuracy in technical writing including reports, Instructions, and graphical Interpretation.	TPS3	9.1.2	20%	4	1
CO3	Draft agendas, notices, and minutes of meetings in accordance with standard organizational formats and communication protocols.	TPS3	9.1.3	20%	5	1
CO4	Design effective technical presentation slides using visual clarity, proper formatting, and appropriate data representation techniques.	TPS3	9.2.2	20%	4	1
CO5	Apply professional and ethical communication practices in social media and workplace digital communication using proper netiquette and sentence construction.	TPS3	9.3.2	20%	11	1

4. Assessment Pattern

CO	Assessment 1						Assessment 2			Terminal (%)		
	Written Test 1 (%)			Assignment 1 (%)			Lab Activities					
TPS	1	2	3	1	2	3	1	2	3	1	2	3
CO1	-	-	20%	-			-	-	20%	-	-	20%
CO2	-	-	20%	50%			-	-	20%	-	-	20%
CO3	-	-	20%	-			-	-	20%	-	-	20%
CO4	-	-	20%	-			-	-	20%	-	-	20%
CO5	-	-	20%	50%			-	-	20%	-	-	20%
TOTAL	100%			100%					100%	100%		

5. Syllabus

Module1

Technical Reading and Vocabulary Development

Technical Reading Strategies – Skimming, Scanning, Intensive and Extensive Reading – Manuals - Academic Articles — Technical Word Families – Prefixes and Suffixes in Engineering Terminology – Collocations in Engineering Discourse – Inferring meaning from Context- Note-making, Summarising and Paraphrasing Technical Content.

Lab Activity: Listening files and Note-taking& Reading- based note making

Module 2

Editing, Analytical Reading and Ethical AI Communication Skills

Analytical Reading and Error Identification – Sentence clarity, cohesion and transition signals – Ethical use of AI in Writing and Communication – AI-assisted Editing and Summarising – Interpreting Charts, Graphs and Diagrams.

Lab Activity: Reading-based Editing Exercises – Picture/Chart Description Activity.

Module 3

Professional and Technical Workplace Communication

Formal Letters – Permission- Bona fide - Business Letters – Formats – Letters of Inquiry, Complaint, and Recommendation – Minutes of Meetings and Notices – Agenda preparation – Recording and Circulating Minutes – Action Items and Follow-up Communication.

Lab Activity: Listening to Audio files and Preparing Minutes

Module 4

Oral Communication and Interpersonal Skills

Question Forms and Question Tags- Spotting Errors- Types of Sentences- Oral Presentation Skills – Planning and Structuring a Technical Presentation – Designing effective Slides (visual clarity, data display) – Verbal and Non-verbal Communication – Handling Q&A Sessions.

Lab Activity: Digital Presentation, Spotting Errors

Module 5

Career Communication and Digital Professionalism

Social Media and Workplace Digital Communication – Professional Use of Platforms – etiquette – Data Privacy and Ethical Communication Practices – Environmental and SDG-aligned Communication- Jumbled Sentences.

Lab Activity: Presentation on SDG topics, Jumbled Sentences

6. Learning Resources

6.1 Text Book

1. **Sanjay Kumar and Pushplata,** "Communication Skills", 3rd Edition, Oxford University Press, 2021.
2. **M. Ashraf Rizvi,** "Effective Technical Communication", 2nd Edition, McGraw-Hill Education India, 2018.
3. **John M. Lannon and Laura J. Gurak,** "Technical Communication", 15th Edition, Pearson Education, 2020.

Department of English, Technical English Work Book, 1st Edition, New Century Book House (P) Ltd., Chennai.

6.2 Reference Books & Web resources

- Michael Markel and Stuart A. Selber, "Technical Communication", 12th Edition, Bedford/St. Martin's, 2018.
- Sharon J. Gerson and Steven M. Gerson, "Technical Writing: Process and Product", 8th Edition, Pearson, 2017.
- Adrian Wall work, "English for Writing Research Papers", 2nd Edition, Springer, 2016.
- AICTE Examination Reform Policy, November 2018 – https://www.aicte-india.org
- MIT Open Courseware – Technical Writing (21W.035): https://ocw.mit.edu
- NPTEL – Communication Skills (IIT Kharagpur): https://nptel.ac.in

7. Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1.	Technical Word Families, Prefixes/Suffixes	1
2.	Manuals and Academic Articles	1
3.	Collocations & Contextual Meanings	1
4.	Note-making, Summarising & Paraphrasing Technical Content	1
5.	Note-taking & Reading-based Note-making	1
6.	Analytical Reading and Error Identification	1
7.	Sentence Clarity, Cohesion and Transition Signals	1
8.	Ethical Use of AI in Writing and Communication	1
9.	AI-assisted Editing and Summarising	1
10.	Interpreting Charts, Graphs and Diagrams	1
11.	Reading-based Editing Exercises & Picture/Chart Description	1
12.	Formal Letters – Permission – Bona fide – Business Letter Formats	1
13.	Letters of Inquiry, Complaint and Recommendation	1
14.	Minutes of Meetings and Notices	1
15.	Agenda Preparation – Recording, Circulating Minutes & Follow-up Communication	1
16.	Preparing Minutes	1
17.	Question Forms, Question Tags, Spotting Errors & Types of Sentences	1
18.	Oral Presentation Skills – Planning and Structuring Technical Presentation	1
19.	Designing Effective Slides, Verbal & Non-verbal Communication, Handling Q&A	1

20.	Spotting Errors	1
21.	Social Media and Workplace Digital Communication	1
22.	Professional Use of Platforms, Netiquette & Data Privacy	1
23.	Environmental and SDG-aligned Communication & Ethical Practices	1
24.	Professional Use of Platforms & etiquette	1
Total		**24**

8. Course Contents and Lab Schedule: 16 hours

1.	Listening-based Note-taking Exercises	2
2.	Reading-based Editing Exercises and Picture/Chart Description Activity.	2
3.	Preparing Minutes from Audio Files	2
4.	Jumbled sentence activities Exercises	2
5.	Presentation on SDG Topics	2
6.	Technical Presentation Practice	2
7.	Digital Presentation	2
8.	Model Exam	2
Total		**16**

9. Lab Assessment

S.No	Assessment Activity	Skills Assessed	Percentage (%)
1.	Listening to Technical Audio (CO1 – 20 marks)	Listening comprehension and acquisition of technical vocabulary	20%
2.	Spotting Errors (CO4 – 10 marks) and Reading Comprehension (CO5 - 20 marks)	Grammatical correctness, coherence, sentence organization and context understanding	30%
3.	Picture Description (CO2 – 20 marks)	Vocabulary, technical description and fluency	20%
4.	Minutes and Digital Presentation (CO3 – 20 marks, CO4 – 10 marks)	Communication skill, confidence and response to questions	30%

The course includes End Semester Theory Examination.

10. Course Designer(s):

1. Dr.S.Subash Assistant Professor, Department of English | ssheng@tce.edu
2. Dr.M.Arjunan, Assistant Professor, Department of English | maeng@tce.edu

26ELEA0	PYTHON PROGRAMMING	Category	L	T	P	Credits	TE Type
		ESC	2	0	2	3	TCP-P

Preamble

This course provides a practical knowledge on Python programming for solving real-world and engineering problems. Students will learn to develop programs using fundamental programming constructs such as data types, operators, conditional statements, and iterative loops. The course emphasizes modular programming through functions and scope management, along with the effective use of mutable data structures for technical applications. Learners will gain hands-on experience in file handling, exception handling, libraries and the development of robust applications.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

No.	Course Outcome	TCE Proficiency Scale	Performance Indicator	CO Weightage	SDG Addressed	SDG Level
CO1	Solve the given problem statement using programming concepts such as data types, operators, conditions and loops	TPS3	1.5.1 5.1.1	20	SDG 9	2
CO2	Use of functions and scoping in development of simple applications	TPS3	3.2.1	20	SDG 9	2
CO3	Use mutable structures for technical applications	TPS3	3.2.1	20	SDG 9	2
CO4	Use File I/O and exception handling in development of simple applications	TPS3	3.2.1	10	SDG 9	2
CO5	Use python libraries such as random, numpy, matplotlib, pandas in the development of applications	TPS3	3.2.1	10	SDG 9	2
CO6	Examine the given real-world problem to Implement, test and debug the solution using Python programming language	TPS3	4.1.1 5.3.1	20	SDG 4 SDG 9	2

Assessment Pattern

CO	Theory		Practical		Terminal Exam (Practical)
	CAT1	CAT2	OCR/Continuous Assessment	Model Test CO-wise	
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	30		20	20	100
CO2	30		20	20	
CO3	40		20	20	
CO4		30	20	10	
CO5		30	10	10	
CO6		40	10	20	
Total	100	100	100	100	

Assessment Pattern: Practical Component

Type of Assessment	Component	Marks	Remarks
Continuous Assessment	Pre-lab, In-lab, Post-lab	75	Conducted throughout the semester
Model Test	CO-wise (Cognitive, Psychomotor, Affective)	25	Rubrics covering all Domains of learning
Total Internal Marks		**100**	
End Semester Examination	CO-wise (Cognitive, Psychomotor, Affective)	100	Rubrics covering all Domains of learning

Syllabus

Basics: Python interpreter, variables, expressions, operators, assignments, Strings, control flow - conditionals, loops, simple console input and output.
Functions and Scoping: Function definition, Keyword Arguments and default values, Variable arguments, Scoping, Iterators and generators.
Structured Types and Mutability: Tuples, Ranges and Iterables, Arrays-Lists, Set, Dictionary, Higher order functions, Recursion and Global variables.
Files and Exceptions: Modules, Pre-defined packages, File handling -I/O System**,** File I/O, Read and Write operations, Exceptions - Control flow mechanisms.
Libraries: Exploring Data with Numpy, Pandas, Matplotlib**,** Tensor Flow, Keras.

