ANNA UNIVERSITY, CHENNAI

UNDER GRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: B.E., Electronics and Instrumentation Engineering **Regulations:** 2025

Abbreviations:

HUM – Humanities (Languages, Management, Heritage, and others)

BS – Basic Science (Mathematics, Physics, Chemistry)

ES – Engineering Science (General (**G**), Programme Core (**PC**), Programme Elective (**PE**) & Emerging Technology (**ET**))

SD – Skill Development

SL – Self Learning

CDP–Capstone Design Project

OE – Open Elective

L –LaboratoryCourse

T – Theory

LIT –Laboratory Integrated Theory

PW – Project Work

IPW–Internship cum Project Work

DIC – Department Introductory Course

TCP –Total Contact Period(s)

Program Outcomes

1. **Engineering Knowledge**: Apply math, science, and engineering fundamentals to complex problems.
2. **Problem Analysis**: Identify and analyze complex problems using research and sustainability principles.
3. **Design Solutions**: Design systems and processes considering health, safety, cost, culture, and environment.
4. **Investigations**: Use experiments, modelling, and data analysis to reach valid conclusions.
5. **Engineering Tools**: Apply modern tools for modelling and problem-solving, recognizing their limits.
6. **Society & Environment**: Assess societal, legal, and environmental impacts of engineering solutions.
7. **Ethics**: Commit to ethics, human values, diversity, and legal compliance.
8. **Teamwork**: Work effectively as an individual and in multidisciplinary teams.
9. **Communication**: Communicate clearly in reports, presentations, and documentation across diverse groups.

10. **Management & Finance**: Apply management and economic principles in projects and teamwork.
11. **Lifelong Learning**: Engage in continuous learning, adapt to new technologies, and think critically.

Programme Specific Outcomes

1 Design and develop instrumentation systems for domestic and industrial processes.

2 Use modern engineering tools and software for simulation, analysis, and project development in Electronics and Instrumentation systems.

3 Update the knowledge and skills in electronics and instrumentation engineering through research, and professional development and adapt to emerging technologies and industry trends.

Semester - I							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	MA25C01	Applied Calculus	T	3-1-0	4	4	BS
2.	EI25C01	Introduction to Measurement and Instrumentation	T	2-1-0	3	3	ES (PC) – DIC
3.	UC25H01	தமிழர்மரபு/Heritage of Tamils	T	1-0-0	1	1	HUM
4.	EN25C01	English Essentials – I	T	2-0-0	2	2	HUM
5.	PH25C01	Applied Physics – I	LIT	2-0-2	4	3	BS
6.	CY25C01	Applied Chemistry – I	LIT	2-0-2	4	3	BS
7.	CS25C02	Computer Programming: Python	LIT	2-0-2	4	3	ES (PC)
8.	ME25C04	Makerspace	L	0-0-4	4	2	SD
9.	UC25A01	Life Skills for Engineers-I	---	1-0-2	3	1	HUM
10.	UC25A02	Physical Education – I	---	0-0-4	4	1	HUM
11.		NCC / NSS / NSO/ YRC	---	---	---	---	---
			Total Credits		**33**	**23**	

Semester - II							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	MA25C03	Transforms and its Applications	T	3-1-0	4	4	BS
2.	UC25H02	தமிழர்களும் தொழில்நுட்பமும் / Tamils and Technology	T	1-0-0	1	1	HUM
3.	GE25C01	Basic Civil and Mechanical Engineering	T	3-0-0	3	3	ES (G)
4.	PH25C04	Applied Physics (EE) - II	T	2-1-0	3	3	BS
5.	ME25C01	Engineering Drawing	LIT	2-0-4	6	4	ES (G)
6.	EE25C02	Electric Circuit Analysis	LIT	3-0-4	7	5	ES (PC)
7.	EN25C02	English Essentials – II	LIT	1-0-2	3	2	HUM
8.	ME25C05	Re-Engineering for Innovation	L	0-0-4	4	2	SD
9.	UC25A03	Life Skills for Engineers – II	---	1-0-2	3	1	HUM
10.	UC25A04	Physical Education – II	---	0-0-4	4	1	HUM
11.		Foreign Language^	LIT	1-0-2	3	1	HUM
			Total Credits		**41**	**27**	

^ Deutsch / Japanese / Korean

Semester – III							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/ Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	MA25C10	Matrices for Engineers	T	2-0-0	2	2	BS
2.	EI25C10	Electrical Machines and Drives	T	3-0-0	3	3	ES (PC)
3.	EI25C02	Transducers Engineering	T	3-0-0	3	3	ES (PC)
4.	CS25C17	C Programming and Data Structures	T	3-0-0	3	3	ES (G)
5.	EI25C03	Analog Electronics	T	3-0-0	3	3	ES (PC)
6.	EI25C04	Electrical Machines Laboratory	L	0-0-4	4	2	ES (PC)
7.	EI25C05	Transducers Engineering Laboratory	L	0-0-4	4	2	ES (PC)
8.	EN25C03	English Communication Skills Laboratory – I	L	0-0-2	2	1	HUM
9.		Skill Development Course – I	LIT	1-0-2	3	2	SD
				Total credits	**27**	**21**	

Semester – IV							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	MA25C13	Probability and Statistics	T	3-1-0	4	4	BS
2.	EI25C06	Linear Integrated Circuits and Applications	T	3-0-0	3	3	ES (PC)
3.	EI25401	Automatic Control Systems	T	3-0-0	3	3	ES (PC)
4.	EI25402	Applied Machine Learning	T	3-0-0	3	3	ES (ET)
5.	EI25C07	Embedded Systems	T	3-0-0	3	3	ES (PC)
6.	EI25C08	Digital System Design and Applications	T	3-0-0	3	3	ES (PC)
7.	EI25C09	Linear Integrated Circuits Laboratory	L	0-0-4	4	2	ES (PC)
8.	EI25403	Embedded Systems Laboratory	L	0-0-4	4	2	ES (PC)
9.	EN25C04	English Communication Skills Laboratory – II	L	0-0-2	2	1	HUM
10.		Skill Development Course – II	LIT	1-0-2	3	2	SD
				Total Credits	**32**	**26**	

Semester–V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.		Process Control	LIT	3-0-2	5	4	ES (PC)
2.		Signal and Image Processing	T	3-0-0	3	3	ES (PC)
3.		Industrial Instrumentation	LIT	3-0-2	5	4	ES (PC)
4.		Programme Elective – I	T	3-0-0	3	3	ES (PE)
5.		Programme Elective – II	T	3-0-0	3	3	ES (PE)
6.		Programme Elective – III	T	3-0-0	3	3	ES (PE)
7.		Skill Development Course – III	LIT	1-0-2	3	2	SD
8.		Industry Oriented Course - I	LIT	1-0-2	3	1	SD
				Total Credits	**28**	**23**	

Semester–V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T- P	**TCP**		
For Honours Degree							
1.		Capstone Design Project – Level 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.		Introduction to Industrial Processes, Measurement and Control	T	3-0-0	3	3	ES (PC)
2.		Industrial Data Communication	T	3-0-0	3	3	ES (PC)
3.		Industrial Automation Systems	LIT	3-0-4	7	5	ES (PC)
4.		Programme Elective – IV	T	3-0-0	3	3	ES (PE)
5.		Programme Elective – V	T	3-0-0	3	3	ES (PE)
6.		Open Elective	T	3-0-0	3	3	--
7.		Industry Oriented Course- II	LIT	1-0-2	3	1	SD
8.		Self-Learning Course	---	---	0	1	--
				Total Credits	**25**	**22**	
For Honours Degree							
1.		Capstone Design Project – Level 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 Mino rDegree							
1.		Minor Elective – III	T	3-0-0	3	3	

Semester– VI							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/Week**		**Credits**	**Category**
				L-T-P	**TCP**		
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.		Engineering Entrepreneurship Development	T	2-0-2	4	3	HUM
2.		Project Management	T	2-0-0	2	2	HUM
3.		Analytical Instrumentation	T	3-0-0	3	3	ES (PC)
4.		Instrumentation System Design Laboratory	T	0-0-4	4	2	ES (PC)
5.		Programme Elective VI	T	3-0-0	3	3	ES (PE)
6.		Summer Internship/Mini Project	---	---	---	2	SD
Total Credits					**16**	**15**	
For Honours Degree							
1.		Capstone Design Project – Level 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		Project Work / Internship cum Project Work	PW / IPW	0-0-16	16	8	SD
Total Credits					**16**	**8**	

Total Credits: 165

Programme Elective Courses – Streams

Automation	Internet of Things	Advanced Control	Applied Instrumentation	Health Care Instrumentation	Semiconductor/ Communication
PLC Programming	Industrial IoT	Process Modeling and Simulation	Fiber Optics Instrumentation	Biomedical Instrumentation	Digital VLSI
Robotics and Automation	Sensor for IoT Application	Computer Control of Processes	Thermal Power Plant Instrumentation	Bio Signal Processing	Real Time Embedded Systems
Industry 4.0	Data Analytics for IoT	System Identification	Instrumentation in Petrochemical Industry	Medical Imaging Systems	Automotive Electronics
Intelligent Automation	IoT Security	Adaptive Control	Safety Instrumented Systems	Medical Robotics	Communication Systems
IoT for Industry Automation	IoT and Edge computing	Model Based Control	Virtual Instrumentation	Diagnostic and Therapeutic Equipment	Wireless Sensor Network Design
Cyber Security	Cloud Services Management	Optimal Control	Digital Twin and Simulation	Physiological modelling	Nano Electronics

Semester I

MA25C01	Applied Calculus	L	T	P	C
		3	1	0	4

Course Objectives:

- To provide technical competence of modelling engineering problems using calculus.
- To apply the calculus concepts in solving engineering problems using analytical methods and computational tools.

