CK COLLEGE OF ENGINEERING AND TECHNOLOGY
AN AUTONOMOUS INSTITUTION
CAVINKARE PATRONIZED INSTITUTION

C.K. COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University & Recognized under UGC section 2(f) & 12(B)
Accredited by NAAC with 'A' grade and ISO 9001:2015 Certified Institution

Jayaram Nagar, Chellangkuppam, Cuddalore-607 003, Tamil Nadu, India.

DEPARTMENT OF
ROBOTICS AND AUTOMATION ENGINEERING

CURRICULUM AND SYLLABI

I & II SEMESTER

(UNDER CKCET AUTONOMOUS REGULATION)

REGULATION 2026

Academic Year 2026-27 onwards

C. K. COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

UNDERGRADUATE CURRICULUM

Department : Robotics & Automation

Programme : B.E. – Robotics & Automation

Regulations : 2026, with effect from the AY 2026 – 27 to all the students of Undergraduate Programme

OVERVIEW OF CREDITS

Semester / Category	BS	ES (G)	ES (ET)	HUM	SD	ES (PC)	ES (PE)	OE	Total
Semester – I	10	06	-	03	-	03	-	-	**22**
Semester – II	04	03	-	04	02	07	-	-	**20**
Semester – III	04	06	-	-	02	10	-	-	**22**
Semester – IV	-	-	-	-	02	22	-	-	**24**
Semester – V	-	03	-	-	02	16	03	-	**24**
Semester – VI	-	-	03	-	02	09	06	03	**23**
Semester – VII	-	-	-	04	03	09	06	-	**22**
Semester – VIII	-	-	-	-	08	-	-	-	**08**
Total Credits	**18**	**18**	**03**	**11**	**21**	**76**	**15**	**03**	**165**
Percentage (%)	**10.91**	**10.91**	**1.82**	**6.67**	**12.73**	**46.06**	**9.09**	**1.82**	**100**

CATEGORY OF COURSES

HUM	Humanities (Languages, Management, Heritage and others)	BS	Basic Science (Mathematics, Physics, Chemistry)
P	Laboratory Course	T	Theory Course
SD	Skill Development	MC	Mandatory Course
OE	Open Elective	SLC	Self-Learning Course
ES (G)	Engineering Science (General)	LIT	Laboratory Integrated Theory
ES (PC)	Engineering Science (Programme Core)	ES (PE)	Engineering Science (Programme Elective)
ES (ET)	Engineering Science (Emerging Technology)		

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No.: 01 Dated: 21.4.26

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Knowledge and Attitude Profile (WK)

The Knowledge and Attitude Profile (WK) is intended to define the essential knowledge base and professional attitudes expected of program graduates. It ensures alignment with OBE principles and equips graduates with the capability to effectively analyze and address complex engineering problem.

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, reuse 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.

Program Outcomes (POs):

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)

Program Educational Objectives (PEOs):

PEO1: Graduates will build successful careers in Robotics & Automation Engineering and allied domains through a strong foundation in design, digital analysis, experimentation, automation, and research.

PEO2: Graduates will continuously enhance their competencies, work effectively with diverse stakeholders, and uphold ethical values to perform in a dynamic, multicultural global environment.

PEO3: Graduates will promote innovation, multidisciplinary research, and entrepreneurship to solve complex engineering, environmental, and societal challenges, while demonstrating leadership in industry, academia, and society.

Program Specific Outcomes (PSOs):

PSO1: Design and develop robotic and automation systems for real-world industrial and research applications.

PSO2: Equip students with skills in using modern simulation, modeling, and programming software essential for robotics and automation.

PSO3: Demonstrate continuous self-improvement and uphold ethical practices in the rapidly evolving field of robotics and automation.

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Semester – I							
S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1.	26MAC01T	Applied Calculus	T	3-1-0	4	4	BS
2.	26ENC01T	English Essentials - I	T	2-0-0	2	2	HUM
3.	26TLC01T	தமிழர் மரபு / Heritage of Tamils	T	1-0-0	1	1	HUM
4.	26MEC02T	Introduction to Mechanical Engineering	T	2-1-0	3	3	ES (PC)
5.	26CYC02L	Engineering Chemistry	LIT	2-0-2	4	3	BS
6.	26PHC03L	Engineering Physics	LIT	2-0-2	4	3	BS
7.	26MEC01L	Engineering Drawing	LIT	2-0-2	4	3	ES (G)
8.	26CSC02L	Python Programming	LIT	2-0-2	4	3	ES (G)
9.	---	Physical Education-I	P	0-0-1	1	NC	MC
10.	---	Induction Programme	---	---	---	NC	---
Total Credits					**27**	**22**	

Semester – II							
S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1.	26MAC02T	Linear Algebra	T	3-1-0	4	4	BS
2.	26TLC02T	தமிழர்களும் தொழில் நுட்பமும் / Tamils & Technology	T	1-0-0	1	1	HUM
3.	26MEC03T	Engineering Mechanics	T	3-1-0	4	4	ES (PC)
4.	26RA201T	Fluid Mechanics and Thermal systems	T	3-0-0	3	3	ES (PC)
5.	26ENC02L	English Essentials – II	LIT	1-0-2	3	2	HUM
6.	26EE202L	Basic Electrical and Electronics Engineering	LIT	2-0-2	4	3	ES (G)
7.		Foreign Language	P	0-0-2	2	1	HUM
8	26MEC01P	Engineering Practices and Re-Engineering Laboratory	P	0-0-4	4	2	SD
9	---	Foundations of Problem Solving	T	3-0-0	3	NC	MC
10.	---	Physical Education – II	P	0-0-1	1	NC	MC
11.	---	Self – Learning Course – I	---	---	---	NC	SLC
12.	---	Student Transformation & Enrichment Programme (STEP)	---	---	---	NC	---

13.	---	NSS/NCC/NSO	---	---	---	NC	MC
				Total Credits	**29**	**20**	

Semester – III							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	26MAC06T	Computational Differential Equations	T	3-1-0	4	4	BS
2.	26ECC02T	Embedded Systems	T	3-0-0	3	3	ES (G)
3.	26MEC04T	Engineering Materials and Metallurgy	T	3-0-0	3	3	ES (PC)
4.	26EE308L	Electrical Machines and Power Systems	LIT	2-0-2	4	3	ES (G)
5.	26RA301L	Strength of Materials	LIT	3-0-2	5	4	ES (PC)
6.	26RA302L	Industry Oriented Course – I	LIT	2-0-2	4	3	ES (PC)
7.	26RA303P	Career Readiness & Professional Skills – Foundation Level	P	0-0-2	2	1	SD
8.	26RA304P	Project Work – I	P	0-0-2	2	1	SD
9.	-----	Indian Constitution	T	3-0-0	3	NC	MC
10.	---	Self – Learning Course – II	---	---	---	NC	SLC
11.	---	Student Transformation & Enrichment Programme (STEP)	---	---	---	NC	---
				Total Credits	**30**	**22**	

Semester – IV							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	26EE409T	Power Electronics and Drives	T	3-0-0	3	3	ES (G)
2.	26EE410T	Control System Engineering	T	3-0-0	3	3	ES (G)
3.	26RA401T	Hydraulics and Pneumatics	T	3-0-0	3	3	ES (PC)
4	26AD607L	Artificial Intelligence and Data Science	LIT	2-0-2	4	3	ES (G)
5	26RA402L	Robot Kinematics	LIT	3-0-2	5	4	ES (PC)
6.	26RA403L	Manufacturing Technology	LIT	2-0-2	4	3	ES (PC)
7.	26RA404L	Industry Oriented Course – II	LIT	2-0-2	4	3	ES (PC)

8.	26RA405P	Career Readiness & Professional Skills – Intermediate Level	P	0-0-2	2	1	SD
9.	26RA406P	Project Work – II	P	0-0-2	2	1	SD
10.	---	Self-Learning Course – III	---	---	---	NC	SLC
11.	---	Student Transformation & Enrichment Programme (STEP)	---	---	---	NC	---
Total Credits					**30**	**24**	

Semester – V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	26RA501T	Design of Mechanical Transmission Systems	T	3-1-0	4	4	ES (PC)
2.	26RA0XXX	Programme Elective – I	T	3-0-0	3	3	ES (PE)
3.	26RA502T	Optimization Techniques	T	3-0-0	3	3	ES (PC)
4.	26EC5XXL	Digital Signal Processing	LIT	2-0-2	4	3	ES (G)
5.	26RA503L	Dynamics and Control of Manipulators	LIT	2-0-2	4	3	ES (PC)
6.	26RA504L	Industrial Process Automation	LIT	2-0-2	4	3	ES (PC)
7.	26RA505L	Industry Oriented Course – III	LIT	2-0-2	4	3	ES (PC)
8.	26RA506P	Career Readiness & Professional Skills – Advanced Level	P	0-0-2	2	1	SD
9.	26RA507P	Project Work – III	P	0-0-2	2	1	SD
10.	---	Self – Learning Course – IV	---	---	---	NC	SLC
11.	---	Student Transformation & Enrichment Programme (STEP)	---	---	---	NC	---
Total Credits					**30**	**24**	

For Honors Degree							
1.		Capstone Design Project – I	CDP	0-0-12	12	6	SD
Or							
1.		Honours Elective – I	T	3-0-0	3	3	
2.		Honours Elective – II	T	3-0-0	3	3	

For Minor Degree							
1.		Minor Elective – I	T	3-0-0	3	3	
2.		Minor Elective – II	T	3-0-0	3	3	

Semester – VI							
S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1.	26RA601T	Mobile Robotics	T	3-1-0	4	4	ES (PC)
2.	26RA9XXX	Open Elective	T	3-0-0	3	3	OE
3.	26RA0XXX	Programme Elective – II	T	3-0-0	3	3	ES (PE)
4.	26RA0XXX	Programme Elective – III	T	3-0-0	3	3	ES (PE)
5.	26ADC01T	Applied Data Science	T	3-0-0	3	3	ES (ET)
6.	26RA602L	Industry Oriented Course – IV	LIT	2-0-2	4	3	ES (PC)
7.	26RA603P	CNC and System Simulation Laboratory	P	0-0-4	4	2	ES (PC)
8.	26RA604P	Career Readiness & Professional Skills – Placement Level	P	0-0-2	2	1	SD
9.	26RA605P	Project Work – IV	P	0-0-2	2	1	SD
10.	---	Self – Learning Course – V	---	---	---	NC	SLC
11.	---	Student Transformation & Enrichment Programme (STEP)	---	---	---	NC	---
				Total Credits	**28**	**23**	

For Honors Degree							
1.		Capstone Design Project – II	CDP	0-0-12	12	6	SD
Or							
1.		Honours Elective – III	T	3-0-0	3	3	
2.		Honours Elective – IV	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective – III	T	3-0-0	3	3	
2.		Minor Elective – IV	T	3-0-0	3	3	

Semester–VII							
S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1.	26MGC01T	Engineering Entrepreneurship Development	T	2-0-0	2	2	HUM
2.	26CYC01T	Climate Change and Sustainability	T	2-0-0	2	2	HUM
3.	26RA0XXX	Programme Elective – IV	T	3-0-0	3	3	ES (PE)
4.	26RA0XXX	Programme Elective – V	T	3-0-0	3	3	ES (PE)
5.	26RA701L	Industrial Internet of Things	LIT	2-0-2	4	3	ES (PC)
6.	26RA702L	Industry Oriented Course – V	LIT	2-0-2	4	3	ES (PC)
7.	26RA703L	Industry Oriented Course – VI	LIT	2-0-2	4	3	ES (PC)
8.	26RA704P	Major Project – Phase I	P	0-0-4	4	2	SD
9.	26RA705P	Internship	P	---	---	1	SD
					Total Credits	**26**	**22**