Practical:

1. Implement programs using simple statements and expressions (exchange the values of two variables, distance between two points).
2. Implement programs using Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern).
3. Implement programs using Strings. (reverse, palindrome, character count, replacing characters).
4. Implement programs using Functions. (Factorial, largest number in a list, area of shape).
5. Implement programs using Functions/Method which operates on Tuples/List.
6. Implement programs using Functions/Method which operates on Dictionary.
7. Implement programs real-time/technical applications using File handling. (copy from one file to another, word count, longest word).
8. Implement real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
9. Implement programs using Python Standard Libraries (pandas, numpy and Matplotlib).

Text Book

- John V.Guttag, "Introduction to Computation and Programming Using Python: With Application to Understanding Data", Prentice-Hall International publishers, Second Edition, 2017

Reference Books & web resources

- R.G.Dromey, "How to solve it by Computers", Pearson Education India, First Edition, 2008.
- Martin C Brown, "Python-The Complete Reference", McGraw Hill, March 23, 2018
- Meenu Kohli, "Basic Core Python Programming", BPB Publications, First Edition, 2021.
- MIT Open Courseware
- SWAYAM/NPTEL Course on Joy of Computing using Python by Prof. Sudarshan Iyengar IIT Ropar.

SDG Alignment

Activities aligned with SDGs addressed:

1. SDG 4 - Apply programming concepts to solve scientific and engineering problem.
2. SDG 9 - Apply programming techniques to address real-world and engineering challenges, contributing to technological advancement and digital infrastructure. Promote innovation through the development of scalable and maintainable applications using modern programming practices.

Course Contents and Lecture Schedule

Module No	Topics	No of Periods	**Course Outcomes**
1	**Basics:** Python interpreter	1	CO1, CO6
1.1	Variables		CO1, CO6
1.2	Expressions		CO1, CO6
1.3	Operators	1	CO1, CO6
1.4	Assignments		CO1, CO6
1.5	Strings	1	CO1, CO6
1.6	Control flow		CO1, CO6
1.7	Conditionals	1	CO1, CO6
2	Loops		CO1, CO6
2.1	Simple console input and output		CO1, CO6
2.2	**Functions and Scoping:**	2	CO2, CO6
2.3	Function definition		CO2, CO6
2.4	Keyword Arguments and default values		CO2, CO6
2.5	Variable arguments	1	CO2, CO6
2.6	Scoping, Iterators and generators	2	CO2, CO6
2.7	**Structured Types and Mutability:**	2	CO3, CO6
2.8	Tuples,		CO3, CO6
2.9	Ranges and Iterables		CO3, CO6
2.10	Arrays-Lists	1	CO3, CO6
2.11	Set	1	CO3, CO6
2.12	Dictionary		CO3, CO6
2.13	Higher order functions	1	CO3, CO6
2.14	Recursion and Global variables		CO3, CO6
3	**Files and Exceptions:**	1	CO4, CO6
3.1	Modules		CO4, CO6
3.2	Pre-defined packages		CO4, CO6
3.3	File handling -I/O System	1	CO4, CO6
3.4	File I/O		CO4, CO6
3.5	Read and Write operations	1	CO4, CO6
4	Exceptions - Control flow mechanisms	2	CO4, CO6
4.1	**Libraries:** Exploring Data with Numpy	1	CO5, CO6
4.2	Pandas,	1	CO5, CO6
4.3	Matplotlib	1	CO5, CO6
4.4	Tensor Flow	1	CO5, CO6
4.5	Keras	1	CO5, CO6
	Total Periods	**24**	

List of Experiments with CO Mapping

Sl. No.	Name of the Experiment	Level of Experiment	Objective(s)	COs Addressed
1.	Programs using simple statements and expressions	1	3-Experimentation	CO1, CO6
2.	Programs using Scientific problems using Conditionals and Iterative loops.	1	3-Experimentation	CO1, CO6
3.	Programs using Strings	1	3-Experimentation	CO2, CO6
4.	Programs using Functions	1	3-Experimentation	CO2, CO6
5.	Programs using Functions/Methods which operates on Tuples/List	1	3-Experimentation	CO3, CO4, CO6
6.	Programs using Functions/Method which operates on Dictionary	1	3-Experimentation	CO3, CO6
7.	Programs real-time/technical applications using File handling	1	3-Experimentation	CO4, CO6
8.	Implement real-time/technical applications using Exception handling	1	3-Experimentation	CO4 - CO6
9.	Programs using Python Standard Libraries (pandas and numpy, matplotlib)	1	3-Experimentation	CO5 - CO6

Course Designer(s):

Dr.R.A.Alaguraja, alaguraja@tce.edu
Dr.M.Senthilarasi, msiece@tce.edu

26CCEA0	INTRODUCTION TO ENGINEERING	Category	L	T	P	Credits	TE type
		ESC	1	0	2	2	TCP-P

1. Preamble

This course introduces first-year engineering students to the engineering profession, fundamental measurement techniques, and the design of simple functional systems. Through hands-on activities such as product teardown, instrument-based measurements, 3D modelling using TinkerCAD, data analysis with Excel, and team-based projects, students develop essential technical and professional skills. The course follows the CDIO (Conceive–Design–Implement–Operate) framework, fostering engineering thinking from the first semester. It also promotes awareness of engineering ethics, safety, sustainability, and the role of engineering in addressing societal challenges and the UN Sustainable Development Goals.

2. Prerequisite

Nil

3. Course Outcomes

On the successful completion of the course, students will be able to:

No.	Course Outcome	TCE Proficiency Scale	Performance Indicator	CO Weightage	SDG Addressed	SDG Level
CO1	Describe the engineering profession, major engineering disciplines, and the CDIO framework for product and system lifecycle.	TPS 2	1.1.1	15%	SDG 4	1
CO2	Decompose a product or engineering system into its functional components, sub-systems, and operational constraints using structured analysis.	TPS 3	1.2.1	20%	SDG 9	2
CO3	Apply data acquisition systems and computational tools (Excel / Python) to acquire, process, and interpret sensor data with appropriate uncertainty analysis.	TPS 3	5.2.1	20%	SDG 9	2
CO4	Implement and validate a simple engineering artefact/system by applying basic	TPS 3	4.4.1	20%	SDG 9	2

	engineering principles, tools, and teamwork.					
CO5	Demonstrate professional teamwork and technical communication competencies through a structured engineering report and oral presentation.	TPS 3	8.2.1	15%	SDG 4	2
CO6	Evaluate engineering solutions against criteria of professional ethics, occupational safety, and sustainable development, with reference to relevant SDGs.	TPS 4	7.2.1	10%	SDG 12, SDG 13	3

4. Assessment Pattern

CO	Theory		Practical		Terminal Exam (Practical)
	CAT1	CAT2	OCR/Continuous Assessment	Model Test CO-wise	
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1		**25**	**100**	**100**	100
CO2		**35**			
CO3		**30**			
CO4		**10**			
CO5					
CO6					
Total	-	100	100	100	100

5. Assessment Pattern: Practical Component

Type of Assessment	Component	Marks	Remarks
Continuous Assessment	Pre-lab, In-lab, Post-lab	75	Conducted throughout the semester
Model Test	CO-wise (Cognitive, Psychomotor, Affective)	25	Rubrics covering all Domains of learning
Total Internal Marks		**100**	
End Semester Examination	CO-wise (Cognitive, Psychomotor, Affective)	100	Rubrics covering all Domains of learning

6. Syllabus

Module 1: Engineering Around Us

What is engineering? – Major engineering disciplines – Engineering in everyday life – Engineering and society – Creativity and innovation – Engineering products and systems – Product observation and teardown activity.

Module 2: Engineering Measurements and Tools

SI units and engineering measurements – Measurement of dimensions and physical quantities using basic measuring instruments – Data recording – Accuracy, precision, and errors – Engineering estimation and reasoning – Safe use of engineering tools and instruments.

Module 3: Engineering Visualization and Simulation

Introduction to engineering drawings and visualization – Basic 2D and 3D concepts – Excel for tables and graph plotting – Introduction to ThinkerCAD – Simple 3D object creation – Basic circuit simulation.

Module 4: Engineering Making

Introduction to engineering materials – Basic fabrication techniques: cutting, joining, and assembling – Workshop safety practices – Introduction to sensors and automation concepts – Team-based engineering activity – Building a simple functional model.

Module 5: Teamwork, Ethics and Sustainability

Teamwork and collaboration – Basics of technical presentations – Engineering ethics and responsibilities – Engineering safety – Sustainability and SDGs in engineering – Engineering solutions for society.

7. Learning Resources

7.1 Text Books

1. Crawley, E., Malmqvist, J., Ostlund, S., Brodeur, D., "Rethinking Engineering Education: The CDIO Approach", Springer, 2014.
2. Eide, A., Jenison, R., Mashaw, L., Northup, L., "Introduction to Engineering Design and Problem Solving", McGraw-Hill, 3rd Edition.

7.2 Reference Books & Web Resources

1. CDIO Syllabus v3.0, Worldwide CDIO Initiative -- www.cdio.org (free download).
2. MIT Open Course Ware 2.00A: Introduction to Design -- ocw.mit.edu.
3. Python for Engineers: Google Colab notebooks (free, requires internet).
4. IEEE Engineering Ethics Resources -- www.ieee.org/ethics.