Differential Calculus: Functions, graph of functions, New functions from old functions, Limit of a function, Continuity, Limits at infinity, Derivative as a function, Maxima and Minima of functions of single variable, Mean value theorem, Effect of derivatives on the shape of a graph.

Activities: 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, Chain rule, Total derivative, Maxima and minima of functions of two variables, Method of Lagrange's Multipliers, Application problems in engineering.

Activities: 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, Improper integrals, Arc Length, Area of Region, Area of surface of revolution.

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

Multiple Integrals: Iterated integrals and Fubini's theorem, Evaluation of double integrals, change of order of integration, change of variables between Cartesian and polar co-ordinates, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical co-ordinates.

Activities: Double integrals and triple integrals using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Solving of GATE questions (20%), Internal Examinations (40%).

References:

1. Anton, H., Bivens, I. C., & Davis, S. (2021). Calculus: Early transcendentals. John

Wiley & Sons.
2. Ron Larson and David C. Falvo,(2013), Calculus: an Applied Approach. Cengage Learning.
3. Stewart, J., Clegg, D., & Watson, S. (2019). Calculus: Early transcendentals.
4. Thomas, G. B., Jr., Weir, M. D., Hass, J., & Heil, C. (2018). Thomas' calculus: Early transcendentals. Pearson.
5. Singh, K. (2019). Engineering mathematics through applications. Bloomsbury Publishing.
6. Grewal, B. S. (2012). Higher engineering mathematics. Khanna Publishers.

E-resources:

1. https://math.libretexts.org/Bookshelves/Calculus/Map%3A_Calculus__Early_Transcendentals_(Stewart)/
2. https://openstax.org/books/calculus-volume-1/
3. https://tutorial.math.lamar.edu/Classes/CalcII/CalcII.aspx
4. SCILAB, https://www.scilab.org/

	Description of CO	**PO**	**PSO**
CO1	Explain the meaning of derivative, integral, and their geometric and physical interpretations.	---	---
CO2	Apply differentiation and integration techniques to compute maxima, minima, and area.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyze the behavior of single and multivariable functions using derivatives and partial derivatives.	PO2(3)	PSO1(2) PSO3(1)
CO4	Utilize modern computational software and online platforms to deepen understanding, perform complex calculations, and visualize mathematical concepts.	PO5(2) PO11(1)	PSO2(3) PSO3(1)

EI25C01	Introduction to Measurement and Instrumentation	L	T	P	C
		2	1	0	3

Course Objective:

To impart the foundational concepts of the principles and practices of electrical and electronic measurement systems and their applications.

Basics: Units and standards, accuracy, precision, sensitivity, resolution, error types, calibration, loading effects.

Activities: Accuracy and error calculations using sample data, Calibrate a digital multimeter

Analog And Digital Electronics: Operation and Characteristics of electronic devices: PN Junction Diodes, Zener Diode and BJT. Applications: Diode Bridge Rectifier and Shunt Regulator. Digital Electronics: Basics Logic Gates-Flip Flops.

Analog and Digital Instruments: Classification of instruments, Indicating, Recording, Moving Iron, Digital voltmeters, Multimeters. Comparison of Analog vs. Digital Instruments.

Activity: Disassemble and identify components of a multimeter.

Transducers and Sensors: Need for Transducers, Types, Principles, Classification, Characteristics, Selection Criteria. - Recent Trends.

Activity: Virtual demonstration of different transducers, Match sensors to real-world applications (car, home, medical).

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (10%), Assignments (40%) and Internal Examinations (50%)

References:

1. Sawhney, A. K. (2020). A course in electrical and electronic measurements and instrumentation. Dhanpat Rai & Co.
2. Rajput, R. K. (2015). Electrical and electronic measurements and instrumentation. S. Chand.
3. Doebelin, E. O., & Manik, D. N. (2011). Measurement systems: Application and design. McGraw-Hill.
4. Bell, D. A. (2013). Electronic instrumentation and measurements. Oxford University Press.
5. Kalsi, H. S. (2012). Electronic instrumentation. Tata McGraw-Hill.

	Description of CO	PO	PSO
CO1	Explain the operation and applications of transducer and sensors in various systems.	---	PSO1 (2) PSO2 (1) PSO3 (2)
CO2	Apply the knowledge of sensors in various engineering systems.	PO1(3)	PSO1 (2) PSO2 (1) PSO3 (1)
CO3	Identify and select suitable measurement systems.	PO2 (3)	PSO1 (1) PSO3 (1)

UC23H01	தமிழர் மரபு	L	T	P	C
		1	0	0	1

மொழி மற்றும் இலக்கியம்: இந்திய மொழிக் குடும்பங்கள், திராவிட மொழிகள், தமிழ் ஒரு செம்மொழி, தமிழ் செவ்விலக்கியங்கள், சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை, சங்க இலக்கியத்தில் பகிர்தல் அறம், திருக்குறளில் மேலாண்மைக் கருத்துக்கள், தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம், பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள், சிற்றிலக்கியங்கள், தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி, தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை:நடுகல் முதல் நவீன சிற்பங்கள் வரை, ஐம்பொன் சிலைகள், பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் , தேர் செய்யும் கலை, சுடுமண் சிற்பங்கள், நாட்டுப்புறத் தெய்வங்கள், 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, தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

தமிழர்களின் திணைக் கோட்பாடுகள்: தமிழகத்தின் தாவரங்களும், விலங்குகளும், தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள், தமிழர்கள் போற்றிய அறக்கோட்பாடு, சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும், சங்ககால நகரங்களும் துறை முகங்களும், சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி, கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு, இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் , சுயமரியாதை இயக்கம் இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள், தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

References:

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் 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 C ivilization 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.

UC25H01	Heritage of Tamils	L	T	P	C
		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 Thirukural, Tamil Epics and Impact of Buddhism & Jainism in Tamil Land, Bakthi Literature Azhwars and Nayanmars, Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and 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, Making of musical instruments, Mridhangam, Parai, Veenai, Yazh and Nadhaswaram, Role of Temples in Social and Economic Life of Tamils.

Folk and Martial Arts: Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance, Sports and Games of Tamils.

Thinai Concept of Tamils: Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature, Aram Concept of Tamils, Education and Literacy during Sangam Age, Ancient Cities and Ports of Sangam Age, Export and Import during Sangam Age, Overseas Conquest of Cholas.

Contribution of Tamils to Indian National Movement and Indian Culture:

Contribution of Tamils to Indian Freedom Struggle, The Cultural Influence of Tamils over the other parts of India, Self-Respect Movement, Role of Siddha Medicine in Indigenous Systems of Medicine, Inscriptions & Manuscripts, Print History of Tamil Books

References:

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும், 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 C ivilization 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) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL), Reference Book.

EN25C01	English Essentials – I	L	T	P	C
		2	0	0	2

Course Objectives:

- Enhance learners' listening and speaking skills to understand and deliver speeches effectively
- Equip students with the skills to write clear, coherent, and grammatically correct texts for various purposes.
- Strengthen the ability to comprehend, interpret, and analyse written English across diverse contexts.

Speaking Skills: Self-Introduction (Tenses, Adjectives) Expressing opinions (Subject-Verb Agreement), Participating in Conversations (Speech Acts - agreeing & disagreeing – synonyms and antonyms**)**

Suggested Activities: Self-Introduction, Just a Minute (JAM) Video recording, Situational role plays, Spell Bee, Word Substitution, Usage of Apps.

Listening Skills: Listening to Simple Conversations (Understanding tone and intent), Short Speeches / Stories, Extracting information, Pronunciation, Listening to Various Accents.

Suggested Activities: Listening and Repeating, Gap fill exercises, Note-taking

Reading Skills: Reading Strategies – (Skimming, scanning, predicting) intensive reading - short passages and long passages on suggested themes (Sentence Patterns, Prefixes and suffixes, idioms and phrases).

Activities: Reading - newspaper and digital articles, Cloze, Reading comprehension, note making and summarising,

Writing Skills: Word Substitution, Sentence Formation, Hints Development (Guided Writing), Writing Different Types of Paragraphs - (Sentence Structure) – Letter Writing / Emails (Informal)

Activities: Error Detection, Picture and poster description, Descriptive, Narrative and Comparative paragraphs, Brainstorming and Mind Mapping - Informal letters/ Emails

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (10%), Assignments (20%), Speaking Task (10%), Reading Task (10%), Writing Task (10%), Internal Examinations (40%).