For Honors Degree							
1.		Capstone Design Project – III	CDP	0-0-12	12	6	SD
Or							
1.		Honours Elective – V	T	3-0-0	3	3	
2.		Honours Elective – VI	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective – V	T	3-0-0	3	3	
2.		Minor Elective – VI	T	3-0-0	3	3	

Semester–VIII							
S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1.	26RA801P	Major Project - Phase II	P	0-0-16	16	8	SD
					Total Credits	**16**	**8**

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PROGRAMME ELECTIVE COURSES – STREAMS

Vertical - I	Vertical - II	Vertical - III	Vertical - IV	Vertical - V	Vertical - VI	Vertical - VII
Applied Robotics	**Design and Manufacturing**	**Smart Mobility Systems**	**Intelligence Systems**	**Automation**	**Avionics and Drone Technology**	**Diversified Courses Group 1**
Robots and Systems in Smart Manufacturing	Robot and Machine Elements Design	Automobile Engineering	Applied Signal Processing	Object Oriented Programming in C++	Avionics	Linear Integrated Circuits
Drone Technologies	Design for X	Electric and Hybrid Vehicles	Applied Image Processing	Power Electronics	Control Engineering	Single Board Computers
Micro robotics	CNC Machine Tools and Programming	Automotive Mechatronics	Machine Learning for Intelligent Systems	Computer Architecture and Organisation	Guidance and Control	Reliability and Maintenance Engineering
Agricultural Robotics and Automation	Computer Integrated Manufacturing	Automotive System Modelling and Simulation	Condition Monitoring and Fault Diagnostics	Virtual Instrumentation	Navigation and Communication System	Integrated Product Development
Collaborative Robotics	Advanced Manufacturing Systems	Vehicle Dynamics and Controls	Systems Modelling and Simulation Methods	Industrial Network Protocols	Design of UAV systems	Medical Mechatronics
Robot Operating Systems	Additive Manufacturing	Aircraft Mechatronics	---	Motion Control System	Aerodynamics of Drones	Micro Electro Mechanical Systems

LIST OF PROGRAMME ELECTIVE COURSES: VERTICALS

VERTICAL 1: APPLIED ROBOTICS

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26RA001T	Robots and Systems in Smart Manufacturing	T	3-0-0	3	3	ES (PE)
2	26RA008T	Drone Technologies	T	3-0-0	3	3	ES (PE)
3	26RA015T	Micro robotics	T	3-0-0	3	3	ES (PE)
4	26RA022T	Agricultural Robotics and Automation	T	3-0-0	3	3	ES (PE)
5	26RA029T	Collaborative Robotics	T	3-0-0	3	3	ES (PE)
6	26RA036T	Robot Operating Systems	T	3-0-0	3	3	ES (PE)

VERTICAL 2: DESIGN AND MANUFACTURING

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26RA002T	Robot and Machine Elements Design	T	3-0-0	3	3	ES (PE)
2	26RA009T	Design for X	T	3-0-0	3	3	ES (PE)
3	26RA016T	CNC Machine Tools and Programming	T	3-0-0	3	3	ES (PE)
4	26RA023T	Computer Integrated Manufacturing	T	3-0-0	3	3	ES (PE)
5	26RA030T	Advanced Manufacturing Systems	T	3-0-0	3	3	ES (PE)
6	26RA037T	Additive Manufacturing	T	3-0-0	3	3	ES (PE)

VERTICAL 3: SMART MOBILITY SYSTEMS

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26RA003T	Automobile Engineering	T	3-0-0	3	3	ES (PE)
2	26RA010T	Electric and Hybrid Vehicles	T	3-0-0	3	3	ES (PE)

3	26RA017T	Automotive Mechatronics	T	3-0-0	3	3	ES (PE)
4	26RA024T	Automotive System Modelling and Simulation	T	3-0-0	3	3	ES (PE)
5	26RA031T	Vehicle Dynamics and Controls	T	3-0-0	3	3	ES (PE)
6	26RA038T	Aircraft Mechatronics	T	3-0-0	3	3	ES (PE)

VERTICAL 4: INTELLIGENCE SYSTEMS

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26RA004T	Applied Signal Processing	T	3-0-0	3	3	ES (PE)
2	26RA011T	Applied Image Processing	T	3-0-0	3	3	ES (PE)
3	26RA018T	Machine Learning for Intelligent Systems	T	3-0-0	3	3	ES (PE)
4	26RA025T	Condition Monitoring and Fault Diagnostics	T	3-0-0	3	3	ES (PE)
5	26RA032T	Systems Modelling and Simulation Methods	T	3-0-0	3	3	ES (PE)

VERTICAL 5: AUTOMATION

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26RA005T	Object Oriented Programming in C++	T	3-0-0	3	3	ES (PE)
2	26RA012T	Power Electronics	T	3-0-0	3	3	ES (PE)
3	26RA019T	Computer Architecture and Organisation	T	3-0-0	3	3	ES (PE)
4	26RA026T	Virtual Instrumentation	T	3-0-0	3	3	ES (PE)
5	26RA033T	Industrial Network Protocols	T	3-0-0	3	3	ES (PE)
6	26RA040T	Motion Control System	T	3-0-0	3	3	ES (PE)

VERTICAL 6: AVIONICS AND DRONE TECHNOLOGY

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26RA006T	Avionics	T	3-0-0	3	3	ES (PE)
2	26RA013T	Control Engineering	T	3-0-0	3	3	ES (PE)
3	26RA020T	Guidance and Control	T	3-0-0	3	3	ES (PE)
4	26RA027T	Navigation and Communication System	T	3-0-0	3	3	ES (PE)
5	26RA034T	Design of UAV systems	T	3-0-0	3	3	ES (PE)
6	26RA041T	Aerodynamics of Drones	T	3-0-0	3	3	ES (PE)

VERTICAL 7: DIVERSIFIED COURSES

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category
				L-T-P	TCP		
1	26RA007T	Linear Integrated Circuits	T	3-0-0	3	3	ES (PE)
2	26RA014T	Single Board Computers	T	3-0-0	3	3	ES (PE)
3	26RA021T	Reliability and Maintenance Engineering	T	3-0-0	3	3	ES (PE)
4	26RA028T	Integrated Product Development	T	3-0-0	3	3	ES (PE)
5	26RA035T	Medical Mechatronics	T	3-0-0	3	3	ES (PE)
6	26RA042T	Micro Electro Mechanical Systems	T	3-0-0	3	3	ES (PE)

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LIST OF OPEN ELECTIVE COURSES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

S. No.	Course Code	Course Name	Course Type	Periods/Week		Credits	Category L-T-P
				L-T-P	TCP		
1	26RA901T	Sustainable Manufacturing	T	3-0-0	3	3	OE
2	26RA902T	Introduction to Non-Destructive Testing	T	3-0-0	3	3	OE
3	26RA903T	Introduction to PLC Programming	T	3-0-0	3	3	OE
4	26RA904T	Project Report Writing	T	3-0-0	3	3	OE
5	26RA905T	Production Planning and Control	T	3-0-0	3	3	OE
6	26RA906T	Industrial Hygiene	T	3-0-0	3	3	OE
7	26RA907T	Introduction to Industrial Automation Systems	T	3-0-0	3	3	OE
8	26RA908T	Industrial Safety	T	3-0-0	3	3	OE

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Semester – I

26MAC01T	Applied Calculus (Common to all Branches)	Category	L	T	P	C
		BS	3	1	0	4

Prerequisites:

- Fundamental knowledge of Algebra, Functions, Trigonometry, Differentiation and basic Integration.

Course Objectives:

- To provide a strong foundation in differential and integral calculus for Engineering applications.
- To develop analytical skills in solving functions of several variables and optimization problems.
- To enable students to apply integral calculus concepts in computing arc length, area and surface area.
- To introduce multiple integrals and their evaluation in Cartesian, polar, cylindrical and spherical coordinate systems.

Differential Calculus

Functions and graphs - New functions from old functions - Limit of a function - Continuity - Limits at infinity - Derivative as a function - Differentiation rules - Maxima and minima of functions of a single variable - Mean value theorem - Effect of derivatives on the shape of a graph- Applications.

Activities: Open-source Software: Visualization of the functions, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Functions of several variables

Partial derivatives - Higher-order partial derivatives - Total derivative - Chain rule - Taylor's formula for functions of two variables - Maxima and minima of functions of two variables - Method of Lagrange multipliers - Engineering applications.

Activities: Open-source Software: Partial Derivatives with two or three variables, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Integral Calculus

Fundamental theorem of calculus - Indefinite integrals and the net change theorem - Techniques of integration - Improper integrals - Arc length - Area of a plane region - Area of a surface of revolution - Applications.

Activities: Open-source Software: Definite and Indefinite Integrals, Determination of Area, Solving of Competitive Examination questions (Ex. GATE).

Multiple Integrals

Double integrals - Iterated integrals and Fubini's theorem - Change of order of integration - Change of variables: Cartesian to polar coordinates - Triple integrals - Change of variables:

Cartesian to cylindrical and spherical coordinates - Engineering applications. **Activities:** Open-source Software: Double integrals and triple integrals using open-source software, Solving of Competitive Examination questions (Ex. GATE).
Total periods (L: 45; T: 15): 60
Text Books: 1. Grewal, B. S. (2017). Higher Engineering Mathematics. Khanna Publishers. 44th Edition. 2. Kreyszig, E. (2016). Advanced Engineering Mathematics. John Wiley & Sons. 10th Edition. **Reference Books:** 1. K Kandasamy, K Thilagavathy and K Gunavathy K (2026). Engineering Mathematics. S. Chand Publishing. 2. Anton, H., Bivens, I. C., & Davis, S. (2012). Calculus: Early Transcendentals. John Wiley & Sons. 10th Edition. 3. Larson, R., & Falvo, D. C. (2013). Calculus: An Applied Approach. Cengage Learning. 9th Edition. 4. Stewart, J., Clegg, D., & Watson, S. (2021). Calculus: Early Transcendentals. Cengage Learning. 9th Edition. 5. Thomas, G. B., Weir, M. D., Hass, J., & Heil, C. (2018). Thomas' Calculus: Early Transcendentals. Pearson Education. 14th Edition. 6. Singh, K. (2019). Engineering Mathematics through Applications. Bloomsbury Publishing. 2nd Edition.

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Apply the concepts of limits, continuity and differentiation to analyze the behaviour of single-variable functions and solve optimization problems.
CO2	Apply partial differentiation, Taylor's expansion and the method of Lagrange multipliers to solve optimization problems involving functions of several variables.
CO3	Evaluate definite and improper integrals and apply them to compute arc length, plane area and surface area of revolution.
CO4	Evaluate double and triple integrals using appropriate coordinate systems and apply them to Engineering problems.

26ENC01T	English Essentials – I (Common to all Branches)	Category	L	T	P	C
		HUM	2	0	0	2

Prerequisites:

- Basic knowledge on English communication skills (writing, speaking, reading and listening).