8. Course Contents and Lecture Schedule

Module No	Topics	No of Periods	**Course Outcomes**
Module 1:			
1.1	What is engineering? – Major engineering disciplines – Engineering in everyday life	2	CO1
1.2	Engineering and society – Creativity and innovation	1	CO1
1.3	Engineering products and systems – Product observation and teardown activity	1	CO1, CO2
2.1	SI units and engineering measurements – Measurement of physical quantities using basic instruments	1	CO3
2.2	Data recording – Accuracy, precision, and errors – Engineering estimation and reasoning	1	CO3

2.3	Safe use of engineering tools and instruments	1	CO3, CO6
3.1	Introduction to engineering drawings and visualization – Basic 2D and 3D concepts	1	CO2
3.2	Excel for tables and graph plotting – TinkerCAD: 3D object creation and basic circuit simulation	1	CO2, CO3
4.1	Introduction to engineering materials – Fabrication techniques: cutting, joining, assembling – Workshop safety	1	CO4, CO6
4.2	Sensors and automation concepts – Team-based engineering activity – Building a simple functional model	2	CO4
5.1	Teamwork and collaboration – Basics of technical presentations	1	CO5
5.2	Engineering ethics and responsibilities – Engineering safety	1	CO5, CO6
5.3	Sustainability and SDGs in engineering – Engineering solutions for society	1	CO5, CO6
Total (Hrs)		15	

9. List of Experiments with CO Mapping

Sl. No.	Name of the Experiment	Level of Experiment	Objective(s)	COs Addressed
1.	Product Teardown and Functional Analysis	Level 1	Obj. 3 – Experimentation	CO1, CO2, CO6
2.	Product Teardown and Design Improvement	Level 2	Obj. 5 – Design	CO1, CO2, CO4, CO6
3.	Measurement of Dimensions and Physical Quantities Using Basic Engineering Instruments.	Level 1	Obj. 1 – Instrumentation	CO3, CO6
4.	Design and Visualization of Basic 3D Geometric Objects Using TinkerCAD	Level 1	Obj. 5 – Design	CO2, CO3
5.	Design and Simulation of a Basic Electrical Circuit Using TinkerCAD	Level 2	Obj. 3 – Experimentation	CO2, CO3, CO4
6.	Data Tabulation and Graph Plotting Using Microsoft Excel	Level 1	Obj. 4 – Data Analysis	CO3
7.	Micro Project	Level 3	Obj. 5 – Design	CO2, CO4, CO5
8.	Case Study – Engineering Ethics and Responsibility	Level 2	Obj. 13 – Ethics & Integrity	CO5, CO6
9.	Technical Report Writing	Level 1	Obj. 11 – Communication	CO5

10. Course Designer(s):

- Dr. S. Baskar, Professor, EEE, and Dean (A&A), sbeee@tce.edu
- Dr. R. Rajan Prakash, Associate Professor, EEE, r_rajanprakash@tce.edu
- Dr. V. Balasubramani, Associate Professor, Mechanical, vbmech@tce.edu

26PHSB0	Physics Laboratory (Common to all branches)	Category	L	T	P	Credits
		BSC	0	0	3	1.5

Preamble

Physics Laboratory enables first-year engineering students to experimentally explore the concepts taught in the co-requisite theory course (26PHSA0) through carefully designed experiments in core areas of physics. The course develops practical skills in instrumentation, data analysis, model validation, teamwork, safety, and ethical scientific reporting. It also supports Sustainable Development Goals related to quality education, clean energy, innovation, and sustainable development.

Prerequisite

- Engineering Physics (26PHSA0) co-requisite
- Physics at the Higher Secondary (Class XII) level

Course Outcomes

On the successful completion of the course, students will be able to

COs	Course Outcome Statement	TCE Proficiency Scale	Performance Indicators	Objective	SDG Addressed	SDG Level
CO1	Operate laboratory instruments, including photo detectors, solar cell setups, and logic trainers, to measure physical quantities related to core physics experiments.	TPS 3	5.2.1	1	NC	-
CO2	Analyse deviations between theoretical predictions and experimental results in mechanics, electrodynamics, and quantum physics experiments.	TPS 4	2.3.1	2	NC	-
CO3	Evaluate experimental procedures for adequacy of controls, documentation standards, and reproducibility.	TPS 5	4.2.1	3	NC	-
CO4	Examine experimental data using statistical methods to quantify uncertainty and draw valid conclusions.	TPS 3	4.3.1	4	NC	-
CO5	Demonstrate practical skills in setting up and handling optical, mechanical, and electronic experimental systems.	TPS 3	5.2.1	6	NC	-
CO6	Prepare structured laboratory reports that present experimental methods, results, and conclusions in a professional manner, with due regard for ethical standards.	TPS 3	9.1.2	13	NC	-

Assessment Pattern: Cognitive Domain

Type of Assessment	Component	Marks	Remarks
Continuous Assessment	Pre-lab, In-lab, Post-lab	75	Conducted throughout the semester
Model Test	CO-wise (Cognitive, Psychomotor, Affective)	25	Mid/End semester internal test
Total Internal Marks		**100**	
End Semester Examination	CO-wise (Cognitive, Psychomotor, Affective)	100	As directed by COE or as per the curriculum

List of Experiments with CO Mapping

Sl. No.	Name of the Experiment	Level of Experiment	Objective(s)	COs Addressed
1	Determine the acceleration due to gravity (g) and the radius of gyration of a compound pendulum by studying its time period of oscillation.	1	1,2,3,4,13	CO1, CO2, CO3, CO4, CO6
2	Determine the resonant frequency, quality factor (Q), and bandwidth of an LCR series circuit by measuring the frequency response of current amplitude.	1	1,2,3,4,13	CO1, CO2, CO3, CO4, CO6
3	Determine the energy band gap (E_g) of a semiconductor material (Germanium or Silicon) by studying the variation of reverse saturation current with temperature.	1	1,2,3,4,13	CO1, CO2, CO3, CO4, CO6
4	Determine Planck's constant (h) using LEDs of different known wavelengths by measuring the threshold (knee) voltage for light emission.	1	1,2,3,4,6	CO1, CO2, CO3, CO4, CO5
5	Determine the frequency of AC supply using a sonometer and verify the laws of transverse vibrations of stretched strings.	1	1,2,3,4,6	CO1, CO2, CO3, CO4, CO5
6	Realise the Toffoli gate (CCNOT) using standard NAND, AND, and XOR logic gates, and verify its	2	1,3,13	CO1, CO3, CO6

	truth table, demonstrating reversibility and universality.			
7	Study the I-V characteristics of a silicon solar cell under illumination and determine it short-circuit current (Isc), open-circuit voltage (Voc), fill factor (FF), and photoelectric conversion efficiency (η).	1	1,2,3,4,13	CO1, CO2, CO3, CO4, CO6
8	Determine the magnetic field along the axis of a current-carrying circular coil and verify the Biot–Savart law.	1	1,2,3,4,13	CO1, CO2, CO3, CO4, CO6

Course Designer(s):

Dr. M. Mahendran manickam-mahendran@tce.edu
Dr. M. Tamilelakkiya mtphy@tce.edu
Dr. S. Karthickprabhu skphy@tce.edu

26TAAA0	HERITAGE OF TAMILS	Category	L	T	P	Credits
		Audit	1	0	0	0

1. Preamble

Tamil heritage represents a rich blend of culture, literature, art, science, ethics, and social values that have shaped Tamil civilization for centuries. It offers valuable insights into humanism, environmental harmony, indigenous knowledge systems, and inclusive social living. The timeless ideals reflected in Tamil literature and traditions help students develop cultural awareness, ethical responsibility, and global citizenship. This course enables learners to appreciate the contributions of the Tamils and understand the relevance of their heritage in the modern world

2. Prerequisite

NIL

3. Course Outcome:

On the successful completion of the course students will be able to

No	Course Outcome	TPS Level	PO Addressed	CO Weightage	SDG addressed	SDG Level
CO1	Explain the historical development of Tamil language and literature, including Sangam literature, Tamil epics, Bhakti movements, and modern literary contributions	TPS2	PO1 – M PO2 – L	20	SDG 4	1
CO2	Explain the significance of Tamil artistic traditions, temple architecture, handicrafts, musical instruments, and their role in preserving Tamil culture.	TPS2	PO1 – M PO2 – L	20	SDG 4	1
CO3	Illustrate the role of Tamil folk and martial art forms in promoting cultural values, community participation, and traditional knowledge.	TPS3	PO1 – S PO2 – M PO3 – L	20	SDG 4	1
CO4	Illustrate the relationship between Sangam literary concepts, socio-economic life, and the environmental and cultural practices of ancient Tamil society.	TPS3	PO1 – S PO2 – M PO3 – L	20	SDG 4	1
CO5	Illustrate the impact of Tamil cultural, literary, and social contributions on Indian society and heritage.	TPS3	PO1 – S PO2 – M PO3 – L	20	SDG 4	1

4. Assessment Pattern

CO	CAT 1	Assignment 1	CAT 2 (MCQ)	Assignment 2	Terminal Exam (MCQ)
	% of marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	-	-	10	10	10
CO2	-	-	10	10	10
CO3	-	-	20	20	20
CO4	-	-	30	30	30
CO5	-	-	30	30	30
Total	**-**	**-**	**100**	**100**	**100**

* The Terminal Examination and CAT-2 shall be conducted as a Multiple-Choice Question (MCQ) examination.

5. Syllabus

Module 1:
Language Families in India – Dravidian Language – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Management Principles in Thirukkural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bhakti Literature: Azhwars and Nayanmars – Forms of Minor Poetry – Development of Modern Literature in Tamil – Contribution of Bharathiyar and Bharathidasan.

Module 2:
Hero Stone to Modern Sculpture – Bronze Icons – Tribes and their Handicrafts – Art of Temple Car Making – Massive Terracotta Sculptures – Village Deities – Thiruvalluvar Statue at Kanyakumari – Making of Musical Instruments: Mridangam, Parai, Veenai, Yazh and Nadaswaram – Role of Temples in Social and Economic Life of Tamils.

Module 3:
Therukoothu, Karagattam, Villuppattu, Kaniyan Koothu, Oyilattam, Leather Puppetry, Silambattam, Valari, Tiger Dance – Sports and Games of Tamils.

Module 4:
Flora and Fauna of Tamils – Akam and Puram Concept from Tolkappiam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas.