References:

1. Miller, K. Q., & Wahl, S. T. (2023). *Business and Professional Communication: KEYS for Workplace Excellence* (5th ed.). SAGE Publications.
2. Kumar, Sanjay & Pushpalatha. (2018). *English Language and Communication Skills for Engineers*. India: Oxford University Press.
3. Sharma, S., & Mishra, B. (2024). *Communication Skills for Engineers and Scientists* (2nd ed.). PHI Learning.

E-resources:

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

	Description of CO	**PO**	**PSO**
CO1	Listen and comprehend spoken English, take and draft notes.	---	---
CO2	Apply vocabulary and grammar appropriately to communicate in written and spoken forms.	PO1(3)	PSO1(2) PSO3(3)
CO3	Analyze texts in different contexts using appropriate reading strategies.	PO2(2)	PSO2(1)
CO4	Communicate thoughts and ideas in real life situations.	PO9(2)	PSO3(2)
CO5	Develop communication skills relevant to engineering and technology.	PO11(1)	PSO3(3)

PH25C01	Applied Physics – I	L	T	P	C
		2	0	2	3

Course Objective(s):

- To impart knowledge and expose the essentials of physics in various engineering applications.

Properties of Matter: Elasticity, Cantilever, Young's modulus (non-uniform bending), Girders: Bridges and buildings, Viscosity: Stokes method, Surface tension: drop weight method, Thermal expansion, Thermal stress, Bimetallic strips, Expansion joints

Practical: Non-Uniform bending, Young's modulus of the material, Torsional pendulum, Rigidity modulus of the wire and moment of inertia of the disc.

Activities: Virtual demonstration of thermal stress.

Oscillations: Simple Harmonic motion, Torsional pendulum, Couple per unit twist, Damped and Forced Oscillation

Waves: Waves on a stretched string, Energy and Power, standing waves, Ultrasonics, piezo, electric method, Acoustic grating, Electromagnetic waves: Maxwell equation, Production of EM waves by dipole antenna, Propagation of EM waves in free space, wave equation, Cell phone reception

Practical: Melde's string experiment – Frequency of an electrically vibrating metal tip.

Activities: Virtual demonstration of propagation of EM waves

Quantum Mechanics: Black body radiation, Photoelectric effect, de Broglie hypothesis, Schrodinger Wave equation, Particle in a box (infinite potential well - three-dimensional box), Barrier penetration and quantum tunnelling.

Practical: Photo-electric effect, Determination of Planck's constant.

Activities: Virtual demonstration of Scanning Transmission Electron Microscope

Applied Optics: Interference: Air wedge, Michelson's Interferometer, Fiber optics: Structure of a fiber, Fiber Optic Communication System, Fiber Sensors (Virtual demo), Displacement, pressure sensor and Temperature sensor, Einstein Co-efficient, Nd:YAG laser, CO_2 laser (construction, functioning and applications), dye laser

Practical: Ruling width of Compact disc using Laser, Thickness of a thin sheet/wire using Air wedge Method.

Activities: Demonstration of sensors and applications of Lasers

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)

References:

1. Young, H. D., & Freedman, R. A. (2020). University physics with modern physics. Pearson.
2. Gaur, R. K., & Gupta, S. L. (2022). Engineering physics. Dhanpat Rai Publications.
3. Mathur, D. S. (2010). Elements of properties of matter. S. Chand Publishing.
4. Griffiths, D. J. (2018). Introduction to quantum mechanics. Cambridge University Press.
5. Silfvast, W. T. (2008). Laser fundamentals (2nd ed.). Cambridge University Press.

E-Resources:

1. Barrier penetration problem and Quantum tunnelling: https://archive.nptel.ac.in/courses/115/104/115104096/
2. EM waves and wireless channelling: https://onlinecourses.nptel.ac.in/noc24_ee31/preview
3. CO2 Laser: https://onlinecourses.nptel.ac.in/noc25_ph03/preview
4. Bimetallic Strips _ https://www.youtube.com/watch?v=WZQ8lvxdzDk
5. Cell phone Reception_ https://www.youtube.com/watch?v=1JZG9x_VOwA
6. Dipole Antenna_ https://www.youtube.com/watch?v=4xF1Fq2wB1I
7. Optical Sensors_ https://auece.digimat.in/nptel/courses/video/108106173/L02.html
8. Scanning Tunnelling Electron Microscope_ https://www.youtube.com/watch?v=XNYZYbXNWQA

	Description of CO	**PO**	**PSO**
CO1	Explain the physics concepts in various applications.	---	---
CO2	Apply the principles of wave optics and laser physics in practical systems.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyse the behaviour of materials under different conditions.	PO2(2)	PSO1(2) PSO3(1)
CO4	Conduct experiments in groups and interpret the data.	PO4(3) PO8(1)	PSO1(2) PSO2(2)

CY25C01	Applied Chemistry – I	L	T	P	C
		2	0	2	3

Course Objectives:

- To provide students with a solid understanding of the chemical principles for engineering applications.
- To introduce the chemical properties of materials and how these properties influence the selection and use of materials in engineering systems.
- To impart practical applications of chemistry in commonly used engineering devices

Water Technology: Water quality parameters and standards. Industrial feed water, Remediation. Municipal water treatment. Desalination.

Practical: Analysis of alkalinity, hardness and dissolved oxygen.

Activity: Coagulation of water sample using Alum

Nano-chemistry: Classification, Size, dependent properties. Preparation of nanomaterials, Top-down and Bottom-Up approaches, Applications (Flipped classroom).

Practical: Preparation of nanoparticles by Sol-Gel method.

Electrochemistry: Electrochemical cell, Electrode potential., Redox reaction. Conductivity of electrolytes, Factors.

Practical: Conductometric titrations

Activity: Electrochemical cell demonstration

Corrosion & Control: Chemical and electrochemical corrosions, galvanic series, factors influencing corrosion, Electrochemical protection. Organic and Inorganic coating.

Practical:

- Corrosion study by weight loss and salt spray method.
- Potentiometry/UV-visible spectrophotometer.

Activities: Case Study on Corrosion in Pipelines and Electronics, Control measures for a corroded metal

Batteries: Conventional, Contemporary and Emerging battery storage technologies, Primary & Secondary Batteries, Battery Pack, Battery Materials,
Performance Parameters, Testing, Safety aspects.

Practical: Measurement of EMF, Internal Resistance, Charge and Discharge Characteristics.

Activities: Demonstration of battery pack in e-vehicles.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)

References:

1. Jain, P. C., & Jain, M. (2015). Engineering Chemistry (17th ed.). Dhanpat Rai Publishing Company (P) Ltd.
2. Dara, S. S. (2004). A Textbook of Engineering Chemistry. Chand Publications.
3. Sachdeva, M. V. (2011). Basics of Nano Chemistry. Anmol Publications Pvt Ltd.
4. Friedrich, E. (2014). Engineering Chemistry. Medtech.

E-Resources:

1. Water and Wastewater Engineering (Prof. Ligy Philip, IIT Madras) – https://nptel.ac.in/courses/105106202.
2. Electrochemical Energy Systems (Prof. S. Mitra, IIT Madras) – https://nptel.ac.in/courses/113106028.
3. Corrosion (Prof. Kallol Mondal, IIT Kanpur) – https://nptel.ac.in/courses/112104088
4. Chemistry of Battery Systems (Prof. V. R. Marathe, IIT Madras) – https://nptel.ac.in/courses/115106130
5. Resource on all battery types, testing, and safety – https://batteryuniversity.com/articles

	Description of CO	PO	PSO
CO1	Understand the importance of chemistry applications with underlying mechanisms.	---	
CO2	Apply the chemistry concepts in widely used devices.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyse the effect of various chemical parameters on performance of engineering systems.	PO2(2)	PSO1(2) PSO2(1)
CO4	Perform experimentations as a group and interpret the results.	PO4(3) PO8(1)	PSO2(2) PSO3(2)
CO5	Communicate findings through case studies and reports	PO9(1)	PSO2(2) PSO3(3)

CS25C02	Computer Programming: Python	L	T	P	C
		2	0	2	3

Course Objectives:

- To equip engineering students with the foundational knowledge and practical skills in Python programming to analyse and solve computational problems effectively.
- To foster problem-solving, critical thinking, and modular programming skills essential for engineering domains.

Introduction to Python: Problem Solving, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudocode, Interactive and Script Mode, Indentation, Comments, Error messages, Variables, Reserved Words, Data Types, Arithmetic operators and expressions, Built-in Functions, Importing from Packages.

Practical: Problem Analysis Chart, Flowchart and Pseudocode Practices. (Minimum three)

Control Structures: if, if-else, nested if, multi-way if-elif statements, while loop, for loop, nested loops, pass statements.

Practical: Usage of conditional logics in programs. (Minimum three)

Functions: Hiding redundancy, complexity; Parameters, arguments and return values; formal vs actual arguments, named arguments, Recursive & Lambda Functions.

Practical: Usage of functions in programs. (Minimum three)

Strings & Collections: String Comparison, Formatting, Slicing, Splitting, Stripping, Lists, tuples, and dictionaries, basic list operators, searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values.

Practical: String manipulations and operations on lists, tuples, sets, and dictionaries. (Minimum three)

File Operations: Create, Open, Read, Write, Append and Close files. Manipulating directories, OS and Sys modules, reading/writing text and numbers, from/to a file; creating and reading a formatted file (csv, tab-separated, etc.).