Course Objectives:

- To improve Listening and Pronunciation Skills.
- To develop effective verbal and non-verbal skills.
- To enhance Reading and Comprehension abilities.
- To develop Professional Writing Skills.

Listening & Pronunciation Skills

Listening to academic and workplace conversations - Recorded interview - Pronunciation drills: Stress, Intonation, Phonetics basics - Accent neutralization - Listening comprehension tasks.

Grammar: Introduction to Parts of Speech, Word Syllable, Synonyms & Antonyms.

Activities: Audio Exercises, Minimal Pair Practice, Listening Tests.

Basic Grammar and Communication

Self-introduction: Formal, Informal - Making requests and giving instructions - Expressing opinions and ideas - Conversation.

Grammar: Articles, Tenses, Subject Verb & Agreement, Phrasal Verbs, Collocations, Word Formation, One Word Substitution.

Activities: Self-Introduction, Listen Short Podcasts, Just A Minute (JAM) Video Recording, Situational Role Plays, Spell Bee, Group Discussion.

Reading and Language Skills

Reading strategies: Skimming, Scanning, Predicting - Intensive reading: Short passages, Long passages on suggested theme - Reading comprehension passages.

Grammar: Sentence Patterns, Prefixes and Suffixes, Idioms and Phrases, Prepositions - Gerunds - Conjunctions.

Activities: Reading - Newspaper and Digital Articles, Cloze, Reading Comprehension, Note Making and Summarising.

Written Communication

Discourse markers - Completing sentences - Jumbled sentences - Paragraph writing - Essay writing - Report writing.

Grammar: Active and Passive Voice - Direct and Indirect Questions - Wh-Questions - Yes/No Questions.

Activities: Describe a Product, Apply/Request for Internship Program, Listening and Repeating, Gap Filling Exercises, Note-Taking.

Total periods: 30

Reference Books:

1. Tiwari, A. (2022). Communication Skills in English.
2. Murphy, R. (2019). English Grammar in Use. Cambridge University Press. 5th Edition.
3. English Edge (2025). Speaking. Orient BlackSwan.
4. Sharma, S., & Mishra, B. (2024). Communication Skills for Engineers and Scientists. PHI Learning. 2nd Edition.

E - Resources:

1. Cambridge English - https://www.cambridgeenglish.org/learningenglish/grammar-and-vocabulary/
2. Perfect English Grammar - https://www.perfect-english-grammar.com/
3. British Council - Learn English - https://learnenglish.britishcouncil.org/grammar
4. SpSDhling - https://spSDhling.com/
5. mePro by Pearson - https://mepro.pearson.com/
6. TED Talks - https://www.ted.com/

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Demonstrate improved listening skills in academic and real-life contexts.
CO2	Use basic grammatical structures accurately in spoken communication.
CO3	Apply reading strategies to understand and interpret technical and professional texts.
CO4	Develop clear, coherent and professional writing skills.

26TLC01T	தமிழர் மரபு (Common to all Branches)	Category	L	T	P	C
		HUM	1	0	0	1

மொழி மற்றும் இலக்கியம்

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செம்மொழி இலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மை கருத்துக்கள் - தமிழ்க் காப்பியங்கள் - தமிழர்களின் சமண, பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம்: ஆழ்வார்கள், நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார், பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள் - பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத்தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள்: மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

தெருக்கூத்து - கரகாட்டம் - வில்லுப்பாட்டு - கணியான் கூத்து - ஒயிலாட்டம் - தோற்பாவைக் கூத்து - தமிழர்களின் வீர விளையாட்டுகள்: சிலம்பாட்டம், வளரி, புலியாட்டம், ஜல்லிக்கட்டு, கபடி, வழுக்குமரம்.

தமிழர்களின் திணைக் கோட்பாடுகள்

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம், புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும், துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி, இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள் – கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Total periods: 15

References:

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல்மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ், முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி, வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

26TLC01T	Heritage of Tamils (Common to all Branches)	Category	L	T	P	C
		HUM	1	0	0	1

Language and Literature

Language families in India - Dravidian languages - Tamil as a classical language - Classical literature in Tamil - Secular nature of Sangam literature - Distributive justice in Sangam literature - Management principles in Thirukkural - Tamil epics - Impact of Buddhism, Jainism in Tamil land - Bhakti literature: Azhwars, Nayanmars - Forms of minor poetry - Development of modern literature in Tamil - Contribution of Bharathiyar, Bharathidhasan.

Heritage - Rock Art Paintings to Modern Art - Sculpture

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 - Musical instruments: Mridangam, Parai, Veena, Yazh, Nadaswaram - Role of temples in social and economic life of Tamils.

Folk and Martial Arts

Therukoothu - Karagattam - Villu pattu - Kaniyan koothu - Oyilattam - Leather puppetry - Sports and games of Tamils: Silambattam, Valari, Tiger dance.

Thinai Concept of Tamils

Flora and fauna of Tamils - Aham, Puram concepts from Tholkappiyam and Sangam literature - Aram concept of Tamils - Education and literacy during Sangam age - Ancient cities, ports of Sangam age - Export, import during Sangam age - Overseas conquest of Cholas.

Contribution of Tamils to Indian National Movement and Indian Culture

Contribution of Tamils to Indian freedom struggle - Cultural influence of Tamils over other parts of India - Self-respect movement - Role of Siddha medicine in indigenous systems of medicine - Inscriptions, manuscripts - Print history of Tamil books.

Total periods: 15

References:

1. தமிழர் வரலாறு - மக்கள் பண்பாடு - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணியன் பூங்குன்றன் - முதன்மை நூல் - இல. சுந்தரம் (விடியல் பதிப்பகம்).
3. தமிழ் - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr. K.K. Pillay) - A joint publication of TNTB & ESC and RMRL - (in print).
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by:

International Institute of Tamil Studies).
9. Keeladi - Sangam City Civilization on the banks of river Vaigai (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) - Reference Book.

26MEC02T	Introduction to Mechanical Engineering (Common to Mechanical & RAE)	Category	L	T	P	C
		ES (PC)	2	1	0	3

Prerequisites:

- Basic understanding of Physics (mechanics, heat, and energy)
- Elementary Mathematics (units, dimensions, and algebra)
- General awareness of engineering and technology

Course Objectives:

- To introduce the scope and evolution of Mechanical Engineering.
- To impart fundamental concepts of mechanics, materials, and energy systems.
- To provide basic knowledge of machine elements and their applications.
- To familiarize students with manufacturing processes and modern techniques.
- To develop awareness of professional ethics, safety, and engineering practices.

Engineering: History and Evolution of Mechanical Engineering – Basic Mechanical Engineering Principles: Force, Motion, Energy, Work, Power – Units and Dimensions – SI System – Ethics and Professionalism in Engineering.

Activities: Interactive quiz, Conversion between SI and other unit systems.

Mechanics of Materials and Structures: Stress and Strain – Types of Stresses: Tensile, Compressive, Shear – Elasticity and Plasticity – Mechanical Properties of Materials: Strength, Toughness, Hardness – Introduction to Bending, Torsion, Axial Loading – Simple Structural Analysis, Design Concepts.

Activities: Demonstration of Simple truss or beam problems solved using software.

Energy Interactions: System – Energy Transfer – Modes of Heat Transfer: Conduction, Convection, Radiation – Working Principle of Heat Engines – Refrigeration, HVAC Systems.

Activities: Demonstration of working model of internal combustion engine & refrigerator, Virtual demonstration of Thermodynamic cycles.

Machine Elements: Gears, Bearings, Shafts, Fasteners, Couplings – Selection of Machine Components – Quality Control, Safety in Mechanical Engineering.

Activities: Demonstration of working of Gears, bearings, etc. in a mechanical system.

Manufacturing Processes: Casting, Forming, Machining, Joining Processes – CNC, Additive Manufacturing – Overview of Smart Manufacturing.

Activities: Demonstration of various machining processes, 3D printing of simple parts.

Total periods: 45

Text Books:

1. Wickert, J., & Lewis, K. (2022). An Introduction to Mechanical Engineering (4th Edition). Cengage Learning.
2. Rajput, R. K. (2021). Fundamentals of Mechanical Engineering. Laxmi Publications.
3. Kalpakjian, S., & Schmid, S. (2020). Manufacturing Engineering and Technology (8th Edition). Pearson.

Reference Books:

1. Shigley, J. E. (2019). Mechanical Engineering Design. McGraw Hill.
2. Çengel, Y. A., & Boles, M. A. (2020). Thermodynamics: An Engineering Approach. McGraw Hill

E-Resources:

1. MIT OpenCourseWare – Mechanical Engineering https://ocw.mit.edu
2. PhET Simulations – University of Colorado Boulder
3. https://phet.colorado.edu
4. LibreTexts Engineering https://eng.libretexts.org

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Explain the scope, evolution, and fundamental principles of mechanical engineering, including force, motion, energy, work, and power.
CO2	Apply basic concepts of stress, strain, and material properties to understand simple mechanical structures and components.
CO3	Describe energy transfer mechanisms and the working principles of heat engines, refrigeration, and HVAC systems.
CO4	Identify and explain the functions of common machine elements and their role in mechanical systems with consideration of safety and quality.
CO5	Illustrate basic manufacturing processes, including conventional and modern techniques such as CNC and additive manufacturing.

26CYC02L	Engineering Chemistry (Common to Mechanical & RAE)	Category	L	T	P	C
		BS	2	0	2	3

Prerequisites:

- Basic knowledge of Chemistry (atomic structure, reactions)

Course Objectives:

- To learn about water sources, impurities, quality, boiler problems, and basic water treatment methods.
- To understand types of corrosion, factors affecting and methods of protection.
- To learn about fuels, combustion, lubricants and their practical applications.
- To understand phase rule and phase diagrams, composites and its applications.
- To understand batteries and various modern energy storage systems.

Water Technology

Water – sources and impurities – water quality parameters - boiler feed water – requirements – troubles (scale & sludge, boiler corrosion). Water treatments: ion-exchange process, zeolite and desalination (RO) – internal water treatments – calgon, colloidal, and phosphate.

Practical:

1. Determination of Hardness by EDTA Method.
2. Determination of DO by Winkler Method.

Corrosion science and surface protection

Introduction to corrosion, chemical corrosion, electrochemical corrosion, soil corrosion, pitting corrosion, water line corrosion, stress corrosion – galvanic series – factors influencing corrosion – electrochemical protection: Sacrificial anodic protection, impressed current cathodic protection – protective coatings: Metallic coatings: galvanizing, tinning, organic coatings: Paints

Practical:

3. Corrosion study by weight loss, salt spray method.
4. Estimation of iron using potentiometer.

Fuels and Combustion

Fuels-classification of fuels, calorific value, determination – combustion principles: Reaction kinetics, air fuel ratio, knocking – hydrogen combustion – flue gas analysis – lubricants: Types, functions, key properties, synthetic lubricants, mechanisms, emerging lubricants: Bio lubricants, applications.

Practical:

5. Proximate analysis of coal.
6. Determination of viscosity using Oswald viscometer.

Phase Rule and Composites

Phase rule: introduction, definition of terms, examples – one component system: Water system – reduced phase rule: lead silver system – thermal analysis – composites: Classification, role of matrix, reinforcements, polymer reinforced composites, metal composites, ceramic

composites, applications.