Module 5:
Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the Other Parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous System of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

6. Learning Resources

- தமிழக வரலாறு - மக்களும் பண்பாடும் (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
- கணித் தமிழ் - முனைவர் இல சுந்தரம் (விகடன் பிரசுரம்)
- கீழடி - வைகை நதிக்கரையில் சங்ககால நாகரீகம் (தொல்லியல் துறை வெளியீடு)
- பொருநை ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு)
- Social Life of the Tamil – The Classical Period (Dr.K.K.Pillay) A joint publication of TNTB&ESC and RMRL – (inprint)
- Social Life of the Tamils- The Classical Period (Dr.S.Singaravelu) Published by: International Institute of TamilStuies.
- Historial Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu)) Published by: International Institute of TamilStuies.
- The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) Published by: International Institute of TamilStuies
- Keeladi – Sangam City Civilzation on the banks of river Vaigai (Jointly Published Department of Archaeology & Tamil Nadu Text Book and Educational Servics Corporation,Tamilnadu)
- Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillai, Publisher by The Author)

- Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Education Service Corporation, TamilNadu)
- Journey of Civization indus to Vaigai (R.Balakrishnan) Published by: RMRL – Reference Book

1. Course Contents and Lecture Schedule

Module No.	Topics	No. of Periods
1	**LANGUAGE AND LITERATURE**	
1.1	Language Families in india – Dravidean Language – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature	1
1.2	Management Principles in Thirukural – Tamil Epics and impact of Buddhism & jainesm in Tamil Land – Bakthi Literature Azhwar and Nayanmars	1
1.3	Forms of minor Poetry – Development of Modern Literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.	1
2	**HERITAGE – ROCK ART PAINTING TO MODERN ART – SUCLPUTRE**	
2.1	Hero Stone to Modern Sculputre – Bronze icons – tribes and their handicrafts – Art of Temples car making	1
2.2	Massive Terracotta Sculputres, Village deties, Thiruvalluvar State at Kanyakumari, Making of musical instruments	1
2.3	Mridhangam, Parai,Veenai, Yazh and Nadhaswaram-Role of Temples in Social and Economic Life of Tamils.	1
3	**FOLK AND MARTIAL ARTS**	
3.1	Therukoothu, Karagattam,Villu Pattu,	1
3.2	Kaniyan koothu,Oyillattam,Leather puppertry,	1
3.3	Silambattam,Valari,Tiger dance-Sports and Games of Tamils.	1
4	**THINAI COCEPT OF TAMILS**	
4.1	Flora and Fauna of Tamils &Aham and Puram Concept forTholkappiam and Sangam Litearture	1
4.2	Aram Concept of Tamils – Education and Literacy during Sangam Age	1
4.3	Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age- Overseas Conduest of Cholas.	1
5	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	
5.1	Contribution of Tamils TO Indian Freedom Struggle	1
5.2	The Cultural Influnence of Tamils over the other parts of India – Self – Respect Movement	1
5.3	Role of Siddha Medicine in Indigenous System of Medicine – Inscription & Manuscripts – Print History of Tamil Books	1
	Total	15

Course Designers:

Mr. M Babu.mbutce@tce.edu

26CCAA0	VISION and SPEED MATHS (Common to all Programmes)	Category	L	T	P	Credits
		AC	0	0	2	0

1. Preamble

This course inducts first-year students into the TCT Career Training (CT) framework. It combines a Vision induction — orientation, baseline online assessment, and group counseling — with WOWs, a structured Speed-Maths workshop that introduces mental-arithmetic methods. Together these elements build the motivation, baseline awareness, and computational fluency that support all subsequent CT courses.

2. Course Outcomes

After the successful completion of the course, students will be able to:

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage
CO1	Articulate personal and academic goals aligned with the CT programme objectives.	TPS3	2.1.1	20%
CO2	Assess baseline aptitude through diagnostic tests and identify focus areas for improvement.	TPS3	2.1.2	20%
CO3	Apply foundational mental-arithmetic methods (SAW, Oz, Mirror, High 5) to solve numeric problems.	TPS3	1.4.1	20%
CO4	Apply advanced WOWs methods (square/cube roots, Crisscross, Base multiplication) to multi-digit calculations.	TPS3	1.4.1	20%
CO5	Demonstrate computational speed and accuracy in time-bound aptitude challenges.	TPS4	2.4.1	20%

3. Assessment Pattern

CO	CAT1 (% of Marks)	CAT2 (% of Marks)	Terminal Exam (% of Marks)
CO1	50	—	10
CO2	50	—	10
CO3	—	50	20
CO4	—	50	20
CO5	—	—	40
Total	**100**	**100**	**100**

The assessment will be conducted by the Training Team, and the marks will be submitted by the respective faculty in charge.

4. Syllabus

Module 1: Vision — Orientation & Programme Overview

Programme overview – CT framework – Expectations and outcomes – Code of conduct

Module 2: Vision — Diagnostic Online Test

Baseline aptitude assessment – Section-wise diagnosis – Personal scorecard – Improvement plan

Module 3: Vision — Group Counseling & Career Mapping

Career exploration – Goal setting – Strengths / interests mapping – Sector overview – Action planning

Module 4: WOWs — Foundational Methods

SAW method – Oz method – Mirror method – High 5 method – Minion's method – King and Queen method – Square root and cube root – Butterfly method – Inception method

Module 5: WOWs — Advanced Methods

Cube of a number – Goldeneye method – Base multiplication – Crisscross method – Super power method – Cast away method

5. Learning Resources

5.1 Text Book

M. Tyra — "Magical Book on Quicker Maths", BSC Publishing.

5.2 Reference Books & Web Resources

1. Bhanu Prakash — "Quicker Maths", S. Chand Publishing.
2. Arun Sharma — "How to Prepare for Quantitative Aptitude", McGraw Hill.
3. TCT CT Internal Workshop Manual — Speed Maths (WOWs).

6. Course Designer(s)

1. Mr. S. A. R. Sheik Masthan, Asst. Professor, Mechatronics, sarsmech@tce.edu
2. Dr. R. Rajan Praksah, Associate Professor, EEE, r_rajanprakash@tce.edu

CURRICULUM AND DETAILED SYLLABI

FOR

B. E. DEGREE PROGRAMME
(Electronics and Communication Engineering)

SECOND SEMESTER

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2026-27

THIAGARAJAR COLLEGE OF ENGINEERING
(A Government Aided Autonomous Institution Affiliated to Anna University)
MADURAI – 625 015, TAMILNADU

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26ELSA0	LINEAR ALGEBRA AND NUMERICAL TECHNIQUES	Category	L	T	P	Credits
		BSC	2	1	0	3

1. Preamble

Linear Algebra and Numerical Techniques provide the essential mathematical tools needed in VLSI engineering. This course covers vector spaces, linear transformations, orthogonality, eigenvalue problems, and numerical methods for solving equations and performing computations. These topics directly support VLSI applications such as circuit analysis, signal processing, and device simulation.

2. Prerequisite

Nil

3. Course Outcomes

After the successful completion of the course, students will be able to:

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Apply the concepts of vector spaces to produce basis, dimension, row space, column space, null space.	TPS3	1.1.1	20%	SDG4	2
CO2	Apply linear transformations and matrix representations to solve problems involving mappings between vector spaces.	TPS3	1.1.1	10%	SDG4	2
CO3	Use the Gram-Schmidt process to construct an orthonormal basis.	TPS3	1.1.1	20%	SDG4	2
CO4	Use eigenvalues and eigenvectors to perform Singular Value Decomposition.	TPS3	1.1.1	20%	SDG4	2
CO5	Solve nonlinear equations and system of linear equations using numerical techniques.	TPS3	1.1.1	20%	SDG4	2
CO6	Compute numerical derivatives and definite integrals using numerical techniques.	TPS3	1.1.1	10%	SDG4	2

4. Assessment Pattern

CO	CAT1	Assignment 1	CAT2	Assignment 2	Terminal Exam
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	40%	40%	-	-	20
CO2	20%	20%	-	-	10
CO3	40%	40%	-	-	20
CO4	-	-	40%	40%	20
CO5	-	-	40%	40%	20
CO6	-	-	20%	20%	10
Total	100	100	100	100	100

5. Syllabus

Vector Spaces: Vector space - Definition and Examples – Subspaces - Linear independence - Basis and Dimension - Row space and Column space - Rank and Nullity theorem.

Linear Transformations: Definitions and Examples - Matrix Representations of Linear Transformations.

Orthogonality: Orthogonal Subspaces - Inner Product spaces - Orthonormal sets - Orthogonal Matrices -Gram-Schmidt process - QR Factorization.

Matrix Eigenvalue Problems: Eigenvalues and Eigenvectors – Diagonalization - Quadratic forms - Singular Value Decomposition.

Solution of Algebraic and Transcendental Equations: Solving non-linear equation: Iteration method - Newton Raphson method - Solving system of linear equations: Gauss Elimination method - Gauss Jacobi and Gauss–Seidel iterative methods.

Numerical Differentiation and Integration: Derivatives (at end points) using Newton's forward and backward difference formula - Trapezoidal rule - Simpson's one-third rule – Simpson's three-eight rules.

6. Learning Resources

6.1 Text Book

1 Steven J. Leon, "Linear Algebra with Applications", Pearson, 10th edition, 2021.
Vector Spaces: 3.1, 3.2, 3.3, 3.4, 3.6
Linear Transformations: 4.1, 4.2
Orthogonality: 5.2, 5.4, 5.5, 5.6
Matrix Eigenvalue Problems: 6.5

2 Erwin Kreszig, "Advanced Engineering Mathematics", John Wiley & Sons, Inc, 10th edition, 2011
Matrix Eigenvalue Problems: 8.1, 8.4

3 B. S. Grewal, "Numerical Methods in Engineering and Science: C, C++ and MATLAB", Mercury Learning and Information LLC, 1st edition, 2014.
Solution of Algebraic and Transcendental Equations: 2.11, 2.12, 3.4, 3.5
Numerical Differentiation and Integration: 8.1, 8.2, 8.4, 8.5

6.2 Reference Books & Web resources

1. David C. Lay, "Linear Algebra and its applications", Pearson Addison – Addison Wesley, 3rd edition, 2006.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2012.
3. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2018.
4. https://onlinecourses.nptel.ac.in/noc23_ma05/preview
5. https://onlinecourses.nptel.ac.in/noc21_ma45/preview

6. https://nptel.ac.in/courses/111108066
7. https://www.coursera.org/specializations/linear-algebra-elementary-to-advanced
8. https://www.coursera.org/specializations/mathematics-engineers