Practical: Opening, closing, reading and writing in formatted file format and sort data. (Minimum three)

Packages: Built-in modules, User-Defined modules, Numpy, SciPy, Pandas, Scikit-learn**.**

Practical: Usage of modules and packages to solve problems. (Minimum three), Project (Minimum Two)

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References:

1. Matthes, E. (2019). *Python crash course: A hands-on, project-based introduction to programming* (2nd ed.). No Starch Press.
2. Brown, M. C. (2018). *Python: The complete reference* (4th ed.). McGraw Hill Publishers.
3. Guttag, J. V. (2016). *Introduction to computation and programming using Python: With applications to understanding data* (2nd ed.). MIT Press.
4. McKinney, W. (2017). *Python for data analysis: Data wrangling with pandas, NumPy, and IPython*. Shroff/O'Reilly.

E-Resources:

1. Official Python Documentation – https://docs.python.org/3/
2. Python Tutorials – https://www.w3schools.com/python/
3. NumPy – https://numpy.org/doc/
4. SciPy – https://scipy.org/
5. Google's Python class – https://developers.google.com/edu/python/

	Description of CO	PO	PSO
CO1	Explain the potential usage of Python in engineering applications	---	---
CO2	To apply the concepts of Python in solving engineering problems and formulate new projects.	PO1 (2) PO5 (2)	PSO2(2) PSO3(1)
CO3	To interpret the data and effectively communicate in groups.	PO2 (3) PO8 (1) PO9 (1)	PSO3(1) PSO3(2)
CO4	Adapt new programming concepts and technologies in the profession.	PO11 (1)	PSO2(2)

ME25C04	Makerspace	L	T	P	C
		0	0	4	2

Course Objectives:

1. To impart practical skills in the assembly, disassembly, and welding of components using appropriate tools and techniques.
2. To provide hands-on training in electrical wiring practices, and the use of electronic components, sensors, and actuators.

List of Activities

(A). Dis-assembly & Assembly Practices

i. Tools and its handling techniques.
ii. Dis-assembly and assembly of home appliances – Grinder Mixer Grinder, Ceiling Fan, Table Fan & Washing Machine.
iii. Dis-assembly and assembly of Air-Conditioners & Refrigerators.
iv. Dis-assembly and assembly of a Bicycle.

(B). Welding Practices

i. Welding Procedure, Selection & Safety Measures.
ii. Power source of Arc Welding – Gas Metal Arc Welding & Gas Tungsten Arc Welding processes.
iii. Hands-on session of preparing base material & Joint groove for welding.
iv. Hands-on session of MAW, GMAW, GTAW, on Carbon Steel & Stainless Stell plates / pipes, for fabrication of a simple part.

(C). Electrical Wiring Practices

i. Electrical Installation tools, equipment & safety measures.
ii. Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box.
iii. Hands-on session of electrical connections for Lightings, Fans, Calling Bells.
iv. Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.

(D). Electronics Components / Equipment Practices

i. Electronic components, equipment & safety measures.
ii. Dis-assembly and assembly of Computers.
iii. Hands-on session of Soldering Practices in a Printed Circuit Board.
iv. Hands-on session of Bridge Rectifier, Op-Amp and Transimpedance amplifier.
v. Hands-on session of integration of sensors and actuators with a Microcontroller.

vi. Demonstration of Programmable Logic Control Circuit.

(E). Contemporary Systems

i. Demonstration of Solid Modelling of components.
ii. Demonstration of Assembly Modelling of components.
iii. Fabrication of simple components / parts using 3D Printers.
iv. Demonstration of cutting of wood / metal in different complex shapes using Laser Cutting Machine.

References:

1. Stephen Christena, Learn to Weld: Beginning MIG Welding and Metal Fabrication Basics, Crestline Books, 2014.
2. H. Lipson, Fabricated - The New World of 3D Printing, Wiley, 1st edition, 2013.
3. Code of Practice for Electrical Wiring Installations (IS 732:2019)

	Description of CO	**PO**	**PSO**
CO1	Demonstrate proper use and handling of basic hand and power tools.	---	---
CO2	Carry out electrical wiring installations and repairs, applying safety measures in domestic applications.	PO1(3)	PSO2(1)
CO3	Develop solid innovative models through software.	PO5(2)	PSO2(2)
CO4	Adapt and follow safety protocols in the work environment.	PO11(2)	PSO3(2)

UC25A01	Life Skills for Engineers – I	L	T	P	C
		1	0	2	1

Course Objectives

- To equip engineering students with essential life skills encompassing personal and emotional development, effective management of time and stress, financial literacy, digital safety, and civic responsibility.
- To enhance self-awareness, interpersonal skills, and resilience to prepare students for the professional and personal challenges of engineering careers and life beyond academics**.**

Personal and Emotional Development: Self-Awareness & Personality, Emotional Intelligence & Empathy, Positive thinking, Right attitude, Stress & Anger Management, Goal-Setting & Time Management, Growth Mindset & Resilience.

Activities: Personality tests (MBTI, DISC), reflection journals, Empathy circle, role-playing difficult conversations, Guided mindfulness sessions, stress relief toolkit creation, Vision board creation, weekly time audit and planner, Group challenge scenarios, resilience journal.

Management Skills: Financial Literacy: Budgeting & Saving, Nutrition, Health, and Hygiene, Digital Literacy & Online Safety, Civic Responsibility & Ethics

Activities: Create a monthly budget, financial simulation game, Meal planning workshop, physical wellness challenge, Social media audit, privacy and safety scenarios, Community service, values debate.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)

References:

1. Khera, S. (2003). *You can win*. Macmillan.
2. Levesque, H. (n.d.). *Life skills 101: A practical guide to leaving home and living on your own*. (Publication year not specified)
3. Mitra, B. K. (2017). *Personality development & soft skills* (3rd impression). Oxford University Press.
4. ICT Academy of Kerala. (2016). *Life skills for engineers*. McGraw Hill Education (India) Private Ltd.

	Description of CO	PO	PSO
CO1	Understand personality traits and emotional intelligence, in interpersonal interactions.	---	---
CO2	To work and execute as a team through successful implementation of set goals.	PO7 (1) PO8 (2) PO9 (2)	PSO3(2)
CO3	Develop and implement best practices in day-to-day life, in terms of planning and execution.	PO11 (3)	PSO3(2)

UC25A02	Physical Education - I	L	T	P	C
		0	0	4	1

Course Objectives:

- To impart the fundamentals of physical education for development of students' physical, mental, and social well-being.
- To instill a lifelong appreciation for physical activity towards the development of positive attitude and fostering values of team work and sportsmanship.

Introduction to physical education: Exercise for Good Posture – Conditioning and Calisthenics for Before start, Jogging, Bending, Twisting, Standing, Sitting and Relaxation, Training on First Aid Practices.

Participation of athletic events: Rules and regulations of important athletic events, Sprint, Jumps, Throws and Hurdles.

Skill development in any one of the following outdoor games: Basket Ball, Volley Ball, Ball Badminton, Football, Hockey, Kho-Kho, Kabaddi, Cricket, Hand ball and Tennis.

Skill development in any one of the following indoor games: Shuttle Badminton, Chess and Table Tennis.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)

References:

1. Singh, A. (2008). Essentials of physical education. Kalyani Publishers.
2. Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.
3. Mangal, S. K. (2009). *Psychology of sports performance*. Sports Publication.

E-resources:

https://www.who.int/health-topics/physical-activity

	CO Description	PO	PSO
CO1	Understand and explain the importance of physical activity for mental and physical health.	---	---
CO2	Apply basic principles of exercise science in the routine life.	PO1(3)	PSO1(1)
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8(3)	PSO3(2)
CO4	Demonstrate independent learning in health, nutrition, and fitness-related topics.	PO11(2)	PSO3(2)

Semester II

MA25C03	Transforms and its Applications	L	T	P	C
		3	1	0	4

Course Objective:

- To provide a strong foundation in Fourier Series, Laplace, Fourier and Z-Transforms.
- To develop the ability to analyze and solve engineering problems in continuous and discrete time domains using appropriate transform techniques.

Laplace Transforms: Existence conditions, Properties of Laplace transform, Laplace transform of standard functions, derivatives and integrals, Unit step function and Dirac delta function, Laplace transform of periodic functions; Inverse Laplace transform: Partial fraction technique, Convolution theorem.

Application: Solution of second order ordinary differential equations using Laplace transform.

Activities: Compute the Laplace transform of time-domain functions, Inverse Laplace transform, Solution of ordinary differential equations using Laplace transform.

Z-Transform: Z-transform of standard functions, properties; Inverse Z – transform: Standard functions, Partial fraction technique, Convolution theorem.

Application: Solution of difference equation using Z – transform.

Activities: Compute the Z-transform of a discrete-time signal, Solution of linear constant-coefficient difference equations using Z-transform.

Fourier Series: Dirichlet's conditions, General Fourier series, Convergence of Fourier series, Odd and even functions; Half range sine series, Half range cosine series, Root mean square value, Parseval's identity.

Application: Solution of one-dimensional wave and heat equation.

Activities: Compute Fourier coefficients, Reconstruct signal using Fourier series (Partial sum), Plot convergence of Fourier series.