Practical:

7. Study of one component system (water system) – cooling curve
8. Preparation of polymer composite (simple composite)

Batteries and Fuel Cells

Batteries: battery pack, battery materials, testing, safety aspects – types of batteries: Primary battery: dry cell, Secondary battery: lead acid battery, lithium-ion battery – Hydrogen energy: H_2-O_2 fuel cell – supercapacitors: Sodium ion, lithium ion, applications.

Practical:

9. Designing a battery and determination of its characteristics.
10. Measurement of Emf and internal resistance of a battery

Total periods: 45

Text books:

1. Jain, P.C. and Jain, M., 2015. Engineering chemistry, 17th edition, Dhanpat rai publishing company (p) ltd., New Delhi.
2. Shashi Chawla, 2022. A Text book of Engineering chemistry, 6th edition, Dhanpat rai & co., New Delhi.
3. Sivasankar, b., 2018. *Engineering chemistry*, Tata Mcgraw-Hill Education (India) Pvt. Ltd., New Delhi.

Reference books:

1. Palanna, O.G., 2017. Engineering chemistry, Mcgraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Bagotsky, V.S., Skundin, A.M. and Volfkovich Y.V.M., 2015. Electrochemical power sources: batteries, fuel cells and supercapacitors, John Wiley & sons inc.
3. Gowarikar, V.R., Viswanathan, N.V. and Sreedhar, J., 2011. Polymer science, New Age International (P) Ltd., New Delhi.
4. Agarwal, S., 2019. Engineering chemistry: Fundamentals and Applications, 2nd edition, Cambridge University Press, Delhi.
5. Vogel's textbook of quantitative chemical analysis, 8th edition, 2014.

E-resources:

1. Electrochemical energy systems (prof. S. Mitra, IIT madras) – https://nptel.ac.in/courses/113106028
2. Chemistry of battery systems (prof. V. R. Marathe, IIT madras) – https://nptel.ac.in/courses/115106130

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Explain water quality parameters, boiler issues, and apply appropriate water treatment methods.
CO2	Describe types of corrosion and recommend suitable prevention and protection techniques.
CO3	Illustrate fuel properties, combustion principles, and select suitable lubricants for applications.
CO4	Interpret phase diagrams and explain the structure and applications of composite materials.
CO5	Explain battery systems, fuel cells, and modern energy storage technologies for practical use.

26PHC03L	Engineering Physics (Common to Mech, RAE)	Category	L	T	P	C
		BS	2	0	2	3

Prerequisites:

- Basic knowledge of physics at higher secondary level.
- Fundamentals of mathematics (calculus and algebra).
- Basic understanding of mechanics and wave motion.

Course Objectives:

- To provide a strong foundation in the mechanical and thermal properties of matter relevant to engineering structures.
- To develop an understanding of oscillations, wave phenomena and ultrasonic applications in engineering.
- To introduce applied optics, fiber optics, and laser technologies with emphasis on engineering and communication systems.
- To study the magnetic and dielectric properties of materials and their applications in mechanical and robotic systems.
- To explain the principles of electromagnetic waves, Maxwell's equations, and their role in modern communication technologies.

Properties of Matter and Thermal Physics

Elasticity: Stress-strain – Elastic moduli - Young's modulus: non-uniform bending method – cantilever – Griders: I, U, T shaped griders in engineering structures and applications - Viscosity - Stokes' method - surface tension - drop weight method - applications in engineering - thermal expansion - thermal stress - bimetallic strips and expansion joints - Thermal conductivity: Transient plane source method, Transient line source method, conduction through compound media.

Practical:

1. Measurements - Vernier callipers, Screw gauge, Travelling microscope and other measurements.
2. Determination of Young's modulus of the material - Uniform Bending - Using digital scales.
3. Determination of moment of inertia of a rigid body -Torsional pendulum - Digital Set Up.
4. Determination of viscosity – drop weight method.

Oscillations and Waves

Simple harmonic motion: Differential equation - Torsional pendulum - damped and forced oscillations - resonance phenomena - Wave motion on stretched strings, energy and power of waves, standing waves - Ultrasonics waves - piezoelectric method - engineering applications of ultrasonic waves.

Practical:

5. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer/Acoustic Grating.
6. Determination of Thickness of a thin wire – Air wedge method.

Applied Optics and Lasers

Interference: Air wedge method - Michelson interferometer - Fiber optics: structure, fiber optic communication system - Fiber sensors: displacement, pressure and temperature sensor - Lasers: Stimulated and spontaneous process, pumping methods, Nd:YAG, CO_2 and Rhodamine dye lasers with applications.

Practical:

7. Determination of wavelength and divergence angle of laser using diffraction grating.

Magnetic and Dielectric Properties of Materials

Magnetic materials: Basic parameters – Dia, para, ferrro, anti-ferro and ferromagnetic materials – Hysteresis (B-H) curve – Soft and hard magnetic materials: Properties and applications – Magnetic levitation.

Dielectric materials: Properties of dielectric materials – polar and non-polar dielectrics – polarisation and types – local field derivation – Clausius-Mossotti equation – ferro-electricity, piezo-electricity and applications (qualitative) – applications of dielectric materials.

Practical:

8. Hysteresis curve – Determination of energy loss of a coil.

Electromagnetic Waves

Properties of EM waves - Maxwell's equations - Production of electromagnetic waves by dipole antenna - Propagation of EM waves in free space and dielectric medium - Cell phone transmission and reception.

Total periods (L + P): 60

Text Books:

1. Mathur, R. S., & Chand, S. (2012). Properties of matter. S. Chand & Co.
2. Avadhanulu, M. N., & Kshirsagar, P. G. (2022). Engineering physics. S. Chand Publishing.
3. Rajendiran, V. (2023). Engineering physics. Tata McGraw-Hill.
4. Malik, & Singh. (2018). Engineering physics. Tata McGraw-Hill.
5. Han, & Wright. (2020). Experimental method in heat transfer and fluid mechanics. CRC Press.

Reference Books:

1. Bhattacharya, D. K., & Tandon, P. (2024). Engineering physics (2nd ed.). Oxford University Press.
2. Wiley Editorial Team. (2022). Engineering physics (As per AICTE model curriculum). Wiley India.
3. Halliday, D., Resnick, R., & Walker, J. (2023). Fundamentals of physics (11th ed.). Wiley.
4. Griffiths, D. J. (2017). Introduction to electrodynamics (4th ed.). Cambridge University Press.
5. Kittel, C. (2005). Introduction to solid state physics (8th ed.). Wiley.

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Analyze elasticity, viscosity, surface tension, thermal expansion, and conductivity, and apply these concepts to engineering structures and thermal systems.
CO2	Solve problems related to oscillations and wave motion, and apply ultrasonic techniques in mechanical and robotics applications.
CO3	Demonstrate knowledge of interference, fiber optics, and laser systems, and utilize them in sensing and communication applications.
CO4	Explain the properties of magnetic and dielectric materials, interpret hysteresis behavior, and apply piezoelectric and ferroelectric concepts in engineering and robotics.
CO5	Apply Maxwell's equations to understand electromagnetic wave propagation, and evaluate their applications in antenna systems, cell phone transmission, and reception.

26MEC01L	Engineering Drawing (Common to AI&DS, BME, CIVIL, CSE, EEE, IT, Mechanical and R&A)	Category	L	T	P	C
		ES (G)	2	0	2	3

Prerequisites:

- Basic knowledge of geometry, including lines, angles, circles and simple shapes.
- Familiarity with basic mathematical concepts such as measurements, proportions and scaling.
- Basic computer literacy for operating CAD software and handling digital drawing tools.

Course Objectives:

- To impart knowledge on dimensions and drawing standards.
- To explore the orthographic projection of lines and solids.
- To provide the understanding of orthographic, isometric and perspective views.

Fundamentals

Drawing instruments, Drawing standards (BIS), Lettering in engineering, Sheet layout, elements of dimensioning, Systems of dimensioning. Free hand sketching of 2D & 3D objects, Conics – Ellipse, Parabola and Hyperbola.

Activities: Virtual Demonstration of Conics and Cycloids.

Orthographic Projection

First angle projection, Projection of points, straight lines and planes.

Projection of Solids

Projection of Simple Solids when the axis is inclined to one reference plane.

Activities: Development of models of various solids and virtual demonstration of sectioning and development of Surfaces. CAD modelling of 2D objects.

Isometric Projection

Isometric Scale, Projection of Simple solids.

Activities: Conversion of 3D into 2D orthographic views, CAD modelling of 3D objects.

Perspective Projection

Simple solids projection.

Activities: Virtual demonstration of perspective views.

Project: Development of 2D objects and 3D objects using CAD tools.

Total Periods (L: 30; P:30): 60

Reference Books:

1. Natarajan, K. V. (2025). A Text Book of Engineering Graphics. Dhanalakshmi Publisher.
2. K. Venugopal and V. Prabhu Raja (2022). Engineering Drawing with AutoCAD. New Age International Publishers. 6th Edition.

E–Resources:

1. CAD Software – https://www.freecadweb.org/
2. Engineering Drawing and Computer Graphics, Prof. Rajaram Lakkaraju (IIT Kharagpur) – https://onlinecourses.nptel.ac.in/noc22_me105/preview

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Apply standard drawing practices, including BIS conventions, lettering, dimensioning and sheet layout, in engineering drawings.
CO2	Construct and interpret freehand sketches and conic sections (ellipse, parabola, hyperbola) for basic engineering applications.
CO3	Develop orthographic projections of points, lines, planes and simple solids using first–angle projection methods.
CO4	Create isometric and perspective projections of simple solids and convert between 2D and 3D representations.
CO5	Utilize CAD tools to model and visualize 2D and 3D objects.

26CSC02L	Python Programming (Common to Mechanical, RAE & BME)	Category	L	T	P	C
		ES (G)	2	0	2	3

Prerequisites:

- Basic understanding of mathematics, including arithmetic operations and logical reasoning.
- Familiarity with high school-level problem solving and analytical thinking.
- Basic knowledge of computer fundamentals such as input/output devices, memory, and operating systems.
- Ability to follow step-by-step instructions and logical sequences.
- No prior programming knowledge is required; however, exposure to any programming language is an added advantage.

Course Objectives:

- To understand the fundamentals of computational thinking and algorithmic problem-solving techniques.
- To learn the basics of Python programming including data types, expressions, and statements.
- To develop the ability to use control flow constructs and functions for solving problems.
- To familiarize students with Python data structures for effective data organisation and manipulation.
- To enable understanding of file handling, exception handling, and modular programming in Python.

Computational Thinking and Problem Solving

Introduction to Python – Features – Compiler vs interpreter – Computational thinking: Identification of computational problems, Problem decomposition, Abstraction, Pattern recognition – Algorithms: Definition, Characteristics, Representation, Complexity – Notations: Pseudocode, Flowcharts, Programming languages – Building blocks of algorithms: Statements, State, Control flow, Functions – Algorithm efficiency, Optimization – Algorithmic problem-solving techniques – Strategies for developing algorithms: Iteration, Recursion

Illustrative Problems:

- Find minimum in a list.
- Insert a card in a sorted list.
- Guess an integer in a range.
- Towers of Hanoi.

Data Types, Expressions and Statements

Python interpreter, Interactive mode – Debugging techniques, Common error types – Values, data types: Integer, Float, Boolean, String, List, Tuple, Dictionaries – Variables, Assignment statements – Expressions, Statements – Tuple assignment, Multiple assignment – Operator precedence, Associativity – Comments, Documentation – Input statements, Output statements.