7. Course Contents and Lecture Schedule

Module No	Topics	No of Periods
1	**Vector Spaces**	
1.1	Vector space - Definition and Examples	1
1.2	Subspaces	1
	Tutorial	1
1.3	Linear independence	1
1.4	Basis and Dimension	1
	Tutorial	1
1.5	Row space and Column space, Rank and Nullity theorem	2
2	**Linear Transformations**	
2.1	Linear Transformations: Definitions and Examples	1
2.2	Matrix Representations of Linear Transformations	2
	Tutorial	1
3	**Orthogonality**	
3.1	Orthogonal Subspaces	1
3.2	Inner Product Space	1
	Tutorial	1
3.3	Orthonormal sets, Orthogonal Matrices	1
3.4	Gram-Schmidt process, QR Factorization	1
	Tutorial	1
4	**Matrix Eigenvalue Problems**	
4.1	Eigenvalues and Eigenvectors	1
4.2	Diagonalization	1
	Tutorial	1
4.3	Quadratic forms	1
4.4	Singular Value Decomposition	2
	Tutorial	1
5	**Solution of Algebraic and Transcendental Equations**	
5.1	Solving non-linear equations: Iteration method	1
5.2	Newton Raphson method	1
	Tutorial	1
5.3	Solving system of linear equations: Gauss Elimination method	1
5.4	Gauss Jacobi iterative method	1
	Tutorial	1
5.5	Gauss–Seidel iterative method	1
6	**Numerical Differentiation and Integration**	
6.1	Numerical Differentiation: Derivatives using Newton's forward and backward difference formula	1
	Tutorial	1
6.2	Numerical Integration: Trapezoidal rule - Simpson's rules	1
	Tutorial	1
	Total	36 Hrs

8. Course Designer(s):

- Dr. S. Suriyakala, Assistant Professor, Department of Mathematics, ssamat@tce.edu
- Dr. P. Krishnapriya, Assistant Professor, Department of Mathematics, pkamat@tce.edu
- Dr. K. Saravanakumar, Assistant Professor, Department of Mathematics, kskmat@tce.edu

		Category	L	T	P	Credit
26CHSB0	**APPLIED CHEMISTRY**	**BSC**	**3**	**0**	**0**	**3**

1. Preamble

This course equips students of circuit and computer branches with chemical principles underlying key engineering technologies. It covers water quality assessment and treatment, spectroscopic analytical techniques, electrochemical energy storage systems, and chemistry of advanced engineering materials.

2. Prerequisite

- Nil

3. Course Outcomes

After the successful completion of the course, students will be able to

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Explain water quality parameters and assessment techniques, including IOT based sensors, to assess water suitability for domestic, industrial, and boiler applications.	2	1.2.1	10	SDG 3 – Good Health and well-being SDG 6 - Clean water and sanitation	2
CO2	Apply standard estimation techniques, appropriate water treatment methods to select and justify solutions for boiler feed water preparation and industrial effluent treatment.	3	1.2.1	20	SDG 6 - Clean water and sanitation	2
CO3	Apply the principles and instrumentation of spectroscopic techniques to identify materials and interpret spectra for chemical, environmental, biomedical, and space applications.	3	1.2.1	20	SDG 3 – Good Health and well-being	2
CO4	Apply electrochemical principles to analyze energy storage systems and photovoltaic devices	3	1.2.1	16	SDG 7 – Affordable and Clean Energy	2

CO5	Use the concepts of corrosion mechanisms and surface protection techniques to select appropriate corrosion control measures for electronic devices.	3	1.2.1	14	SDG 9 – Industry, Innovation and Infrastructure	2
CO6	Apply structure–property relationships of ceramics, carbon-based nanomaterials to select suitable materials for specific applications.	3	1.2.1	20	SDG 9 - Industry, Innovation and Infrastructure SDG 12 – Responsible consumption	2

4. Assessment Pattern

CO	CAT1	Assignment 1	CAT2	Assignment 2	Terminal Exam
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	20				10
CO2	40	50			20
CO3	40	50			20
CO4			32	50	16
CO5			28		14
CO6			40	50	20
Total	100	100	100	100	100

5. Syllabus

Water: Water Quality parameters: Physical, Chemical, Biological- Alkalinity-Hardness of water: types-determination of hardness by EDTA method –Boiler trouble –- Softening of water: Internal and External treatment methods – Ion-Exchange method, Desalination process: reverse- and forward osmosis, electrodialysis, solar and multistage flash distillation, Advanced oxidation process for Effluent Treatment. IOT-based sensor for water quality monitoring. [10 hours]

Spectroscopic techniques and applications: Principle, instrumentation, and applications: UV–Visiblespectroscopy-Fluorescence-Inductively Coupled Plasma-Optical Emission, Infra-red-Nuclear magnetic resonance, Magnetic resonance imaging - Spectroscopy in automobile, environmental, biomedical & space applications. [8 hours]

Electrochemical technologies for energy storage and surface protection: Basics of electrochemistry – Batteries: Parameters, Primary -and Secondary batteries (Lead-acid, Lithium-ion, Sodium, Air-batteries, Redox-flow battery, Numerical Problems) –Fuel cells - Photovoltaics and its types, Numerical Problems. Hydrogen generation and storage. Corrosion of electronic devices: causes, effects, Electrochemical methods of corrosion analysis. Control measures -Electroplating-Electroless plating. [11 hours]

Chemistry of Engineering materials: Bonding and the properties of materials -Ceramics and advanced ceramics: types, properties, applications – Nano-materials: Synthesis, structure, properties and applications. Carbon based materials – Graphene, Carbon fibers -. Molecular electronics - Conducting polymers and organic semiconductors, Organic light-emitting devices (OLEDs), Applications in wearable and flexible electronics. [7 hours]

6. Text Book

1. P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, Dhanpat Rai publications, New Delhi,17th edition, 2018.

Reference Books& web resources

1. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry", S.Chand & Company,12th Edition, Reprint, 2022.
2. V. K. Ahluwalia, Instrumental Methods of Chemical Analysis, Springer Cham, 1st Edition, 2023.
3. T. Pradeep, *A Textbook of Nanoscience and Nanotechnology*, McGraw-Hill (Indian Edition), 2012
4. Organic Semiconductors - https://www.youtube.com/watch?v=q2fPrFay0A0&list=PL-WugosnKdMsy8abZQDVZWBNya2Opdklf

7. Course Contents and Lecture Schedule

Module No	Topics	No of Periods
1	**WATER**	
1.1	Importance of water, standards for drinking water, (WHO, BIS & ICMR standards) physical, chemical & biological characteristics, Alkalinity (principle only)	2
1.2	Hardness of water- types, units. Determination of hardness by EDTA method and numerical problems	2
1.3	Boiler trouble: Scale and sludge formation, Langelier saturation index, boiler corrosion, priming and foaming, caustic embrittlement	1
1.4	Internal treatment methods: Carbonate, Phosphate, Colloidal, Calgon conditioning	1
1.5	Softening of water: ion exchange process	1
1.6	External treatment method: Desalination-forward & reverse osmosis, electrodialysis, multistage flash distillation	1
1.7	Effluent Treatment -Advanced oxidation process. IOT-based sensor for water quality	1
2	**SPECTROSCOPIC TECHNIQUES AND APPLICATIONS**	
2.1	Introduction to Electromagnetic Radiation, Types of spectra	1
2.2	**Principle, Instrumentation and Applications:** UV–Visible spectroscopy	2
2.3	Fluorescence spectroscopy, Inductively Coupled Plasma-Optical Emission Spectroscopy	2
2.4	Infra-red spectroscopy	2
2.5	Nuclear magnetic resonance spectroscopy –Magnetic resonance imaging	1
2.6	Spectroscopy in environmental, biomedical & space applications	1
3	**ELECTROCHEMICAL TECHNOLOGIES FOR ENERGY STORAGE AND SURFACE PROTECTION**	
3.1	Electrochemistry-Introduction–Basics of electrochemistry–Redox process, EMF	1
3.2	Energy storage–Batteries, Battery quality parameters, Primary battery–Dry cell and Alkaline cell	1
3.3	Secondary battery–Lead-acid battery, Lithium-ion, Sodium, Air-	2

	batteries, Redox-flow battery, Numerical Problems	
3.4	P hotovoltaics and its types, Numerical Problems	1
3.5	Fuel cells– Fundamentals, types and applications. Hydrogen generation and storage	2
3.6	Corrosion of electronic devices: causes, effects, Electrochemical methods of corrosion analysis	2
3.7	Control measures - Electroplating–Introduction, Process, Applications (Gold and nickel plating). Electroless plating – Principle, process, Applications (PCB manufacturing)	2
4	**CHEMISTRY OF ENGINEERING MATERIALS**	
4.1	Bonding and the property of materials - melting point-brittleness, ductility–thermal, electrical, and ionic conductivity-magnetic - optical-hydrophobic, hydrophilic properties	2
4.2	Ceramics and advanced ceramics: types, properties, applications	2
4.3	Nanomaterials – Classification, Synthesis and properties	1
4.4	Carbon based materials - Synthesis, structure, properties, and applications of graphene, carbon fibers	1
4.5	Molecular electronics - Conducting polymers and organic semiconductors, Organic light-emitting devices (OLEDs), Applications in wearable and flexible electronics	1
	Total Periods	36

8. Course Designer(s):

1. Dr. V. Velkannan, Assistant Professor and Head (i/c), Chemistry velkannan@tce.edu
2. Dr. M. Velayudham, Assistant Professor, Chemistry mvchem@tce.edu
3. Dr. B. Shankar, Assistant Professor, Chemistry bsrchem@tce.edu
4. Dr. R. Sivakumar, Assistant Professor, Chemistry rsrchem@tce.edu
5. Dr. P. Ramkumar, Assistant Professor, Chemistry prrchem@tce.edu

26ELCB0	DIGITAL LOGIC DESIGN	Category	L	T	P	Credits
		PCC	2	1	0	3

1. Preamble

Digital systems form the foundation of modern electronic devices by processing information in binary form. This course provides students with hands-on training in the design and analysis of combinational and sequential logic circuits. It emphasizes the use of Hardware Description Language (HDL) for modelling, simulating, and implementing digital logic designs on standard integrated circuits, preparing students for real-world digital system applications.