Fourier Transform: Complex Fourier transform, Properties, Relation between Fourier and Laplace transform, Fourier sine and cosine transforms, Parseval's identity, Convolution theorem.

Application: Simple applications to solve partial differential equations using Fourier transform.

Activities: Compute the Fourier and inverse Fourier transform, Parseval's theorem validation.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (10%), Internal Examinations (50%).

References:

1. Kreyszig, G. E. (2018). *Advanced engineering mathematics*. John Wiley & Sons Ltd.
2. Grewal, B. S. (2021). *Higher engineering mathematics*. Khanna Publications.
3. Zill, D. G. (2022). *Advanced engineering mathematics*. Jones & Bartlett India Ltd.
4. Wylie, C. R., & Barrett, L. C. (2019). *Advanced engineering mathematics*. Tata McGraw-Hill.
5. Duffy, D. G. (2017). *Advanced engineering mathematics with MATLAB*. CRC Press.

E-resources:

1. Stanford Engineering Everywhere | EE261 - The Fourier Transform and its Applications
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/
3. https://www.coursera.org/learn/mathematics-engineers-fourier-laplace-z-transforms
4. Transforms and Applications Handbook | Alexander D. Poularikas, Artyom

	Description of CO	PO	PSO1	PSO2	PSO3
CO1	Explain the concept of various transform functions in engineering applications	---			
CO2	Apply Laplace and inverse Laplace transforms for solving differential equations.	PO1(3)			
CO3	Apply Z-transform methods to solve problems and analyze the results	PO1(2) PO2 (1) PO5 (1)			
CO4	Apply Fourier series to express functions and analyze the convergence behavior of the series.	PO1 (3) PO2 (1) PO5 (1)			
CO5	Select and apply appropriate software for applying transform functions	PO1 (2) PO2 (2) PO5 (1)			

UC25H02	தமிழர்களும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத் தொழில், பானைத் தொழில்நுட்பம், கருப்பு சிவப்பு பாண்டங்கள், பாண்டங்களில் கீறல் குறியீடுகள்.

வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு, சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள், மாமல்லபுரச் சிற்பங்களும், கோவில்களும், சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள், மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ, சாரோசெனிக் கட்டிடக் கலை.

உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை, உலோகவியல், இரும்புத் தொழிற்சாலை, இரும்பை உருக்குதல், எஃகு, வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள், நாணயங்கள் அச்சடித்தல், மணி உருவாக்கும் தொழிற்சாலைகள், கல்மணிகள், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்கு மணிகள், எலும்புத்துண்டுகள், தொல்லியல் சான்றுகள், சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு, சோழர்காலக் குமுழித் தூம்பின் 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 கணித்தமிழ்: அறிவியல் தமிழின் வளர்ச்சி, கணித்தமிழ் வளர்ச்சி, தமிழ் நூல்களை மின்பதிப்பு செய்தல், தமிழ் மென்பொருட்கள் உருவாக்கம், தமிழ் இணையக் கல்விக்கழகம், தமிழ் மின் நூலகம், இணையத்தில் தமிழ் அகராதிகள், சொற்குவைத் திட்டம்.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (20%), Assignments (30%), Internal Examinations (50%)

Text-Cum-Reference Books

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் 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 C ivilization 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.

UC25H02	Tamils and Technology	L	T	P	C
		1	0	0	1

Weaving and Ceramic Technology: Weaving Industry during Sangam Age, Ceramic technology, Black and Red Ware Potteries (BRW), Graffiti on Potteries.

Design and Construction Technology: Designing and Structural construction House & Designs in household materials during Sangam Age, Building materials and Hero stones of Sangam age, Details of Stage Constructions in Silappathikaram, Sculptures and Temples of Mamallapuram, Great Temples of Cholas and other worship places, Temples of Nayaka Period, Type study (Madurai Meenakshi Temple), Thirumalai Nayaka rMahal, Chetti Nadu Houses, Indo, Saracenic architecture at Madras during British Period.

Manufacturing Technology: Art of Ship Building , Metallurgical studies, Iron industry, Iron smelting, steel, Copper and gold Coins as source of history - Minting of Coins, Beads making, industries Stonebeads, Glass beads, Terracotta beads, Shell beads / bone beats, Archeological evidences, Gem stone types described in Silappathikaram.

Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompuof Chola Period, Animal Husbandry - Wells designed for cattle use , Agriculture and Agro Processing -Knowledge of Sea -Fisheries, Pearl, Conche diving, Ancient Knowledge of Ocean -Knowledge Specific 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.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (20%), Assignments (30%), Internal Examinations (50%)

Text-Cum-Reference Books

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் 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 C ivilization 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.

GE25C01	Basic Civil and Mechanical Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart major fundamental concept of civil & mechanical engineering & provide the insight with regard to applications

Historical Evaluation of Engineering: History, Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering, Role for infrastructure development, Buildings, Types and Terminologies, Impact on environment.

Activities: Visit to construction sites, Energy consumption in building.

Building Materials: Types, selection criteria, Bricks and Blocks, Composition- Fly ash brick, FRP bricks, Types of Cements, Mortar, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials.

Activities: Virtual demonstration of cement manufacturing, virtual demonstration of heat infiltration to the building.

Building Components: Foundations, Types, Bearing capacity and settlement, Brick masonry, Stone Masonry, Beams, Columns, Lintels and Rain Water Harvesting, concept of Green Buildings.

Activities: Virtual demonstration of foundations, Erection of transformers.

Power Plants: Classifications, Working principle of steam, Gas, Diesel, Hydro, electric and Nuclear Power plants. Renewable energy scenario.

Activities: Virtual demonstration of Power plants.

Thermal systems: Classifications, Working of IC Engines and its applications, Turbines and Pumps. Working of HVAC systems.

Activities: Virtual demonstration of IC Engines, Turbines and Pumps, Case study on energy consumption in Refrigeration systems.

Manufacturing: Welding, Machining, Forming and Additive manufacturing.

Activities: Virtual demonstration of any machining processes.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (10%), Assignments (40%) & Internal Examinations (50%)

References:

1. Shanmugam, G., & Palanichamy, M. S. (2015). Basic Civil and Mechanical Engineering. Tata McGraw Hill.
2. Ramesh Babu, V. (2010). Basic Civil and Mechanical Engineering. Scitech Publications.

3. Venugopal, K., & Prahu Raja, V. (2006). Basic Mechanical Engineering. Anuradha Publications.
4. Rangwala, S. C. (2008). Engineering Materials. Charotar Publishing House.

	CO Description	PO	PSO1	PSO2	PSO3
CO1	Understand the scope and significance of civil and mechanical engineering in societal and industrial development.	---			
CO2	Apply basic technical knowledge in the field of civil and mechanical engineering.	PO1(3)			
CO3	Develop an appreciation for interdisciplinary roles of civil and mechanical engineers in solving real-world problems.	PO11(1)			

PH25C04	Applied Physics (EE) – II	L	T	P	C
		2	1	0	3

Course Objectives:

- To impart knowledge on physics concepts and explore the potential applications in the field of electrical engineering.

Semiconductor Materials: Intrinsic and Extrinsic Semiconductors - Carrier Concentration- Fermi level -Dependence on carrier-concentration and temperature- Carrier generation and recombination-Carrier transport: diffusion and drift- Hall Effect – Applications- Metal-semiconductor junction (Ohmic and Schottky)

Activities: Determination of Hall coefficient

Dielectrics Materials: Dielectric polarization under static fields - electronic, ionic and dipolar polarizations-internal fields in solid-Clausius-Mossotti equation -Behavior of dielectrics in alternating fields- Application of dielectrics in transformers-Capacitor materials – Ferro and piezo materials- Complex dielectric permittivity- dipolar relaxation- dielectric loss- Applications.

Activities: Measurement of Dielectric Constant of different materials

Magnetic Materials: Magnetic material parameters –Ferromagnetic materials – Ferrites - Soft and Hard magnetic materials – GMR sensors - magnetic disk memories – Principle of magnetic recording – Materials for magnetic data storage.

Activities: Determination of Hysteresis loop for a ferromagnetic material (B-H curve)

Advanced Materials: Thermocouple, bimetals, leads soldering and fuses Materials – their applications

Activities: Virtual demonstration of working of various types of thermocouples.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (10%), Assignments (30%), Flipped Class (10%), Internal Examinations (50%)

References:

1. Kasap, S. O. (2007). Principles of electronic materials and devices. McGraw-Hill Education.
2. Callister, W. D., & Rethwisch, D. G. (2014). Materials science and engineering. John Wiley & Sons.
3. Indulkar, C. S., & Thiruvengadam, S. (n.d.). An introduction to electrical engineering materials. S. Chand.

E-Resources:

1. The emergence of spin electronics in data storage -Claude Chappert, Albert Fert and Frédéric Nguyen Van Dau, Nature Publishing Group 2007
2. Hall Effect - https://ssp-amrt.vlabs.ac.in/exp/hall-effect-charge-

carrier/simulation.html

3. Magnetic Susceptibility – https://em-amrt.vlabs.ac.in/exp/quinckes-method
4. NPTEL : NOC:Nanophotonics, Plasmonics, and Metamaterials.