Illustrative Programs:

- Exchange the values of two variables.

- Circulate the values of n variables.
- Compute distance between two points.

Control Flow, Functions and Strings

Boolean values, Logical operators – Conditional statements: Simple if, If-else, If-elif-else, Nested conditionals – Iteration constructs: While loop, Infinite while loop, For loop, Nested loops, Break, Continue, Pass statements – Functions: Definition, Parameters, Arguments, Return values, Function call, Local scope, Global scope, Function composition, Recursion, Built-in functions, User-defined functions, Lambda functions – Strings: Indexing, Slicing, Immutability, String operations, String methods, String module, String iteration – Lists: Lists as arrays.

Illustrative Programs:

- Square root computation.
- GCD using iteration and recursion.
- Exponentiation.
- Sum of an array of numbers.
- Linear search and binary search.

Lists, Tuples, Sets and Dictionaries

Lists: Operations, Indexing, Slicing, Traversal, Mutability, Aliasing, Cloning, Passing lists as parameters, Nested lists – Tuples: Creation, Operations, Tuple assignment, Tuples as return values – Dictionaries: Creation, Operations, Accessing elements, Updating elements, Deleting elements, Dictionary methods – Sets: Creation, Built-in set function, Unordered nature, Unindexed nature, Mutability, Set manipulation, Frozen sets, Typecasting objects, Set methods – Advanced list processing: List comprehension.

Illustrative Programs:

- Simple sorting algorithms.
- Histogram.
- Student marks statement.
- Retail bill preparation.

Files, Modules and Exceptions

File handling: Creation, Text files, File modes, Reading files, Writing files, Format operator, File manipulation – Command line arguments – Exceptions: Types of errors, Exception handling: Try-except-finally, Raising exceptions, Handling multiple exceptions – Modules, packages: Importing modules, Creating modules, Working with packages – CSV file handling: Introduction.

Illustrative Programs:

- Word count from a file.
- Copy file content.
- Voter's age validation.
- Marks range validation (0–100).

Total periods (L): 30

List of Experiments:

1. Implement and trace algorithms using pseudocode and flowcharts for engineering problems (e.g., finding minimum in a list, Towers of Hanoi).
2. Implement iterative solutions: find GCD, compute exponentiation, sum of n numbers.
3. Implement recursive solutions: factorial, Fibonacci series, and Towers of Hanoi.
4. Write Python programs using different data types, variables, and input/output operations with type conversion.
5. Evaluate arithmetic and logical expressions; demonstrate operator precedence and associativity.
6. Develop programs using conditional statements: exchange values of two variables, circulate n variables, find the largest among three numbers.
7. Implement looping constructs (for, while, break, continue, pass): compute sum of a series, print patterns, and perform linear search.
8. Implement binary search and sorting algorithms using loops and conditionals.
9. Develop user-defined functions with parameters and return values; demonstrate local and global scope.
10. Implement string operations: slicing, immutability, built-in string methods, and string module functions.
11. Perform operations on lists: traversal, slicing, aliasing, cloning, and nested lists; simulate arrays.
12. Implement list comprehension and advanced list processing; prepare a student marks statement and histogram.
13. Perform tuple and set operations: creation, assignment, manipulation, frozen sets, and typecasting.
14. Perform dictionary operations: creation, update, deletion, traversal, and methods; prepare a retail bill.
15. Implement file handling and exception handling: read/write text files, handle multiple exceptions using try-except-finally, and work with CSV files.

Total periods (P): 30

Total periods (L + P): 60

Text Books:

1. Allen B. Downey (2024). Think Python: How To Think Like A Computer Scientist. O'Reilly Media. 3rd Edition.
2. Eric Matthes (2023). Python Crash Course: A Hands-On, Project-Based Introduction to Programming. No Starch Press. 3rd Edition.

Reference Books:

1. Mark Lutz (2013). Learning Python. O'Reilly Media. 5th Edition.
2. John Zelle (2016). Python Programming: An Introduction To Computer Science. Franklin, Beedle & Associates. 3rd Edition.
3. Harsh Bhasin (2022). Python Programming Using Problem Solving. Mercury Learning and Information.

4. Guido van Rossum et al. (n.d.). Python 3 Official Documentation. Python Software Foundation. https://docs.python.org

E-Resources:

1. NPTEL – Programming, Data Structures and Algorithms Using Python by Prof. Madhavan Mukund, IIT Madras — nptel.ac.in
2. GitHub – Think Python Interactive Jupyter Notebooks by Allen B. Downey — allendowney.github.io/ThinkPython
3. docs.python.org – Python 3 Official Tutorial and Documentation by Python Software Foundation — docs.python.org/3/tutorial
4. W3Schools – Python Tutorial with Interactive Code Editor for Beginners — w3schools.com/python

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Understand the fundamentals of computational thinking, algorithm design, and Python program structure including data types, variables, expressions, and operators.
CO2	Develop Python programs using conditional statements, looping constructs, and string operations to solve computational problems,
CO3	Apply functions including user-defined, built-in, recursive, and lambda functions to implement modular and reusable Python programs.
CO4	Implement Python data structures such as lists, tuples, sets, and dictionaries using advanced techniques like list comprehension to 37rganize and manipulate data.
CO5	Design Python programs involving file handling, exception handling, modules, and packages for robust and real-world applications.

Approved by
Academic Council Meeting
No.: 01 Dated: 21.4.26

Recommended by
Board of Studies of RAE Dept.
Meeting No.: 01 Dated: 27.3.26

Semester – II

26MAC02T	Linear Algebra (Common to AI&DS, CSE, IT, Mech. and R&A)	Category	L	T	P	C
		BS	3	1	0	4

Prerequisites:

- Basic knowledge of matrices and systems of linear equations.

Course Objectives:

- Understand the structure of vector spaces and analyze subspaces, linear combinations, span, basis and dimension.
- Examine linear transformations by computing null space, range, matrix representations, eigenvalues, eigenvectors and determining diagonalizability.
- Apply concepts of inner product spaces including norms, orthogonality, Cauchy–Schwarz inequality and Gram–Schmidt orthogonalization.
- Perform matrix decompositions such as diagonalization of symmetric matrices, QR decomposition and Singular Value Decomposition (SVD) and solve least squares problems.

Vector Spaces

Introduction to vector spaces, examples - subspaces - linear combinations - span, generating sets - linear dependence, linear independence - basis - dimension, dimension of subspaces.

Activities: Open-Source software: Exercises to test linear dependence and independence using rank, compute span and basis of a set of vectors, determine the dimension of subspaces and illustrate the concept of subspace and basis in R^2/R^3 with visualization.

Linear Transformations and Diagonalization

Linear Transformations: Null space, range, dimension theorem (statement only) matrix representation of a linear transformation - Eigen values, Eigen vectors, diagonalizability.

Activities: Open-Source software: Exercises to compute the matrix representation of a linear transformation, find the null space and range of a matrix and compute Eigen values and Eigen vectors of a matrix.

Inner Product Spaces

Inner Product Spaces: Inner product, norms, Cauchy Schwarz inequality, triangle inequality – Orthogonalization: Gram Schmidt orthogonalization, simple problems up to R^3.

Activities: Open-Source software: Exercises to compute inner products and vector norms.

Matrix Decomposition

Matrix Transformations: Orthogonal transformation of a symmetric matrix to diagonal form, positive definite matrices – Decompositions: QR decomposition, singular value decomposition (SVD) - Least Squares: Least squares solutions, simple problems up to R^3.

Activities: Open-Source software: Exercises to check if a matrix is positive definite, perform QR decomposition and SVD using built-in functions.

References:

1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). Linear algebra. Pearson.
2. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). Linear algebra and its applications with

MATLAB. Pearson.
3. Bronson, R. (2011). Schaum's outline of matrix operations. McGraw-Hill Education.
4. Strang, G., & Thomson, R. (2005). Linear algebra and its applications. Brooks/Cole.
5. Lipschutz, S., & Lipson, M. (2009). Schaum's outline of linear algebra. McGraw-Hill.
6. Kreyszig, E. (2018). Advanced engineering mathematics. Wiley India.

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Understand and apply the fundamental concepts of vector spaces, including subspaces, span, linear dependence/ independence, basis and dimensions.
CO2	Analyze linear transformations by computing null space, range, matrix representation, Eigen values and Eigen vectors and determining diagonalizability.
CO3	Apply inner product space concepts to compute norms, verify inequalities and construct orthonormal bases using Gram-Schmidt orthogonalization.
CO4	Use matrix decomposition techniques (orthogonal diagonalization, QR, SVD) and least squares methods to analyze matrices using open-source computational tools.

26TLC02T	தமிழர்களும் தொழில்நுட்பமும் (Common to all Branches)	Category	L	T	P	C
		HUM	1	0	0	1

நெசவு மற்றும் பானைத் தொழில்நுட்பம்

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு, சிவப்பு பானைகள் மற்றும் கீறல் குறியீடுகள்.

வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

சங்க காலத்தில் வடிவமைப்பு, கட்டுமானங்கள் - சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகற்களும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்கள், கோவில்கள் - சோழர் காலத்து பெருங்கோயில்கள், பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல் - மதுரை மீனாட்சி அம்மன் ஆலயம், திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னை இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

உற்பத்தித் தொழில் நுட்பம்

கப்பல் கட்டும் கலை - உலோகியல் - இரும்புத் தொழிற்சாலை - இரும்பு உருக்குதல் - எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு, தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - மணிகள்: கல்மணிகள், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்

அணை - ஏரி - குளங்கள் - மதகு - சோழர் காலக் குமிழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்

அறிவியல் தமிழின் வளர்ச்சி - கணினித் தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம்: தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

Total periods: 15

References:

1. தமிழர் வரலாறு - மக்கள் பண்பாடு - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இள. சுந்தரம் (விகடன் பதிப்பகம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr. K.K. Pillay) - A joint publication of TNTB & ESC and RMRL - (in print).
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - Sangam City Civilization on the banks of river Vaigai (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) - Reference Book.

26TLC02T	Tamils and Technology (Common to all Branches)	Category	L	T	P	C
		HUM	1	0	0	1

Weaving and Ceramic Technology

Weaving industry during Sangam age - Ceramic technology - Black, Red ware potteries (BRW) - Graffiti on potteries.

Design and Construction Technology

Designing, Structural construction of houses during Sangam age - Design in household materials during Sangam age - Building materials, Hero stones of Sangam age - Details of stage constructions in Silappathikaram - Sculptures, Temples of Mamallapuram - Great temples of Cholas, Other worship places - Temples of Nayaka period - Type study: Madurai Meenakshi temple - Thirumalai Nayakar mahal - Chettinad houses - Indo-Saracenic architecture at Madras during British period.

Manufacturing Technology

Art of ship building - Metallurgical studies - Iron industry - Iron smelting - Steel - Copper, Gold coins as sources of history - Minting of coins - Bead making industries: Stone beads, Glass beads, Terracotta beads, Shell beads, Bone beads - Archaeological evidences - Gemstone types described in Silappathikaram.

Agriculture and Irrigation Technology

Dam - Tank - Ponds - Sluice - Significance of Kumizhi thoompu of Chola period - Animal husbandry - Wells designed for cattle use - Agriculture, Agro processing - Knowledge of sea - Fisheries - Pearl, Conch diving - Ancient knowledge of ocean - Knowledge-based society.