2. Prerequisite

Nil

3. Course Outcomes

After the successful completion of the course, students will be able to:

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Explain the fundamentals of digital information systems and apply number system concepts in digital design	TPS2	1.3.1 1.6.1 1.7.1	10%	SDG 4	1
CO2	Apply Boolean algebra and graphical minimization techniques (K-Map, Quine-McCluskey) to simplify and optimize logic functions for efficient digital circuit implementation.	TPS3	1.7.1 2.8.1	10%	SDG 4	1
CO3	Design and implement combinational logic circuits using standard gate networks to meet given functional specifications	TPS3	3.5.1 3.6.1 3.6.1	24%	SDG 4 SDG 9	2
CO4	Design synchronous sequential circuits using state machine models (flip-flops, counters, registers) for a given specification,	TPS3	3.8.1 3.8.3	24%	SDG 4 SDG 9	2
CO5	Design asynchronous sequential circuits for a given specification using fundamental-mode analysis, primitive flow tables, merger diagrams, and race-free state assignment	TPS3	2.6.1 2.6.3	12%	SDG 4 SDG 9	2
CO6	Analyse sequential circuits using Moore and Mealy Finite State Machine (FSM) models to construct state diagrams, state tables, and output logic.	TPS4	2.7.1 2.7.2 3.7.1	20%	SDG 4 SDG 9	2

4. Assessment Pattern

CO	CAT1	Assignment 1	CAT2	Assignment 2	Terminal Exam
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	**20**	**20**	**-**	**-**	**5**
CO2	**30**	**30**	-	-	**15**
CO3	**50**	**50**	**-**	**-**	**20**
CO4	**-**	**-**	**40**	**30**	**20**
CO5	-	-	**20**	**30**	**10**
CO6	**-**	**-**	**40**	**40**	**30**
Total	**100**	**100**	**100**	**100**	**100**

5. Syllabus

Module 1
Digital Information Processing: Basis of Digital System, Number systems and Codes, Methods of base conversions, Code Converters and their Applications.
Module 2
Boolean Algebra and Switching Functions: Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions – Sum of Product (SOP) and Product of Sum (POS) forms; NAND and NOR Implementation - Simplification of switching functions– Karnaugh Maps and Quine- McCluskey tabular methods.
Module 3
Combinational Logic Design: Adders/subtractors, Fast adder, Magnitude comparator, Multiplexer Demultiplexer, Encoders, Decoders, Multiplier, and Parity generator and Checker, Standard IC Data Sheets and its Descriptions, HDL implementation of combinational circuits.
Module 4
Synchronous Sequential circuits: Bistable elements, Latches and flip flops- S-R, JK, D and Master- Slave JK FF, Analysis and Design of Clocked Sequential Circuits, State Minimization and State Assignment, Shift Registers, Counters. HDL implementation of sequential circuits.
Module 5
Asynchronous Sequential Circuits: Design and Analysis of asynchronous sequential circuits: Fundamental Mode, Flow Table, cycles, races, and Hazard- Static and Dynamic.
Module 6
Finite State Machine Design: Design and Analysis of Moore/Mealy FSM Models, State reduction, Algorithmic State Machines (ASM), System Design Applications: Vending Machine and Traffic Light Controller.

6. Learning Resources

6.1 Text Book

- M. Morris Mano and Michael D. Ciletti, “Digital Design: With an Introduction to the Verilog HDL VHDL, and System Verilog, Sixth Edition, Pearson, 2018.
- Wakerly, John, Digital Design: Principles and Practice (5th edition), Pearson, 2021.

6.2 Reference Books & Web resources

- D. D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, New Delhi, 2017.
- Charles. H. Roth, Jr., Fundamentals of Logic Design, Enhanced Seventh Edition,2020
- Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson, 2015
- William I. Fletcher,” An Engineering Approach to Digital Design,1st Edition reprint 2015.
- NPTEL course Digital Circuits: https://nptel.ac.in/courses/117106086/

7. Course Contents and Lecture Schedule

Module No	Topics	No of Periods
1	Digital Information Processing	
	Introduction	1
1.1	Basis of Digital System	0.5
1.2	Number systems and Codes	0.5
1.3	Methods of base conversions	1
1.4	Code Converters and their Applications	1
2	Boolean Algebra and Switching Functions	
2.1	Basic postulates and fundamental theorems of Boolean algebra	1
2.2	Standard representation of logic functions – Sum of Product (SOP) and Product of Sum (POS) forms	1
2.3	NAND and NOR Implementation	1
2.4	Simplification of switching functions– Karnaugh Maps	2
2.5	Quine- McCluskey tabular methods	2
3	Combinational Logic Design.	
3.1	Adders/subtractors,	1
3.2	Fast adder, Magnitude comparator	1
3.3	Magnitude comparator, Encoders, Decoders	1
3.4	Multiplier, and Parity generator and Checker	1
3.5	Standard IC Data Sheets and its Descriptions	1
3.6	HDL implementation of combinational circuits.	1
4	Synchronous Sequential circuits	
4.1	Bistable elements, Latches and flip flops- S-R, JK, D and Master- Slave JK FF	2
4.2	Analysis and Design of Clocked Sequential Circuits,	2
4.3	State Minimization and State Assignment	1
4.4	Shift Registers, Counters.	1
4.5	HDL implementation of sequential circuits	1
5	Asynchronous Sequential Circuits	
5.1	Design and Analysis of asynchronous sequential circuits: Fundamental Mode	2
5.2	Flow Table, cycles, races	1
5.3	Hazard- Static and Dynamic	1
6	Finite State Machine Design	
6.1	Design and Analysis of Moore/Mealy FSM Models	3
6.2	State reduction, Algorithmic State Machines (ASM)	2
6.3	System Design Applications: Vending Machine	2
6.4	Traffic Light Controller	1
	Total Hours	36

8. Course Designer(s):

Dr.D.Gracia Nirmala Rani, gracia@tce.edu
Dr.S.Rajaram, rajaram_siva@tce.edu

26ELEB0	ELECTRONIC DEVICES	Category	L	T	P	Credits
		ESC	3	0	0	3

1. Preamble

Electronic Devices is a core course that introduces semiconductor materials and the operating principles of electronic devices used in modern electronic systems. The course provides knowledge on PN junction diodes, transistors, field effect devices, optoelectronic devices, and power devices. It develops the ability to analyze device characteristics and select suitable devices for practical electronic applications. The course forms the foundation for analog electronics, VLSI, and communication systems.

2. Prerequisite

Nil

3. Course Outcomes

After the successful completion of the course, students will be able to

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage	SDG addressed	SDG Level
CO1	Explain the fundamentals of semiconductors and energy band theory.	TPS2	1.2.1	15	SDG 4	1
CO2	Analyze the characteristics and applications of PN junction diodes and rectifiers.	TPS3	1.3.1	20	SDG 9	2
CO3	Interpret the operation and characteristics of Bipolar Junction Transistors.	TPS3	1.3.2	20	SDG 9	2
CO4	Examine the characteristics and applications of JFETs and MOSFETs.	TPS4	2.1.1	20	SDG 9	2
CO5	Identify and apply photoelectric and power electronic devices in practical systems.	TPS3	3.1.2	15	SDG 7	2
CO6	Interpret datasheets and select suitable electronic devices for applications.	TPS4	5.1.1	10	SDG 9	2

4. Assessment Pattern

CO	CAT1	Assignment 1	CAT2	Assignment 2	Terminal Exam
	% of Marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	**30**	**30**	**-**	**-**	**20**
CO2	**40**	**40**	-	-	**20**
CO3	**30**	**30**	**-**	**-**	**20**
CO4	**-**	**-**	**30**	**40**	**10**
CO5	-	-	**40**	**30**	**10**
CO6	**-**	**-**	**30**	**30**	**20**
Total	**100**	**100**	**100**	**100**	**100**

5. Syllabus

Semiconductor Fundamentals: Conductors, Semiconductors, and Insulators - Silicon Crystal Structure - Intrinsic Semiconductors - Extrinsic Semiconductors - N-Type Semiconductors - P-Type Semiconductors - Majority and Minority Charge Carriers - Energy Band Structure - Energy Levels and Energy Gap - Fermi Level Concept - Carrier Drift and Diffusion - Temperature Effects on Semiconductors.**PN Junction Diodes and Applications:** Formation of PN Junction - Unbiased PN Junction - Forward Bias Characteristics - Reverse Bias Characteristics - Diode Current Equation - Breakdown Mechanisms - Zener Breakdown - Avalanche Breakdown - Transition Capacitance - Diffusion Capacitance - Rectifier Circuits - Half Wave Rectifier - Full Wave Rectifier - Bridge Rectifier - Filters and Ripple Factor - Zener Diode and Voltage Regulation - Understanding Diode Datasheets - Applications - Power supplies - Voltage regulation - Clipping and clamping circuits. **Bipolar Junction Transistors (BJT):** Structure and Operation of BJT - Types of BJTs – NPN and PNP - Unbiased and Biased Transistors - Transistor Currents - Emitter Current - Base Current - Collector Current - CE, CB, and CC Configurations - Input and Output Characteristics - Base Curve and Collector Curve - Transistor Regions of Operation - Cutoff Region - Active Region - Saturation Region - Understanding BJT Datasheets – Application: Amplifiers. **Field Effect Transistors (FET):** Introduction to FETs - JFET Construction and Operation - Drain Characteristics - Transfer Characteristics - Transconductance - Pinch-off Voltage - MOSFET Fundamentals - Depletion Mode MOSFET - Enhancement Mode MOSFET - MOSFET Regions of Operation - Ohmic Region - Saturation Region - Cutoff Region - CMOS Concept Introduction - Understanding FET Datasheets – Application: Amplifiers - Digital switching - CMOS integrated circuits. **Photoelectric and Power Devices:** Photodiode - Light Emitting Diode (LED) - Light Dependent Resistor (LDR) - Silicon Controlled Rectifier (SCR) - DIAC - TRIAC – Applications: Automatic lighting systems - Sensor applications.

6. Learning Resources

6.1 Text Book

- Albert Paul Malvino and David J Bates," Electronic Principles", 8th Edition, McGraw Hills, 2020.
- Neamen, D. A., "Semiconductor physics and devices", 4th Edition, McGraw-Hill, 2021.

6.2 Reference Books & Web resources

- Robert L. Boylestad, Louis Nashelsk, "Electronic Devices and Circuit Theory", 11th Edition, Pearson, 2013.
- Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press Seventh Edition, 2015.