	Description of CO	**PO**	**PSO**
CO1	Explain the concepts of physics in electrical engineering stream.	---	---
CO2	Apply appropriate techniques in physics to solve engineering problems.	PO1(3)	PSO1(3)
CO3	Analyse physical systems and interpret data from the virtual studies in the core branches in electrical engineering.	PO2(2)	PSO1(2)

ME25C01	Engineering Drawing	L	T	P	C
		2	0	4	4

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: Simple Solids, Section of Solids, Development of Surfaces

Activities: Development of models of various solids and virtual demonstration of sectioning, 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.

Weightage:
Continuous Assessment: 50%
End Semester Examinations: 50%

Assessment Methodology:
Project – 10%, Models - 5%, Assignments - 35% and Internal Examinations - 50%

References:

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

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
3. MIT Design Handbook: Engineering Drawing and Sketching – https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/

	CO Description	**PO**	**PSO1**
CO1	Explain the advantages of engineering drawing in engineering applications	---	
CO2	Apply the concepts of projections in formulating various solid parts in engineering systems.	PO1(3)	PSO1(2)
CO3	Analyse the various view and interpret the engineering drawings.	PO2(3)	PSO1(2)
CO4	Use CAD tools for creation of various models.	PO3(1)	PSO2(2)
CO5	Critically think and develop innovative models.	PO11(1)	PSO3(1)

EE25C02	Electric Circuit Analysis	L	T	P	C
		3	0	4	5

Course Objective:

- To impart the fundamental concepts of electrical circuits and expose to analysis of various electric circuits.

Fundamentals: Concepts of Resistance, Inductance, and Capacitance, Energy sources, Ohm's Law, Kirchhoff's Laws, DC Circuits, Resistors in series and parallel, AC Circuits, Average and RMS values, Complex Impedance, Phasor diagram, Real and Reactive Power, Power Factor, Energy, Mesh current and Node voltage methods for DC and AC circuits.

Practical: Familiarization of various electrical components, sources, and measuring instruments, Simulation and experimental verification of series and parallel electrical circuits

Network Reduction: Network reduction: voltage and current division, source transformation, star-delta conversion.

Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, Reciprocity, Millman's, and Tellegen's theorems and Applications.

Practical: Solving Circuit problems with simulation.

Transient Response Analysis: Introduction, Laplace and inverse Laplace transforms, Standard test signals, Transient response of RL, RC, and RLC circuits for source-free, step input, and sinusoidal input.

Practical: Validation of electric circuit transients with simulation.

Resonance and Coupled Circuits: Series and parallel resonance, Frequency response, Quality factor and Bandwidth, Self and mutual inductance, Coefficient of coupling, Dot rule, Analysis of coupled circuits, Single tuned circuits.

Practical: Frequency response of RLC circuits with simulation.

Three-Phase Circuits: Analysis of circuits with star and delta connected loads, Balanced and unbalanced systems, Phasor diagram, Power measurement, Power Factor calculations.

Practical: Three-phase balanced and unbalanced star and delta networks with simulation.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (10%), Assignments (40%) and Internal Examinations (50%)

References:

1. Hayt, W. H., Jr., Kemmerly, J. E., & Durbin, S. M. (2020). Engineering circuit analysis. McGraw Hill.
2. Alexander, C. K., & Sadiku, M. N. O. (2019). Fundamentals of electric circuits.

McGraw Hill.
3. Robbins, A. H., & Miller, W. C. (2013). Circuit analysis: Theory and practice. Cengage Learning India.
4. Chakrabarti, A. (2020). Circuit theory: Analysis and synthesis. Dhanpat Rai & Sons.
5. Edminister, J. A., & Nahvi, M. (2019). Electric circuits. Schaum's Outline Series, McGraw-Hill.
6. Van Valkenburg, M. E. (2015). Network analysis. Prentice-Hall of India.
7. Dorf, R. C., & Svoboda, J. A. (2018). Introduction to electric circuits. John Wiley & Sons.
8. Sudhakar, A., & Shyam Mohan, S. P. (2015). Circuits and networks: Analysis and synthesis. McGraw Hill.

E-Resource:

1. https://nptel.ac.in/courses/108104139

	Description of CO	PO	PSO
CO1	Explain the behavior of electrical circuits from the concepts.	---	PSO1 (2) PSO2 (1) PSO3 (3)
CO2	Apply the network theorems in the electrical circuits for evalation of electrical behavior.	PO1(3) PO2 (1)	PSO1 (2) PSO2 (1) PSO3 (2)
CO3	Utilise different engineering tools and interpret the various parameters in the electrical systems	PO2 (2) PO5 (1)	PSO1 (2) PSO2 (3) PSO3 (2)

EN25C02	English Essentials – II	L	T	P	C
		1	0	2	2

Course Objectives:

- Enable learners to improve fluency and accuracy in spoken and written communication.
- Develop learners' ability to articulate ideas clearly and effectively in formal and informal spoken interactions.
- Help learners construct well-organised written documents relevant to academic and workplace contexts.

Oral Communication: Types (Verbal and Nonverbal), Interpersonal and group communication, Telephonic conversation.

Suggested Activities: Short presentations, Debates, Formal Speeches (Welcome, Vote of Thanks and introducing guests), Listen and respond to short podcasts.

Business Correspondence: Email Communication, Formal Letters (Types), Business Meeting.

Suggested Activities: Email and letter writing (Complaint, request, permission), Agenda, minutes of the meeting.

Academic Writing: Paraphrasing, Summarizing, Essay Writing, Instructions and Recommendations.

Suggested Activities: Essay writing (Cause and effect, argumentative, persuasive), User guides/ manuals, policy document.

Team Work: Leadership Skills (Team building, Team Leader, Team player), Negotiation and Problem solving skills

Suggested Activities: SWOT Analysis, Brainstorming and Group discussions.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Worksheets (10%), Group Activity (20%), Report Writing (20%), Internal Examinations (50%)

References:

1. Koneru Aruna. (2020*). English Language Skills for Engineers*. McGraw Hill Education.
2. Taylor, Shirley & Chandra .V. (2010). *Communication for Business A Practical Approach*. India: Pearson Longman.
3. Ian Badger, et al., (2014). *Listening: B2 (Collins English for Life: Skills)*, Collins.
4. Raymond Murphy (2019), *Grammar in Use*, Cambridge University Press.

E-Resources:

1. Communication for Business Success - https://open.umn.edu/opentextbooks/textbooks/8
2. TED Talks – https://www.ted.com/

	Description of CO	PO	PSO
CO1	Understand the importance of communication and drafting skills in engineering and technology.	---	
CO2	Apply listening strategies to comprehend spoken English in various contexts.	PO1(3)	PSO3(2)
CO3	Participate actively in group discussions by analysing critically from different views.	PO2(2) PO8(1)	PSO3(3)
CO4	Create written reports coherently for various purposes.	PO9(2)	PSO3(2)
CO5	Adapt communication styles to global, multicultural environments.	PO11(1)	PSO2(2)

ME25C05	Re-Engineering for Innovation	L	T	P	C
		0	0	4	2

Course Objectives:

- To cultivate foundational skills in prototyping, and automation for development of prototypes with real-world applications.
- To provide a comprehensive, hands-on exposure to product development through reverse engineering concepts.

Bootcamp 1: Introduction to Product Development, Reverse Engineering, Overview of the product lifecycle, Hands-on disassembly of simple products, Practice of basic measurements and sketching, Introduction to CAD modeling of disassembled parts, Virtual assembly of parts.

Bootcamp 2: Embedded System Programming (Open-source platforms), Practice of interfacing sensors, reading data, automation in home, healthcare and agriculture.

Reverse Engineering: Sketch and prototype alternative designs, Group brainstorming sessions, Manufacture prototype parts using 3D printing and / or workshop tools, Assemble prototype product.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Project (30%), Assignment (10%), Practical (30%), Internal Examinations (30%)

References:

1. Wang, W. (2010). Reverse engineering: Mechanisms, structures, systems & materials. CRC Press.
2. Margolis, M. (2020). Arduino cookbook: Recipes to begin, expand, and enhance your projects (3rd ed.). O'Reilly Media.

E-resources:

1. GrabCAD – https://grabcad.com/
2. GitHub – https://github.com/

	Description of CO	PO	PSO
CO1	Understand the product development lifecycle, including stages such as concept generation, design, prototyping, and testing.	---	
CO2	Apply reverse engineering techniques to analyze and document existing products.	PO1 (3) PO2 (2)	PSO1(2)
CO3	Collaborate in teams to fabricate prototypes using appropriate tools.	PO5 (2) PO8 (1) PO9 (1)	PSO3(3)
CO4	Engage in independent learning and continuously adapt to emerging technologies in product design	PO11(2)	PSO2(2) PSO3(2)

UC25A03	Life Skills for Engineers – II	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart and cultivate analytical reasoning, innovative thinking, effective collaboration, and ethical leadership to prepare students for complex challenges in professional and personal environments.

Critical Thinking: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Activities: Two-Brainstorm Method, “30 Circles” Challenge, “Desert Survival” Simulation, Lateral thinking riddles and puzzles, "What If?" Scenario Writing, Fast vs. Slow Thinking Game, Creativity Myth Busters

Problem Solving: Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

Activities: Case study analysis, Escape Room challenge.