Scientific Tamil & Tamil Computing

Development of scientific Tamil - Tamil computing - Digitalization of Tamil books - Development of Tamil software - Tamil virtual academy - Tamil digital library - Online Tamil dictionaries - Sorkuvai project.

Total periods: 15

References:

1. தமிழர் வரலாறு - மக்கள் பண்பாடு - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இள. சுந்தரம் (விகடன் பதிப்பகம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr. K.K. Pillay) - A joint publication of TNTB & ESC and RMRL - (in print).
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).

7. Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - Sangam City Civilization on the banks of river Vaigai (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) - Reference Book.

26MEC03T	Engineering Mechanics (Common to Civil, Mech. & RAE)	Category	L	T	P	C
		ES (PC)	3	1	0	4

Prerequisites:

- Basic knowledge of Physics (forces, motion, energy, and vectors).
- Understanding of Mathematics (algebra, trigonometry, and vector calculus basics).
- Familiarity with engineering drawing concepts.
- Fundamental problem-solving and analytical skills.

Course Objectives:

- Understand the fundamental concepts of force systems acting on particles and rigid bodies in two and three dimensions.
- Apply equilibrium principles using Free Body Diagrams to analyse engineering structures and mechanical systems.
- Compute centroids, moments of inertia and related geometric properties essential for structural and mechanical design.
- Analyse frictional forces in practical systems such as wedges, ladders, and belt drives encountered in everyday engineering.
- Apply Newton's laws of motion, work-energy and impulse-momentum principles to solve particle dynamics problems.

Statics of Particles: Resultant of Forces in a Plane – Equilibrium of a Particle in a Plane – Addition of Concurrent Forces in Space – Equilibrium of a Particle in Space.

Activities: Assignments and Quiz on resultant forces, Solving of GATE questions.

Statics of Rigid Bodies: Concept of Free Body Diagram – Equivalent Systems of Forces – Transmissibility – Moment of a Force: About a Point, About an Axis – Couples, Force-Couple Systems – Equilibrium of Rigid Bodies: Two Dimensions, Three Dimensions – Principle of Virtual Work.

Activities: Virtual demonstration of rigid bodies, Solving of GATE questions.

Moments of Inertia: First Moments of Areas, Lines – Centroids of Composite Areas, Lines – Theorems of Pappus-Guldinus – Second Moment of Area – Parallel Axis Theorem – Rectangular Moments of Inertia, Polar Moments of Inertia: Composite Areas – Radius of Gyration – Product of Inertia – Principal Axes, Principal Moments of Inertia – Mass Moments of Inertia: Thin Plates.

Activities: Virtual Simulation of Moment of Inertia, Principal Axes Determination, Solving of GATE questions.

Friction: Laws of Friction – Coefficients of Friction – Angles of Friction – Types of Friction Problems – Wedges, Ladder Friction – Belt Friction.

Activities: Virtual Demonstration of Friction in belts and pulleys, Solving of GATE questions

Dynamics of Particles: Introduction to Dynamics – Newton's Laws of Motion: Applications to Rectilinear Motion, Curvilinear Motion – D'Alembert's Principle – Work, Kinetic Energy: Work-Energy Theorem – Impulse, Momentum: Impact of Bodies.

Total Periods: 60

Text Books:

1. Hibbeler, R. C. (2023). Engineering mechanics: Statics and dynamics (15th ed.). Pearson Education.
2. Bansal, R. K. (2018) Engineering mechanics. Laxmi Publications.
3. Beer, F. P., Johnston Jr., E. R., & Mazurek, D. F. (2021). Vector mechanics for engineers (12th ed.). McGraw Hill.
4. Timoshenko, S. P., & Young, D. H. (2017). Engineering mechanics. McGraw Hill.

References:

1. Beer, F. P., Johnston Jr., E. R., DeWolf, J. T., & Mazurek, D. F. (2015). Mechanics of materials. McGraw-Hill Education.
2. Meriam, J. L., & Kraige, L. G. (2018). Engineering mechanics: Statics and dynamics. Wiley.
3. Pytel, A., & Kiusalaas, J. (2014). Engineering mechanics (Indian ed.). Cengage Learning India.

E-resources:

1. Moment of Inertia Calculator – https://skyciv.com/free-moment-of-inertia-calculator/
2. OpenStax – University Physics Volume 1 – https://openstax.org/books/university-physics-volume-1/pages/10-4-moment-of-inertia-and-rotational-kinetic-energy
3. Engineering Mechanics, Dr. Dwarakish. G. S. – https://onlinecourses.swayam2.ac.in/ntr24_ed75/preview

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Apply vector mechanics and equilibrium principles to solve engineering problems.
CO2	Construct and analyze free body diagrams for various mechanical systems.
CO3	Determine centroids, moments of inertia, and related properties of engineering components.
CO4	Evaluate frictional forces in practical applications such as wedges, ladders, and belts.
CO5	Solve problems in particle dynamics using Newton's laws, energy, and momentum methods.

26RA201T	Fluid Mechanics and Thermal systems	Category	L	T	P	C
		ES (PC)	3	0	0	3

Prerequisite:

- Proficiency in Vector Calculus (divergence/gradient) and Differential Equations to solve continuity and flow equations.
- A strong grasp of Classical Mechanics (force/motion) and basic Properties of Matter (density/viscosity) to understand fluid statics.
- Familiarity with the concepts of Heat, Work, and Energy to apply the First and Second Laws to thermal modelling.
- Basic knowledge of Sensors and Actuators to effectively design Pitot/Venturi-based motor cooling solutions.

Course Objective:

- To knowledge in Fluid Properties and Statics.
- To understand the concept of fluid kinematics and Dynamics.
- To learn about the flows in fluid, Viscous flows and flow through pipes.
- To understand the basics laws of thermodynamics.
- To understand the second law of thermodynamics and entropy.

Fluid properties and fluid statics

Fluid Definition and Classification – Properties of fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension – Fluid statics: Concept of fluid static pressure – Pascal‘s law –Absolute and Gauge pressures – Manometers: Types and Pressure measurement – Concept of Buoyancy and Floatation.

Fluid kinematics and fluid dynamics

Fluid Kinematics: Types of fluid flow – Continuity equation in two and three dimensions – Velocity and Acceleration of fluid particle – Velocity potential function and Stream function. Fluid dynamics: Euler's equation along a streamline –Bernoulli's equation and applications – Venturi meter, Orifice meter and Pitot tube.

Viscous flow, flow through pipes and dimensional analysis

Viscous flow: Shear stress, pressure gradient relationship – Flow of viscous fluid through circular pipe – Flow through pipes: Loss of head due to friction – Minor head losses – Hydraulic gradient and Total energy lines – Flow through pipes in series and in parallel – Power transmission through pipes. Dimensional analysis: Buckingham's theorem.

Basics of thermodynamics and first law of Thermodynamics

Thermodynamics – Microscopic and macroscopic point of view – Systems, properties, process, path, cycle. Thermodynamic equilibrium – Zeroth law of Thermodynamics – internal energy, enthalpy, specific heat capacities CV and CP, Relationship between CV and CP. First law of Thermodynamics – Application to closed and open systems – Steady Flow Energy Equation (SFEE) – Simple problems.

Second Law, Entropy, and Energy Efficiency

Second Law of thermodynamics – Kelvin Planck and Clausius Statements – Equivalents of Kelvin Planck and Clausius statements. Reversibility – Irreversibility, reversible cycle – Heat engine, heat pump and refrigerator. Carnot cycle and Clausius theorem, the property of entropy, the inequality of Clausius – Entropy principle – General expression for entropy – Simple problems in entropy.
Total Periods: 45
Text Books: 1. Bansal, r. k. (2025). A Textbook of Fluid Mechanics and Hydraulic Machines, (11th Ed.) 2. Yunus Çengel, John Cimbala, Afshin Ghajar. (2021). Fundamentals of Thermal-Fluid Sciences. **Reference Books:** 1. Anup Goel, Siddu Patil. (2021). Applied Thermodynamics 2nd Ed.). 2. Nag P.K., (2013). Engineering Thermodynamics‖, 5th Edition, Tata McGraw Hill Publishing Company, New Delhi. 3. Rajput R. K. (2022). Thermal Engineering (11th Ed.). 4. Meinhard T. Schobeiri . (2022). Advanced Fluid Mechanics and Heat Transfer for Engineers and Scientists.

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Calculate buoyancy and stability parameters for submersible robotic platforms.
CO2	Design and calibrate fluid-based sensors (Pitot/Venturi) for drone navigation.
CO3	Develop thermal management solutions for high-density robotic electronics and motors.
CO4	Evaluate the energy efficiency and entropy footprint of an automated robotic cell.
CO5	Solve the problems related to fluid and thermal systems.

26ENC02L	English Essentials - II (Common to all Branches)	Category	L	T	P	C
		HUM	1	0	2	2

Prerequisites:

- Fundamental communication skills required for academic and professional contexts.

Course Objectives:

- To enhance practical communication skills through lab-based activities.
- To train students in professional and workplace communication.
- To improve listening, presentation and teamwork skills.
- To equip students with essential skills for interviews and career readiness.

Communication Concepts

Types of communication: Verbal, Non-verbal, Written - Process of communication - Interpersonal, Intrapersonal communication - Barriers to communication - Ways to overcome barriers - Listening skills - Active listening.

Lab Activities: Listening practice using audio clips: Note-taking - Role-play: Formal, Informal communication - Group activity: Identify communication barriers in real-life cases - Short self-introduction: Record, Review - Think-pair-share discussions.

Business Correspondence

Email writing - Cover letter, Resume writing - LinkedIn, Profile building basics - SOP writing.

Lab Activities: Write professional emails: Leave request, Complaint, Enquiry - Resume preparation: ATS-friendly format - Cover letter drafting: Internships, Jobs - Peer review of resumes - Email etiquette - Email writing: Request for education loan, Internship, Placement - Spot-the-error in business email.

Presentation Skills

Public speaking techniques - Structuring a presentation - Body language, Voice modulation - Use of visual aids: PPT - Poster making - Use of AI tools.

Lab Activities: 2-3-minute speech on technical, General topics - PPT presentation - Mirror practice for confidence building - Record, Analyse student presentations - Body language activity: Gesture control, Posture.

Workplace Readiness

Interviews - Types of interviews - Preparing for interviews - Mock interviews - Group discussion - Types of GDs - Preparing for GD - Parameters used for evaluating GD - Telephone, Video call etiquette.

Lab Activities: Simulated job interview: Peer panel - 5-minute group discussion on a given topic - Picture-based non-verbal communication exercise.

Total periods (L: 15; P: 30): 45

Text Books:

1. Raman, M., & Sharma, S. (2008). Technical Communication: English Skills for Engineers. Oxford University Press.
2. Subhashini, B., et al. (2025). English for Technical Communication. RK Publications.

3. Ibbotson, M. (2008). Cambridge English for Engineering. Cambridge University Press.

E - Resources:

1. Cambridge English - https://www.cambridgeenglish.org/learningenglish/grammar-and-vocabulary/
2. Communication for Business Success-https://open.umn.edu/opentextbooks/textbooks/8
3. TED Talks - https://www.ted.com/
4. Speechling - https://speechling.com/
5. mePro by Pearson - https://mepro.pearson.com/

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Demonstrate improved listening and pronunciation skills.
CO2	Draft effective business emails, resumes and cover letters.
CO3	Deliver structured and impactful presentations.
CO4	Apply workplace communication skills including group discussion and interviews.