7. Course Contents and Lecture Schedule

Module No	Topics	No of Periods
1.	Semiconductor Fundamentals :	
1.1	Conductors, semiconductors and insulators, Silicon crystal structure,	1
1.2	Intrinsic and extrinsic semiconductors	0.5
1.3	N-type and P-type semiconductors	0.5
1.4	Majority and minority carriers	0.5
1.5	Energy bands and Fermi level	0.5
1.6	Drift and diffusion currents	1
1.7	Temperature effects	1
2	**PN Junction Diodes and Applications**	
2.1	Formation of PN junction,	1
2.2	Forward and reverse characteristics	1
2.3	Diode current equation	1
2.4	Breakdown mechanisms, Junction Capacitances	1

2.5	Half-wave, full-wave and bridge rectifiers	1
2.6	Filter circuits and ripple factor	1
2.7	Zener diode and voltage regulation	1
2.8	Clipping and clamping circuits, Diode datasheets	1
3	**Bipolar Junction Transistors**	
3.1	Structure and operation of BJT	1
3.2	NPN and PNP transistors	1
3.3	Transistor currents	1
3.4	CB, CE and CC configurations	1
3.5	Input and output characteristics	1
3.6	Regions of operation	1
3.7	Cut-off, active and saturation regions	1
3.8	BJT datasheets	1
3.9	Applications in amplifiers	1
4	**Field Effect Transistors**	
4.1	Introduction to FETs	1
4.2	JFET construction and operation	1
4.3	Drain and transfer characteristics	1
4.4	Pinch-off voltage	1
4.5	MOSFET fundamentals	1
4.6	Enhancement and depletion MOSFETs	1
4.7	Regions of operation	0.5
4.8	CMOS concept	0.5
4.9	FET datasheets	0.5
4.10	Applications in switching and integrated circuits	0.5
5	**Photoelectric and Power Devices**	
5.1	Photodiode	1
5.2	LED, LDR	1
5.3	SCR	1
5.4	DIAC	1
5.5	TRIAC	1
5.6	Automatic lighting systems, Sensor applications	1
	Total Periods	**36**

8. Course Designer(s):

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Dr V.Charumathi, vciece@tce.edu

26ELCE0	DIGITAL LOGIC DESIGN LABORATORY	Category	L	T	P	Credits
		PCC	0	0	2	1

1. Preamble

This laboratory serves as the practical counterpart to the theory course by providing students with hands-on experience in designing, implementing, testing, and verifying digital circuits using real hardware platforms. It bridges the gap between theoretical concepts and practical applications by enabling students to analyze and validate the behavior of logic gates, combinational circuits, and sequential systems under actual operating conditions.

2. Prerequisite

Nil

3. Course Outcomes

On the successful completion of the course, students will be able to

COs	Course Outcome 1 (CO1)	TCE Proficiency Scale	Performance Indicators	SDG Addressed	SDG Level
CO1	Construct digital circuit to examine Boolean algebra, truth table of different logic gates.	TPS 3	1.6.1 1.7.1	SDG 4	1
CO2	Design, test and evaluate various combinational circuits such as adders, subtractors, multiplexers, demultiplexers, decoders, Code converters etc.	TPS 3	3.5.1 3.6.1	SDG 9	2
CO3	Construct and deploy flip-flops, counters, and shift registers in digital circuits.	TPS 3	3.5.1 3.6.1	SDG 9	2
CO4	Utilize Verilog Hardware Description Language (HDL) to model and simulate Combinations Circuits.	TPS 4	5.4.1 5.4.2	SDG 9	2
CO5	Utilize Verilog Hardware Description Language (HDL) to model and simulate sequential circuits.	TPS 4	5.4.1 5.4.2	SDG 9	2
CO6	Develop, model, and deploy a Finite State Machine (FSM) capable of detecting specific sequences of inputs, employing both Moore and Mealy state machine architectures.	TPS 3	3.7.1	SDG 9	2

4. Assessment Pattern: Cognitive Domain

Type of Assessment	Component	Marks	Remarks
Continuous Assessment	Pre-lab, In-lab, Post-lab	75	Conducted throughout the semester
Model Test	CO-wise (Cognitive, Psychomotor, Affective)	25	Mid/End semester internal test
Total Internal Marks		**100**	
End Semester Examination	CO-wise (Cognitive, Psychomotor, Affective)	100	As directed by COE or as per curriculum

5. List of Experiments with CO Mapping

Sl. No.	Name of the Experiment	Level of Experiment	Objective(s)	COs Addressed
1.	Verification of Basic and Universal Logic Gates and Boolean Laws and Theorems.	1	1, 3	CO1
2.	Introduction to HDL Coding and simulation of Logic Gates	1	3	CO4
3.	Design and Implementation of Arithmetic Circuits a. Adder b. Subtractor	1	1, 3	CO2
4.	Design and Implementation of combinational circuits – Multiplexer and Demultiplexer using MSI chips.	1	1, 3	CO2
5.	Design and Simulation of Encoder and Decoder using HDL code.	1	3	CO4
6.	Design and Implementation of code converters a) Gray code to Excess-3 code. b) BCD to Seven segment display.	1	1, 3	CO2
7.	Design, Simulate and implementation of Latches and Flip-flips using HDL Code	1	1, 3	CO4
8.	Design and Implementation of Shift Registers	1	1, 3	CO3
9.	Design and Implementation of Synchronous Mod counters.	2	1, 3	CO3
10.	Design and HDL Implementation of Sequence Detectors using FSM Approaches	2	1, 3	CO5/CO6
11.	Mini Project	3	5	CO1-CO6

6. Course Designer(s):

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26CHSC0	CHEMISTRY LABORATORY	Category	L	T	P	Credits
		BSC	0	0	3	1.5

Preamble

This course aims to provide the students with basic practical knowledge in chemistry. The objective of this course is to develop students' intellectual and psychomotor skills by providing hands-on experience in quantitative analysis, electrochemistry, physicochemistry, photocolorimetry, and green nanomaterial synthesis techniques.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

COs	Course Outcome	TCE Proficiency Scale	Performance Indicators	SDG Addressed	SDG Level
CO1	Operate pH meters, conductivity bridges, colorimeters, potentiometric systems, and volumetric apparatus to determine physicochemical properties of engineering samples.	TPS 3	5.2.1	SDG 9 – Industry, Innovation and Infrastructure	2
CO2	Measure readings from volumetric, and instrumental methods to determine concentration of chemical and water samples.	TPS 3	4.1.2	SDG 6 – Clean Water and Sanitation	2
CO3	Demonstrate precise laboratory techniques, including pipetting, burette handling, endpoint detection, calibration, and solution preparation during quantitative chemical analysis.	TPS 3	5.3.1	SDG 4 – Quality Education	2
CO4	Apply laboratory safety procedures, chemical handling practices, and waste disposal protocols during analytical and electrochemical experiments.	TPS 3	6.4.1	SDG 12 – Responsible Consumption and Production	2
CO5	Demonstrate structured laboratory reports by interpreting observations, calculations, graphs, error analysis, and experimental conclusions using scientific documentation practices.	TPS 3	9.1.2	SDG 4 – Quality Education	2
CO6	Apply collaborative responsibilities ethically during experimentation, data recording, analysis, and laboratory discussions.	TPS 3	8.2.1	SDG 16 – Peace, Justice and Strong Institutions	2
CO7	Analyse deviations and experimental errors in titrimetric, electrochemical, and instrumental methods, and recommend	TPS 4	4.3.1	SDG 9 – Industry, Innovation and Infrastructure	2

	corrective measures to improve analytical accuracy.				
CO8	Evaluate electrochemical behaviour, corrosion characteristics, and electroplating efficiency of metallic systems using modern electrochemical techniques.	TPS 5	3.3.1	SDG 9 – Industry, Innovation and Infrastructure	2

Assessment Pattern: Cognitive Domain

Type of Assessment	Component	Marks	Remarks
Continuous Assessment	Pre-Lab, In-Lab, and Post-Lab Activities	75	Conducted throughout the semester as per laboratory assessment framework and openness levels specified in the curriculum guidelines.
Model Test	CO-wise Assessment covering Cognitive, Psychomotor, and Affective Domains	25	Mid-semester / End-semester internal practical assessment using structured rubrics aligned with all three learning domains.
Total Internal Marks		**100**	Continuous Assessment (75) + Model Test (25).
End Semester Examination	CO-wise Assessment covering Cognitive, Psychomotor, and Affective Domains	100	Conducted as per COE regulations and curriculum requirements using structured laboratory evaluation rubrics.

List of Experiments with CO Mapping

Sl. No.	Name of the Experiment	Level of Experiment	Objective(s)	COs Addressed
1	Estimation of Total Hardness of Water	Level 1	Instrumentation, Data Analysis, Psychomotor Skills	CO1, CO2, CO3, CO4, CO5
2	Estimation of Calcium in a Milk Sample	Level 1	Experimentation, Data Analysis, Psychomotor Skills	CO2, CO3, CO5, CO6
3	Estimation of Chemical Oxygen Demand in Effluent	Level 2	Experimentation, Data Analysis, Safety	CO1, CO2, CO4, CO5, CO7
4	Determination of the Surface Tension of a Liquid	Level 2	Instrumentation, Models, Psychomotor Skills	CO1, CO2, CO3, CO5
5	Estimation of Antacid in a Tablet	Level 1	Experimentation, Data Analysis,	CO2, CO3, CO5

			Psychomotor Skills	
6	Estimation of Acid Strength in Citrus Fruit	Level 1	Experimentation, Data Analysis, Psychomotor Skills	CO2, CO3, CO5, CO6
7	Determination of the Molecular Weight of a Polymer by the Ostwald Viscometer	Level 2	Models, Instrumentation, Data Analysis	CO1, CO2, CO5, CO7
8	Estimation of Acidic Impurities in Soft Drinks by the Conductometric Method	Level 2	Instrumentation, Data Analysis, Learn from Failure	CO1, CO2, CO5, CO7
9	Estimation of the pH of a Soil Sample	Level 1	Instrumentation, Psychomotor Skills, Data Analysis	CO1, CO3, CO4, CO5
10	Estimation of Fe^{2+} using the Potentiometric Method	Level 2	Instrumentation, Experimentation, Data Analysis	CO1, CO2, CO5, CO7
11	Green Synthesis of Plasmonic Silver Nanoparticles Using Plant Extract and Quantitative Analysis by Photocolorimetry	Level 2	Instrumentation, Experimentation, Data Analysis, Creativity	CO1, CO2, CO5, CO7, CO8
12	Estimation of the rate of Corrosion of a Metal Specimen by Electrochemical Method	Level2	Instrumentation, Experimentation, Data Analysis,	CO1, CO2, CO5, CO7, CO8

Course Designer(s):

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26TAAB0	TAMILS AND TECHNOLOGY	Category	L	T	P	Credits
		Audit	1	0	0	0

1. Preamble

The Tamil language is not merely a tool for communication; it is a repository of the knowledge, way of life, and scientific thought of the Tamil people, spanning millennia.