Leadership: Leadership Styles & Self-Assessment, Communication & Active Listening, Decision-Making & Responsibility, Teamwork & Delegation, Empathy, Integrity & Conflict Management, Vision, Motivation & Goal-Setting.

Activities: Crisis Leadership Simulation, Tower Challenge, Leadership Dilemmas Role-Play, Team Vision Board

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)

References:

1. De Bono, E. (2017). *Six thinking hats*, Little, Brown Book Group.
2. Facione, P. A. (2015). *Critical thinking: What it is and why it counts*. Insight Assessment.
3. Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.
4. Whetten, D. A., & Cameron, K. S. (2016). *Developing management skills*. Pearson.

	Description of CO	PO	PSO
CO1	Explain the importance of leadership and management skills in life.	---	
CO2	Apply and demonstrate creative thinking techniques to generate innovative solutions.	PO7 (3)	PSO1(1) PSO2(1)
CO3	Exhibit effective collaboration and communication skills through teamwork, active listening, and conflict resolution strategies.	PO8 (2)	PSO3(3)
CO4	Integrate scientific temperament and logical reasoning into c problem solving in engineering and real-world contexts.	PO11 (2)	PSO2(1) PSO3(2)

UC25A04	Physical Education - II	L	T	P	C
		0	0	4	1

Course Objectives:

- To impart knowledge on gymnastic exercises and pressing needs for upskilling in a particular game.

Basic gymnastics exercises: Warming up, Suitable exercise, Lead up games, Safety education, Movement education, Balanced Walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

Upskilling in any one of the athletics: Broad Jump, High Jump, Triple Jump, Relay Sprints, Javelin Throw, Discuss Throw, Shot Put, Short and Long-distance Running.

Advance skills in any one of the indoor/outdoor games, which has been opted by the student in the I semester.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)

References:

1. Singh, A. (2008). Essentials of physical education. Kalyani Publishers.
2. Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.
3. Mangal, S. K. (2009). *Psychology of sports performance*. Sports Publication.
4. Kandappan, K. (2004). *Foundations of physical education*. Friends Publications.

E-resources:

https://www.who.int/health-topics/physical-activity

	CO Description	PO	PSO
CO1	Understand and explain the importance of physical activity for mental and physical health.	---	
CO2	Apply safety principles and methods during sports activities.	PO1(3)	PSO3(1)
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8 (3)	PSO3(2)
CO4	Demonstrate the advanced technical skills and strategic understanding in the game of their interest.	PO11(1)	PSO3(2)

Foreign Language^

UC25F01	Deutsch – I	L	T	P	C
		1	0	2	1

Course Objectives:

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

Basics & Introduction: German alphabet and pronunciation, Basic greetings and farewells, Introducing yourself and others (Ich heiße…, Wer bist du?), Numbers 1–100 and days of the week, Personal pronouns (ich, du, er, sie…), Sentence structure (SVO word order).

Activities: Alphabet spelling game, short skits, Use color-coded cards for SVO sentences.

Grammar Essentials & Everyday Vocabulary: Present tense of regular verbs (spielen, arbeiten, machen…), Common irregular verbs: sein (to be), haben (to have), gehen, kommen, Articles and gender (der, die, das; ein, eine), Simple questions and negation (nicht, kein), Describing people and things: adjectives and colors, Family, school, food, and common objects vocabulary.

Activities: Conjugate regular and irregular verbs, “Question Chain” game, Create a simple family tree.

Everyday Communication in German: Asking for and giving directions, Telling the time and talking about schedules, Ordering food and drinks at a café or restaurant, Talking about hobbies, weather, and daily routines, Listening to short conversations and responding appropriately, Introduction to German culture and formal/informal language use (du vs Sie).

Activities: Ordering food and drinks, Give directions, Formal / Informal greetings, Do’s and Don’ts.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. Funk, H., Kuhn, C., & Demme, S. (2015). Menschen A1: Deutsch als Fremdsprache Kursbuch. Hueber Verlag.

	CO Description	PO	PSO
CO1	Understand simple spoken Deutsch in everyday contexts.	---	
CO2	Communicate with widely used Deutsch words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Deutsch language.	PO11 (1)	PSO3(2)

UC25F02	Japanese – I	L	T	P	C
		1	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 speech 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.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (30%), Quiz (10%) and Internal Examinations 60%

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.

	CO Description	PO	PSO
CO1	Understand simple spoken Japanese in everyday contexts.	---	
CO2	Communicate with widely used Japanese words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Japanese language.	PO11 (1)	PSO3(2)

UC25F03	Korean – I	L	T	P	C
		1	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).

Activities: 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).

Activities: 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 speech 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.

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

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. King, R., Yeon, J., & Brown, A. (2015). Elementary Korean (2nd ed.). Tuttle Publishing.
2. Cho, Y., Lee, H., Schulz, C., Sohn, H.-M., & Sohn, S.-O. (2001). Integrated Korean: Beginning 1. University of Hawai‘i Press.

	CO Description	PO	PSO
CO1	Understand simple spoken Korean in everyday contexts.	---	
CO2	Communicate with widely used Korean words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Korean language.	PO11 (1)	PSO3(2)

Semester III

MA25C10	Matrices for Engineers	L	T	P	C
		2	0	0	2

Course Objectives: The Objectives of the course are to enable the students to understand and apply matrix concepts such as eigenvalues, orthogonal transformations, matrix decompositions (QR and SVD), quadratic forms and least-squares solutions for solving engineering problems.

Matrices: Introduction – Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation. Matrix norms, Jordan Normal form, QR decomposition – Singular Value Decomposition (SVD) - Least squares solutions- simple problems.

Activities: Computation of eigenvalues and eigenvectors, matrix norm, QR decomposition and SVD using open-source software, Solving Competitive Examination questions.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Solving Competitive Examination questions (20%), Internal Examinations (40%).

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, (11th ed.), John Wiley & Sons, USA,2025.
2. Alan Jeffrey, *Matrix Operations for Engineers and Scientists,* Springer Science, 2010.
3. Gilbert Strang. Linear Algebra for Everyone. 2020. Wellesley-Cambridge Press

E-resources:

1. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
2. https://nptel.ac.in/courses/111108066

	Description of CO	PO	PSO
CO1	Understand concepts of eigenvalues, eigenvectors and matrix norms.	-	-
CO2	Apply QR decomposition and SVD to solve matrix problems arising in engineering applications.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyze quadratic forms using orthogonal transformations and use least-squares methods to obtain approximate solutions of linear systems.	PO2(3) PO5(3)	PSO2(3) PSO3(2)

EI25C10	Electrical Machines and Drives	L	T	P	C
		3	0	0	3

Course Objective:

This course provides foundational knowledge of AC and DC machines, including their construction, operation, testing, and control. It introduces special machines and power electronic devices with an emphasis on switching characteristics. The course also covers DC and AC drives, their control strategies, and integration using power electronic circuits.

DC Generator

Construction of D.C. Machines – DC Generator: Principle of operation, Characteristics.

Activities:

Simulate the open circuit characteristics of DC shunt generator, Load characteristics of DC shunt generator using simulation software.

DC Motor

DC Motor: Principle of operation, Types, Torque equation, Characteristics, Speed Control.

Transformers

Transformer – Principle – Theory of ideal transformer – EMF equation – Construction details of shell and core type transformers – Regulation and Efficiency - Tests on transformers.

Activities:

Group seminar on no-load and load test on transformers.

Three-Phase Induction Motor

Three-phase Induction Motor: Construction and principle of operation, Torque and torque-slip characteristics, Efficiency, Applications, Starting methods, Speed control of induction motor.

Power Semiconductor Devices and Characteristics

Operating principle and switching characteristics: Power diodes, Power BJT, Power MOSFET, IGBT, SCR, TRIAC.

Drives And Control

Static and Dynamic equations of DC and AC machines – Electrical braking – Rectifier and chopper control of DC drives – Open loop and Closed loop schemes for DC and AC drives. – Servo drives VFD.

Tasks:

T1: Compare the different types of dc generator by their construction, characteristics and applications.
T2: Distinguish different types of dc motors by their construction, operating principle, characteristics and applications.
T3: Analyze the operating principle, construction types and tests to determine model parameters of a single phase transformer.
T4: Investigate working principle, speed-torque relationship, and starting techniques used for 3-phase squirrel cage and slip ring induction motors.
T5: Analyze the operating principle and switching characteristics of power diodes, power BJT, power MOSFET, IGBT and SCR.
T6: Using static and dynamic equations investigate various modes operation and different control techniques of dc dives and analyze the closed loop control of ac drives.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Review of GATE questions (20%), Internal Examinations (40%).

References

1. Fitzgerald, A. E., Kingsley, C., & Umans, S. D. (2003). Electric machinery (6th ed.). McGraw-Hill.
2. Theraja, B. L. (2007). A textbook of electrical technology (Vol. II). S. Chand and Co.
3. Mohan, U., Undeland, T. M., & Robbins, W. P. (1995). Power electronics: Converters, applications, and design. John Wiley & Sons.
4. Del Toro, V. (1995). Electrical engineering fundamentals. Prentice Hall of India.
5. Cotton, H. (1999). Advanced electrical technology (6th ed.). Sir Isaac Pitman and Sons Ltd.
6. Vasudevan, K. (n.d.). Lecture series on Electrical Machines I and II. Indian Institute of Technology Madras.

e-Resources

NPTEL Lecture Series on Power Electronics by Dr. B.G. Fernandes, IIT Bombay.