26EE202L	Basic Electrical and Electronics Engineering	Category	L	T	P	C
		ES (G)	2	0	2	3

Prerequisites:

- Basic knowledge of Physics, particularly electricity, magnetism, and simple circuits.
- Familiarity with fundamental mathematics, including algebra, basic trigonometry, and complex numbers.

Course Objectives:

- To understand basic electrical circuit concepts and AC/DC fundamentals.
- To understand power electronic devices and converters.
- To study electrical machines used in mechanical systems and industrial drives.
- To learn electric drives and speed control techniques used in automation.
- To introduce traction motors used in electric vehicles and modern mechanical systems.

Electrical Circuit Fundamentals

Charge, Current, Voltage, Power, Energy – Ohm's law – Kirchhoff's voltage, Current laws – DC circuit analysis – Sinusoidal voltage, Current – RMS, Average values – Power factor – Phasor representation – Simple AC circuits: RL, RC, RLC series circuits.

Analog Electronics and Power Devices

Semiconductor fundamentals – PN Junction diode, Zener Diode characteristics – Bipolar Junction Transistor: BJT – MOSFET – Power Electronic devices: SCR, TRIAC, IGBT – Rectifier circuits – Inverter basics, Applications in motor drives.

Electrical Machines

Principle of electromechanical energy conversion – DC motors: Construction, working principle, Types: Shunt, Series, Compound motors – Speed-torque characteristics – Starting, Braking methods.

Three-phase Induction motor – Construction, Working principle – Torque-speed characteristics – Applications in pumps, Compressors, Machine tools: Qualitative.

Electric Drives

Concept of electric drives – Advantages of electrical drives in mechanical systems – Speed control of DC motors – Fully controlled rectifier-fed DC drives – Four quadrant chopper drives: Qualitative approach.

Speed control of AC motors – Stator voltage control – V/f control – Slip power recovery schemes – Applications in industrial automation.

Traction Motors and EV Applications

Electric traction systems – Requirements of traction motors – Construction, working principle: BLDC motor, PMDC motor, PMSM motor, Switched Reluctance Motor: SRM – Comparison of traction motors – Applications in electric vehicles, Robotics: Qualitative.

Total periods (L): 30

List of Experiments:

1. Verification of ohms and Kirchhoff's Laws.
2. Load test on DC Shunt Motor.
3. Load test on three Phase Induction Motor.
4. Speed control of PMDC Motor.
5. Speed Control of SRM Motor.
6. V-I characteristics of Zener and P-N junction diode.
7. V-I Characteristics of SCR and TRIAC.
8. Characteristics of BJT in CE configuration.

Total periods (P): 30

Total periods (L + P): 60

Text Books:

1. Hayt, W. H., Kemmerly, J. E., Phillips, J. D., & Durbin, S. M. (2023). Engineering circuit analysis (10th ed.). McGraw Hill.
2. Kothari, D. P., & Nagrath, I. J. (2020). Basic electrical and electronics engineering (2nd ed.). McGraw Hill Education, New Delhi.
3. Boylestad, R. L., & Nashelsky, L. (2015). Electronic devices and circuit theory (11th ed.). Pearson Education.
4. Dubey, G. K. (2010). Fundamentals of electrical drives (2nd ed.). Narosa Publishing House.

References:

1. Alexander, C., & Sadiku, M. (2021). Fundamentals of electric circuits. Tata McGraw Hill, New Delhi.
2. Mittal, V. N., & Mittal, A. (2017). Basics of electrical engineering. Tata McGraw Hill, New Delhi.
3. Ali, W. H., Abood, S. I., & Sadiku, M. N. O. (2019). Fundamentals of electric machines. CRC Press, New York.
4. Boylestad, R. L., & Nashelsky, L. (2013). Electronic devices and circuit theory. Pearson, New Delhi.

COURSE OUTCOMES	
CO1	Apply Ohm's Law, Kirchhoff's Laws, and phasor methods to analyze DC and AC electrical circuits.
CO2	Analyze the characteristics of semiconductor devices, power electronic devices such as SCR, TRIAC, IGBT, and design basic rectifier and inverter circuits.
CO3	Explain the construction, working principle, and speed-torque characteristics of DC motors and three-phase induction motors.
CO4	Describe the concept of electric drives and explain speed control methods of DC and AC motors used in industrial automation.
CO5	Compare traction motors such as BLDC, PMDC, PMSM, and SRM and explain their applications in electric vehicles and robotics.

26MEC01P	Engineering Practices and Re-Engineering Laboratory (Common to all Branches)	Category	L	T	P	C
		SD	0	0	4	2

Prerequisites:

- Basic understanding of science concepts (Physics fundamentals like force, electricity and energy).
- Familiarity with basic tools, measurements and safety practices (school-level exposure is sufficient).
- Basic awareness of computers and simple programming concepts (intro level).
- Willingness to engage in hands-on activities and teamwork.

Course Objectives:

- To develop practical skills in fabrication, assembly and disassembly of everyday products using appropriate tools and safety practices.
- To provide hands-on training in electrical wiring, electronic components, sensors and microcontroller-based automation.
- To expose students to modern fabrication technologies including 3D printing and laser cutting.
- To cultivate product thinking through reverse engineering - sketching, measuring, modelling and proposing design improvements.
- To build confidence and problem-solving ability in students, particularly those with limited prior exposure to engineering tools and concepts.

List of Experiments

Tools, Safety and Hands - on - Fabrication

1. Identification and safe handling of common workshop and electrical tools - spanners, screw drivers, pliers, multimeter, soldering iron, drill machine.
2. Dis-assembly and assembly of common household appliances: Mixer-Grinder, Ceiling Fan / Table Fan, Washing Machine - understanding of mechanisms, bearings, switches and motor connections.
3. Dis-assembly and assembly of Refrigerator / Air-Conditioner - introduction to refrigeration cycle components (compressor, condenser, expansion valve, evaporator).
4. Dis-assembly and assembly of a Bicycle - chain drive, gearing, brake mechanism and frame joints.
5. Welding Practices: Safety measures, types of joints, hands-on session on SMAW and GMAW on mild steel / stainless steel plates.

Electrical Wiring and Electronics

1. Electrical installation tools and safety measures; handling of Fuses, Miniature Circuit Breakers (MCB) and Distribution Boards.
2. Hands-on wiring for domestic loads: Lights (series and parallel), Fans, Calling Bells.
3. Hands-on wiring for motors and UPS - single-phase motor starter circuit.
4. Electronic components identification: resistors, capacitors, diodes, transistors, LEDs,

relays - safe use and testing using multimeter.

5. Soldering practices on Printed Circuit Board (PCB) - soldering, desoldering and inspection.
6. Hands-on construction and testing of a Bridge Rectifier circuit and an Op-Amp based amplifier.

Microcontroller Programming and Automation

1. Introduction to open-source microcontroller platforms (Arduino / ESP32) - architecture, IDE setup, pin configuration, digital and analog I/O.
2. Interfacing digital and analog sensors: temperature sensor (LM35 / DHT11), light sensor (LDR), soil moisture sensor, ultrasonic distance sensor.
3. Interfacing actuators: LED, buzzer, relay, DC motor with L298N driver, servo motor.
4. Mini Project 1 - Home Automation: Automatic light control using LDR sensor and relay.
5. Mini Project 2 - Agricultural Application: Soil moisture-based water pump automation.
6. Mini Project 3 - Healthcare Application: Temperature monitoring with alert system.

Digital Fabrication and Reverse Engineering Project

1. Introduction to Solid Modelling - demonstration and practice on CAD software (Fusion 360 / SolidWorks / Creo) for simple components.
2. 3D Printing - introduction to FDM technology, slicing software (Cura), printing parameters; fabrication of a simple mechanical component.
3. Laser Cutting - demonstration of cutting wood and acrylic sheets into complex profiles for mechanical parts / enclosures.
4. Reverse Engineering Activity (Group of 3-4 students): Select a familiar product (e.g., hand pump, door latch, bicycle brake, water tap, pressure cooker safety valve). Perform: complete disassembly; dimensional measurement using vernier calipers / screw gauge; freehand engineering sketching of each part; CAD modelling of at least two key parts; virtual assembly; identification of one design improvement; fabrication of improved part using 3D printing or workshop tools; presentation of the reverse-engineered model.

Total periods: 60

Text Books:

1. Christena, S. (2014). Learn to Weld: Beginning MIG Welding and Metal Fabrication Basics. Crestline Books.
2. Lipson, H., & Kurman, M. (2013). Fabricated: The New World of 3D Printing. Wiley.
3. Wang, W. (2010). Reverse Engineering: Mechanisms, Structures, Systems & Materials. CRC Press.
4. Margolis, M. (2020). Arduino Cookbook: Recipes to Begin, Expand and Enhance Your Projects. O'Reilly Media. 3rd Edition.
5. Bureau of Indian Standards (2019). Code of Practice for Electrical Wiring Installations (IS 732:2019).

E - Resources:

1. GrabCAD (Free CAD models library) - https://grabcad.com/.
2. GitHub (Open-source microcontroller code repositories) - https://github.com/.
3. Tinkercad (Free browser-based CAD and Arduino simulation) - https://www.tinkercad.com/.
4. NPTEL - Workshop Technology / Manufacturing Processes - https://nptel.ac.in/.

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Apply appropriate tools and safety measures to disassemble, inspect and reassemble common household appliances and mechanical systems.
CO2	Execute basic electrical wiring and electronic circuit connections for domestic and industrial applications.
CO3	Interface sensors and actuators with a microcontroller to realise simple automation systems relevant to home, agriculture and healthcare contexts.
CO4	Fabricate simple components using 3D printing and demonstrate cutting operations using laser cutting machines.
CO5	Reverse-engineer a given product by disassembling it, taking measurements, preparing sketches, creating a CAD model and identifying scope for design improvement.
CO6	Design and build a working prototype of an improved or alternative product using workshop tools, 3D printing and embedded system programming.

26FLC01P	Foreign Language (German) (Common to all Branches)	Category	L	T	P	C
		HUM	0	0	2	1

Course Objectives:

- To enable students to communicate in everyday situations using basic German vocabulary, greetings, numbers and simple sentence structures.
- To develop foundational German grammar skills including verb conjugation, articles, pronouns, question formation and basic tenses.
- To build practical communicative competence through dialogue, role-play and short writing tasks in real-life contexts such as food, travel, city navigation and social interactions.

GUTEN TAG!

1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages.
2. Vocabulary: related to the topic.
3. Grammar: W - Questions, Verbs & Personal pronouns I.

FREUNDE, KOLLEGEN UND ICH

1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers.
2. Vocabulary: related to the topic.
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural.

IN DER STADT

1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences.
2. Vocabulary: related to the topic.
3. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sie verbs.

GUTEN APPETIT!

1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences.
2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs.

TAG FÜR TAG/ZEIT MIT FREUNDEN

1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone.
2. Vocabulary: related to the topic.
3. Grammar: Time related prepositions, Possessive articles, Modalverbs.

Total periods: 30

Text Books:

1. Dengler, S. (2013). Netzwerk A1.1. Klett-Langenscheidt GmbH.
2. Evans, S., & Pude, A. (2012). Menschen A1. Hueber Verlag.