Today, Tamils are making their mark in the realms of computing and the internet. Their contributions are immense, ranging from leading global technology companies to playing pivotal roles in Artificial Intelligence (AI) and space exploration (ISRO/NASA). Simultaneously, the development of 'Computational Tamil' and internet-based Tamil is gaining momentum, ensuring the language is passed on to the next generation.

The technological acumen of the Tamil people did not emerge overnight; it is ingrained in their very DNA. By cherishing tradition, embracing innovation, and keeping pace with global technological advancements, Tamils continue to stand as pioneers.

2. Prerequisite

NIL

3. Course Outcome:

On the successful completion of the course students will be able to

No	Course Outcome	TPS Level	PO Addressed	CO Weightage	SDG addressed	SDG Level
CO1	Explain the historical Sangam Age Ceramic Technology Graffiti on Potteries	TPS2	PO1 – M PO2 – L	20	SDG 4	1
CO2	Explain the durig Sangam Age Strucural Contution House & Designs in Household materials	TPS2	PO1 – M PO2 – L	20	SDG 4	1
CO3	Metallurgical studies Art of Ship steel – Copper and gold- Coins as source of history Shell beads	TPS3	PO1 – S PO2 – M PO3 – L	20	SDG 4	1
CO4	Agricuture and Agro Procesing Ancient Knowledge of Ocean	TPS3	PO1 – S PO2 – M PO3 – L	20	SDG 4	1
CO5	Development of Scientific Tamil And Tamil computing	TPS3	PO1 – S PO2 – M PO3 – L	20	SDG 4	1

4. Assessment Pattern

CO	CAT1	Assignment 1	CAT 2 (MCQ)	Assignment 2	Terminal Exam (MCQ)*
	% of marks	% of Marks	% of Marks	% of Marks	% of Marks
CO1	-	-	10	10	10
CO2	-	-	10	10	10
CO3	-	-	20	20	20
CO4	-	-	30	30	30
CO5	-	-	30	30	30
Total	**-**	**-**	**100**	**100**	**100**

* The Terminal Examination and CAT 2 shall be conducted as a Multiple-Choice Question (MCQ) examination.

5. Syllabus

Module 1:

Weaving Industry Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW)- Graffiti on Potteries.

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Module 2:

Desiging and Strucural Contution House & Designs in Household materials durig Sangam Age – Building materials and Hero stone os Sangam age – Details of Stage Constructions in Silappathikaram – sculptures and Temples of Mamallapuram- Great Temples of Cholas and other Worship places- Temples of Nayaka Period- Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal – Chetti Nadu House, Indo-Saracenic Architecture at Madras during British Peroiod.

Module 3:

Art of Ship Building – Metallurgical studies – iron industry –iron smelting, steel – Copper and gold- Coins as source of history – Minting of Coins – Beads making – industries Stone beads- Glass beads-Terracotta beads – Shell beads / bone beats – Archeological evidences- Gen stone types described in Silappathikaram.

Module 4:

Dam,Tank,Ponds,Stuice,Signification of Kumizhi Thoompu of Cholo Period, Animal Husbandry-Wells designed for cattle use – Agricuture and Agro Procesing – Knowledge of Sea – Fisheries-Pearl-Conche diving –Ancient Knowledge of Ocean – Knowledge Specific Society.

Module 5:

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books- Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Dictionaries – Sorkuvai Project.

6. Learning Resources

- தமிழக வரலாறு - மக்களும் பண்பாடும் தமிழ்நாடு பாடநூல் :வெளியீடு) (மற்றும் கல்வியியல் பணிகள் கழகம்
- கணித் தமிழ் - முனைவர் இல.சுந்தரம் விகடன் பிரசுர)ம்(
- கீழடி - வைகை நதிக்கரையில் சங்ககால நாகரீகம் தொல்லியல் துறை) (வெளியீடு
- பொருநை ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு)
- Social Life of the Tamil – The Classical Period (Dr.K.K.Pillay) A joint publication of TNTB&ESC and RMRL – (inprint)
- Social Life of the Tamils- The Classical Period (Dr.S.Singaravelu) Published by: International Institute of TamilStuies.
- Historial Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu)) Published by: International Institute of TamilStuies.
- The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) Published by: International Institute of TamilStuies.
- Keeladi – Sangam City Civilzation on the banks of river Vaigai (Jointly Published Department of Archaeology & Tamil Nadu Text Book and Educational Servics Corporation,Tamilnadu)

- Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillai, Publisher by The Author)
- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Education Service Corporation, TamilNadu)
- Journey of Civization indus to Vaigai (R.Balakrishnan) Published by: RMRL – Reference Book

2. Course Contents and Lecture Schedule

Module No.	Topics	No. of Periods
1	**WEAVING AND CERAIC TECHNOLOGY**	
1.1	Weaving Industry Sangam Age – CeramicTechnology	1
1.2	Black and Red Ware Potteries(BRW)	1
1.3	Graffiti on Potteries.	1
2	**DESIGN AND CONSTRUCTION TECHNOLOGY**	
2.1	Desiging and Strucural Contution House & Designs in Household materials durig Sangam Age – Building materials and Hero stone os Sangam age	1
2.2	Details of Stage Constructions in Silappathikaram – sculptures and Temples of Mamallapuram- Great Temples of Cholas and other Worship places- Temples of Nayaka Period- Type study (Madurai Meenakshi Temple)	1
2.3	Thirumalai Nayakar Mahal – Chetti Nadu House, Indo-Saracenic Architecture at Madras during British Peroiod.	1
3	**MANUFACTURING TECHNOLOGY**	
3.1	Art of Ship Building – Metallurgical studies – iron industry –iron smelting, steel – Copper and gold- Coins as source of history – Minting of Coins	1
3.2	Beads making – industries Stone beads- Glass beads-Terracotta beads – Shell beads / bone beats	1
3.3	Archeological evidences- Gen stone types described in Silappathikaram.	1
4	**ARGRICULTURE AND IRRIATION TECHNOLOGY**	
4.1	Dam,Tank,Ponds,Stuice,Signification of Kumizhi Thoompu of Cholo Period	1
4.2	Animal Husbandry-Wells designed for cattle use – Agricuture and Agro Procesing	1
4.3	Knowledge of Sea – Fisheries-Pearl-Conche diving –Ancient Knowledge of Ocean – Knowledge Specific Society.	1
5	**SCIENTIFIC TAMIL & TAML COMPUTING**	
5.1	Development of Scientific Tamil – Tamil computing	1
5.2	Digitalization of Tamil Books- Development of Tamil Software – Tamil Virtual Academy	1
5.3	Tamil Digital Library – Online Dictionaries – Sorkuvai Project	1
	Total	15

Course Designers:

Mr. M Babu.mbutce@tce.edu

26CCAB0	FOUNDATIONS OF PROBLEM SOLVING-1 (Common to all Programmes)	Category	L	T	P	Credits
		AC	0	0	2	0

1. Preamble

This course introduces students to the core habits of structured problem solving. Through algorithmic thinking exercises across numeric, visual, and word-puzzle formats, students learn to decompose problems, identify patterns, and design solution strategies that transfer to both academic problem solving and early recruitment-test contexts.

2. Course Outcomes

After the successful completion of the course, students will be able to:

No.	Course Outcome	TPS Level	Performance Indicator	CO Weightage
CO1	Explain the principles of algorithmic thinking and structured problem solving.	TPS2	3.3.1	20%
CO2	Apply quantitative reasoning techniques to numeric problems.	TPS3	2.1.2	20%
CO3	Use visual pattern recognition to solve diagram-based puzzles.	TPS3	2.1.2	20%
CO4	Identify shortest-path and optimization strategies in problem solving.	TPS3	2.4.1	20%
CO5	Solve complex word puzzles by decomposing them into smaller logical units.	TPS4	2.2.1	20%

3. Assessment Pattern

CO	CA1 (% of Marks)	CA2 (% of Marks)	Terminal Exam (% of Marks)
CO1	50	—	10
CO2	50	—	10
CO3	—	50	20
CO4	—	50	20
CO5	—	—	40
Total	**100**	**100**	**100**

The assessment will be conducted by the Training Team, and the marks will be submitted by the respective faculty in charge.

4. Syllabus

Module 1: Introduction to Problem Solving and Algorithmic Thinking

Problem-solving framework – Algorithmic mindset – Decomposition – Pattern recognition

Module 2: Thinking with Numbers

Numeric reasoning – Quantitative pattern recognition – Mental shortcuts

Module 3: Thinking with Visual

Diagram-based reasoning – Visual patterns – Figure analogies and series

Module 4: Shortest Path

Shortest-path problems – Optimisation – Route and grid problems

Module 5: Word Puzzles (Part 1 & 2)

Lateral thinking – Word arrangement – Logical inference puzzles – Brain teasers

5. Learning Resources

5.1 Text Book

George Polya — "How to Solve It", Princeton University Press.

5.2 Reference Books & Web Resources

1. R. G. Dromey — "How to Solve It by Computer", Pearson.
2. Edward de Bono — "Lateral Thinking: A Textbook of Creativity", Penguin.
3. Arun Sharma — "How to Prepare for Logical Reasoning", McGraw Hill.

6. Course Designer(s)

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