Reference Books:

1. Funk, H., & Kuhn, C. (2009). Studio d A1. Goyal Publishers & Distributors Pvt. Ltd.
2. Dallapiazza, R.-M. (2004). Tangram Aktuell 1 (Deutsch als Fremdsprache). Max Hueber Verlag.
3. Lemcke, C., & Rohrmann, L. (2012). Grammatik Intensivtrainer A1. Goyal Publishers & Distributors Pvt. Ltd.

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Use basic greetings, alphabet, numbers (1-20), telephone numbers and email conventions and identify countries and languages in German.
CO2	Describe hobbies and professions, form W-questions and yes/no questions and construct simple dialogues using correct verb forms and articles.
CO3	Identify places and buildings in a city, ask for and give directions, interpret transport-related information and use imperative and negation correctly.
CO4	Converse about food and shopping, apply accusative case with verbs, pronouns and prepositions and use past tense of haben and sein in context.
CO5	Express time and appointments, describe family and birthday events, write simple invitations and use modal verbs and possessive articles appropriately.

26FLC02P	Foreign Language (Japanese) (Common to all Branches)	Category	L	T	P	C
		HUM	0	0	2	1

Course Objectives:

- To impart fundamentals of the Japanese language, including reading, writing systems, pronunciation and speaking.

Writing Systems & Basic Communication

Introduction to Hiragana: vowels, basic characters, reading & writing, Introduction to Katakana: basic characters and usage, Basic greetings and farewells (こんにちは, おはようございます, さようなら), Introducing yourself (名前、出身、年齢), Basic sentence structure: Subject-Object- Verb, Numbers 1-100, days of the week, classroom expressions.

Activities: Flashcard games and writing drills, Self-introduction, Numbers & date matching, greeting expressions, Listening to audio.

Grammar & Everyday Vocabulary

Particles: は (wa), を (wo), の (no), へ (e), に (ni), Present tense verbs: です, ます-form conjugation (たべます、のみます), Negative forms: ではありません, ません, Describing people and objects using adjectives (い and な), Question formation: なに、どこ、だれ、いつ, Vocabulary for family, food, colors and basic actions.

Activities: Verb conjugation drills, Guessing game, Picture description, “Shopping” with food vocab and counters.

Conversation & Cultural Etiquette

Talking about routines and schedules (daily verbs, time expressions), Asking and giving simple directions (～はどこですか？), Ordering food and making polite requests (～をください、～をおねがいします), Expressing likes and dislikes (すき・きらい), Listening to short conversations and identifying key phrases, Introduction to formal/informal spSDh and Japanese etiquette.

Activities: Skits and role-plays, daily schedule, beginner-level dialogue, Group discussion on etiquette.

Activities: Practice worksheets and flashcards for hiragana, Writing drills and reading simple katakana words, Dialogue practice for greetings and self-introduction, Sentence construction exercises with basic SOV structure, Particle usage exercises and short dialogues, Role-play scheduling, shopping and telling time, Verb conjugation drills for common verbs, Descriptive sentence exercises using adjectives, Practice Q&A dialogues forming questions and negations, Kanji writing practice and quizzes for basic characters, Vocabulary tests and conversational practice on daily topics, Oral presentations and listening comprehension quizzes.

Total periods: 30

References:

1. Banno, E., Ikeda, Y., Ohno, Y., Shinagawa, C., & Tokashiki, K. (2011). Genki I: An integrated course in elementary Japanese. The Japan Times.
2. The Japan Foundation. (2017). Marugoto Japanese language and culture starter (A1)

course book for communicative language activities. Goyal Publishers.

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Understand simple spoken Japanese in everyday contexts.
CO2	Communicate with widely used Japanese words effectively.
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Japanese language.

26FLC03P	Foreign Language (Korean) (Common to all Branches)	Category	L	T	P	C
		HUM	0	0	2	1

Course Objectives:

- To impart fundamentals of the Korean language, including reading, writing systems, pronunciation and speaking.

Fundamentals of Korean

Introduction to Hangul: consonants and vowels, Basic pronunciation and syllable formation, Common greetings and self-introductions, Numbers (Sino-Korean and Native Korean basics), Basic sentence structure (Subject-Object-Verb), Simple expressions (e.g., 감사합니다, 안녕하세요).

Activity: Writing and reading Hangul practice sheets, Pronunciation drills and audio repetition, Dialogue practice for greetings and self-introduction, Counting and number exercises.

Essential Grammar and Vocabulary

Particles (은/는, 이/가, 을/를) and usage, Basic verbs and present tense conjugation, Sentence patterns: affirmative, negative, interrogative, Common adjectives and descriptive sentences, expressing possession and location, Asking simple questions (어디, 뭐, 누구).

Activity: Verb conjugation and sentence formation drills, Role-play conversations for shopping and daily routines, Descriptive writing and speaking exercises, Question and answer practice.

Everyday Korean Communication

Polite spSDh levels and honorifics introduction, talking about time, dates and schedules, ordering food, shopping phrases, counting objects, Simple directions and transportation vocabulary, listening practice with short dialogues, Cultural notes on etiquette and communication.

Activity: Role-play ordering at a restaurant or buying items, listening comprehension exercises, Giving and asking for directions practice, Group conversations and presentations.

Total periods: 30

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Understand simple spoken Korean in everyday contexts.
CO2	Communicate with widely used Korean words effectively.
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Korean language.

	Foundations of Problem Solving	Category	L	T	P	C
		MC	3	0	0	NC

Course Objectives:

- To impart high-speed mental arithmetic techniques (Vedic Mathematics and derivative systems) covering addition, subtraction, multiplication, squaring, division and approximation.
- To develop numerical intuition and estimation abilities that support quantitative aptitude, data interpretation and engineering calculations.
- To build visual and spatial problem-solving skills for non-verbal reasoning, figure analysis and diagrammatic interpretation.
- To cultivate lateral and lexical reasoning through word-puzzles, cryptarithms and language-logic games.

Speed Mathematics – I (Saw, OZ, Mirror Method)

Introduction to Vedic mathematics: Sixteen sutras, Thirteen sub-sutras, Mental-math mindset, Relevance in aptitude tests: TCS NQT, Infosys, Accenture, CAT, GATE aptitude.
SAW method (Split-and-weave): High-speed addition, Subtraction of multi-digit numbers, Carry-less addition, Column-compression techniques.
OZ method (One-zero technique): Multiplication near powers of 10, Base-method multiplication, Use of deficiencies, Surplus.
Mirror method: Left-to-right multiplication of 2-digit × 2-digit, 3-digit × 2-digit numbers, Applications in currency conversion, Instant percentage computation – Classroom drills: 50-problem speed rounds, Target < 60 seconds per set.

Speed Mathematics – II (High5, Minion, Butterfly Methods)

High5 method: Rapid squaring of numbers ending in 5, Squaring close to 50, 100, Instant computation: 55^2, 95^2, 105^2, 995^2.
Minion method: Multiplication of two 2-digit numbers: Same tens digits, Units digits sum to 10, General criss-cross (Urdhva-Tiryagbhyam) for 2×2, 3×2 multiplication.
Butterfly method: Fast addition, Subtraction of fractions without LCM, Instant comparison of fractions, Application in ratio-proportion, Data interpretation problems – Division shortcuts: Nikhilam, Paravartya division, Approximate division for percentage DI questions – Timed drill: 30 questions in 8 minutes, Target accuracy ≥ 85%.

Speed Mathematics – III (Inception, Golden Eye Method)

Inception method: Recursive approximation for square-roots, Cube-roots, Powers – Digit-sum-based verification of computations.
Golden-eye method: Estimation, Approximation heuristics for large-number arithmetic, Rounding-and-adjust technique for advanced data interpretation (CAT-level caselets).
Percentage, Ratio, Average shortcuts: Conversion of fractions to percentages, Allegation, Weighted-average tricks – Application bridge to placement tests: Mapping shortcuts to TCS NQT, AMCAT, eLitmus, CAT question types.

Thinking with numbers and Number-Sense reasoning

Number-sense development: Divisibility rules: 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, Composite divisors, Unit-digit patterns, Last-two-digit patterns, Cyclicity of powers – Number series, Pattern recognition: Arithmetic, Geometric, Squares, Cubes, Mixed, Wrong-term identification – Logical arithmetic puzzles: Cryptarithms (SEND + MORE = MONEY), Alpha-numeric puzzles, Kakuro-style number placements – Magic squares, Number-grid puzzles, Sudoku.

Mini-project: Each student maintains a personal "trick-log" notebook of at least 25 speed-math shortcuts with worked examples.

Visual Problem Solving and Word Puzzles

Problem solving with visual information: Figure series, Analogy, Odd-one-out, Embedded figures, Water images, Mirror images, Paper folding, Cutting problems – Spatial reasoning: Cube, Dice problems, Rotation of 3-D figures, Counting of figures, Pattern completion – Word puzzles: Anagrams, Word ladders, Palindromes, Logical deductions from verbal statements, Syllogism warm-ups – Cross-word, Coded-word puzzles, Lateral-thinking riddles, Introduction to Fermi-style estimation questions.

Group workshop: Teams of 3-4 students solve a 10-puzzle sprint in 30 minutes and present solution strategies to the class.

Total Periods: 45

Text Books:

1. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. Chand Publishing, Revised Edition, 2017. (Units I–IV)

Reference Books:

1. Dhaval Bathia, "Vedic Mathematics Made Easy", Jaico Publishing House, Revised Edition, 2019.
2. Kenneth Williams, "The Cosmic Calculator: A Vedic Mathematics Course for Schools", Motilal Banarsidass Publishers, 2nd Edition, 2015.
3. Jagadguru Sri Bharati Krishna Tirthaji, "Vedic Mathematics", Motilal Banarsidass Publishers, Revised Edition, 2015.
4. Arun Sharma, "How to Prepare for Quantitative Aptitude for the CAT", McGraw Hill Education, 10th Edition, 2023.
5. Shakuntala Devi, "Puzzles to Puzzle You & More Puzzles", Orient Paperbacks, Revised Edition, 2020.

Online Resources / MOOCs:

1. Vedic Maths Forum India — free video lectures and printable drill sheets (https://www.vedicmathsindia.org)
2. PrepInsta Aptitude Daily — TCS NQT pattern quantitative drills (https://prepinsta.com)
3. IndiaBIX Aptitude section — topic-wise unlimited practice (https://www.indiabix.com)
4. NPTEL / SWAYAM — "Speed Mathematics" and "Developing Soft Skills & Personality" MOOCs (https://nptel.ac.in)

COURSE OUTCOMES:

At the end of the course, students will be able to:	
CO1	Execute Vedic-math and derivative speed techniques (SAW, OZ, Mirror, High5, Minion, Butterfly, Inception, Golden-Eye) to perform multi-digit arithmetic mentally within target time limits.
CO2	Apply number-sense, divisibility rules and pattern-recognition heuristics to solve quantitative-aptitude and number-series problems with ≥ 85 % accuracy.
CO3	Interpret and solve visual, spatial and non-verbal reasoning problems encountered in placement aptitude tests and competitive examinations.
CO4	Crack word puzzles, cryptarithms and lateral-thinking problems, demonstrating improved cognitive agility and logical fluency.

Approved by
Academic Council Meeting
No.: 01 Dated: 21.4.26

Recommended by
Board of Studies of RAE Dept.
Meeting No.: 01 Dated: 27.3.26

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