List of Open Source Software / Learning Websites

1. https://nptel.ac.in/courses/108106072
2. https://nptel.ac.in/courses/108105131
3. https://lecturenotes.in/notes/69764-note-for-electrical-drives-and-controls-edc-by-bhuvaneswari-c
4. https://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/electrical-machines-and-drives

5. https://nptel.ac.in/courses/108102146
6. https://nptel.ac.in/courses/108106071
7. https://nptel.ac.in/courses/108104140

	Description of CO	**PO**	**PSO**
CO1	Explain the construction, principle of operation, and characteristics of DC machines.	**-**	**-**
CO2	Analyze the performance and speed control of DC motors and generators.	PO1, PO2, PO3	PSO1(3)
CO3	Analyze the operation, characteristics, and performance of three-phase induction motors.	PO2, PO4	PSO1(3)
CO4	Apply power semiconductor devices and analyze DC and AC drives with control strategies.	PO2, PO3, PO5	PSO2(3)

EI25C02	Transducers Engineering	L	T	P	C
		3	0	0	3

Course Objective:

This course introduces the fundamentals of measurement systems, classification and selection of transducers, and analysis of their static and dynamic characteristics. Students will understand the principles, construction, and application of various resistive, inductive, capacitive, and modern transducers. The course also covers signal conditioning circuit design and advanced sensor technologies including MEMS and smart sensors.

Science of Measurements And Classification of Transducers

Units and standards, Static calibration, Classification of errors, Limiting error and probable error, Error analysis, Statistical methods, Odds and uncertainty, Classification of transducers, Selection of transducers.

Characteristics of Transducers

Static characteristics: Accuracy, precision, resolution, sensitivity, linearity, span and range. Dynamic characteristics: Mathematical model of transducer, Zero, First and Second order transducers, Response to impulse, step, ramp and sinusoidal inputs.

Variable Resistance Transducers

Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, thermistor, hot-wire anemometer, piezo-resistive sensor, humidity sensor.

Variable Inductances

Inductive transducers: Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, Variable reluctance transducers, Synchros, Microsyn.

Capacitance Transducers

Characteristics of capacitive transducers: Types, signal conditioning, Applications: Capacitor microphone, Capacitive pressure sensor, Proximity sensor.

Other Sensors and Transducers

Piezoelectric transducer, Hall effect transducer, Magneto elastic sensor, Digital transducers, Fiber optic sensors, Smart sensors, Film sensor, MEMS and Nano sensors, LASER sensors, Environmental monitoring sensors (Water quality and air pollution).

Tasks:

T1: Perform the error analysis of transducers.
T2: Simulate and obtain the characteristics of first order and second order transducers using any simulation tool.
T3: Design the signal conditioning circuit and compensation circuit for any type of thermocouple..
T4: Analyze the characteristics of the capacitive transducer.
T5: Develop any application using special transducers.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Review of GATE questions (20%), Internal Examinations (40%).

References

1. Doebelin, E. O. (2019). Measurement systems: Applications and design. Tata McGraw-Hill.
2. Jain, R. K. (2017). Mechanical and industrial measurements. Khanna Publishers.
3. Liptak, B. G. (2003). Instrument engineers' handbook: Process measurement and analysis (4th ed.). ISA/CRC Press.
4. Neubert, H. K. P. (2003). Instrument transducers: An introduction to their performance and design. Oxford University Press.
5. Patranabis, D. (2011). Sensors & transducers (2nd ed.). PHI.
6. Turner, J., & Hill, M. (2003). Instrumentation for engineers and scientists. ISA/CRC Press.
7. Zurawski, R. (2017). Industrial communication technology handbook (2nd ed.). CRC Press.

List of Open Source Software / Learning Websites

1. https://nptel.ac.in/courses/108104139
2. http://nptel.iitm.ac.in/courses.php
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
4. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
5. https://instrumentationtools.com/tag/sensors-and-transducers-nptel-pdf
6. https://www.analog.com
7. https://electronics-tutorials.ws/io/io
8. https://www.cse.wustl.edu/~lu/cse521s/Slides/wirelesshart.pdf

	Description of CO	PO	PSO
CO1	Explain the fundamentals of measurement systems, units, standards, classification of transducers, and error analysis including static and dynamic characteristics.	-	-
CO2	Analyze and interpret datasheets and experimental results to evaluate the static and dynamic characteristics of resistive, inductive, and capacitive transducers.	PO2 PO3	PSO1(3)
CO3	Design and implement signal conditioning circuits for resistive, inductive, and capacitive sensors to enhance measurement accuracy and response.	PO3 PO5	PSO1(3)
CO4	Examine and apply the working principles, construction, and characteristics of variable resistance, inductive, capacitance, piezoelectric, and Hall-effect sensors.	PO2 PO3	PSO1(3)
CO5	Understand and evaluate advanced sensor technologies including MEMS, smart sensors, fiber optic sensors, environmental monitoring sensors, and their practical applications.	PO3 PO5	PSO2(3)

CS25C17	C Programming and Data Structures	L	T	P	C
		3	0	0	3

Course Objective:

This course introduces the fundamentals of the C programming language including its advanced features. It enables students to implement linear and non-linear data structures such as lists, stacks, queues, trees, and hashing. The course also covers the design and implementation of sorting and searching algorithms for effective problem-solving.

C Programming Fundamentals, Advanced Features

Data types, variables, operations, expressions and statements, conditional statements, functions, recursive functions, arrays, single and multi-dimensional arrays.Structures, union, enumerated data types, pointers: pointers to variables, arrays and functions, file handling, preprocessor directives.

Linear Data Structures

Abstract Data Types (ADTs), List ADT, array-based implementation, linked list, doubly-linked lists, circular linked list, Stack ADT, implementation of stack, applications, Queue ADT, priority queues, queue implementation, applications.

Non-Linear Data Structures

Trees, binary trees, tree traversals, expression trees, binary search tree, hashing, hash functions, separate chaining, open addressing, linear probing, quadratic probing, double hashing, rehashing.

Sorting and Searching Techniques

Insertion sort, quicksort, heap sort, merge sort, linear search, binary search.

Tasks:

T1. C Programming Fundamentals & Problem Solving: Develop a C programs using variables, operators, control structures, and functions to solve real-world problems. Analyse program correctness and efficiency using test cases.

T2. Arrays, Pointers & File Handling: Develop C programs using arrays and pointers for matrix operations, string manipulation and memory handling. Design a simple application using file handling.

T3. Linear Data Structures Implementation: Design and implementation of List, Stack and Queue ADTs using arrays and linked lists. Discuss their applications in expression evaluation (infix to postfix conversion) and task scheduling.

T4. Non-Linear Data Structures & Hashing: Implement Trees and perform traversals (in-order, preorder, post-order). Design hashing techniques using collision resolution methods and analyze its efficiency.

T5. Sorting and Searching Algorithms: Compare various sorting algorithms and searching techniques. Analyze their time and space complexity and evaluate their performance for different input sizes and conditions.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Review of GATE questions (20%), Internal Examinations (40%).

References:

1. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (1983). Data structures and algorithms. Pearson Education.
2. Deitel, P. J., & Deitel, H. (2013). C how to program (7th ed.). Pearson Education.
3. Horowitz, E., Sahni, S., & Anderson, S. (2008). Fundamentals of data structures. Galgotia.
4. Kernighan, B. W., & Pike, R. (1999). The practice of programming. Pearson Education.
5. Thareja, R. (2016). Programming in C (2nd ed.). Oxford University Press.
6. Weiss, M. A. (1997). Data structures and algorithm analysis in C (2nd ed.). Pearson Education.

List of Open Source Software / Learning Websites:

https://www.coursera.org/specializations/data-structures-algorithms
https://nptel.ac.in/courses/112107243
https://nptel.ac.in/courses/112105598

	Description of CO	PO	PSO
CO1	Explain the fundamentals and advanced features of C programming including data types, arrays, pointers, functions, structures, file handling, and preprocessor directives.	-	-
CO2	Develop C programs to solve computational problems using conditional statements, loops, functions, recursion, arrays, and file operations.	PO2 PO3	PSO1(3)
CO3	Implement and apply linear data structures such as lists, stacks, queues, and priority queues using arrays and linked lists for practical applications.	PO2 PO3	PSO1(3)
CO4	Implement and apply non-linear data structures including trees, binary search trees, expression trees, and hashing techniques for efficient data storage and retrieval.	PO2 PO3	PSO1(3)
CO5	Design, implement, and compare sorting and searching algorithms including insertion sort, quicksort, heap sort, merge sort, linear search, and binary search to evaluate algorithm efficiency.	PO2 PO3	PSO1(3)

EI25C03	Analog Electronics	L	T	P	C
		3	0	0	3

Course Objective:

This course aims to provide a solid understanding of the structure, operation, and applications of electronic devices. It focuses on biasing of BJT and JFET devices, amplifier configurations, feedback concepts, and oscillator design for specified frequencies.

PN Junction Devices

PN junction diode – structure, operation and V-I characteristics, transition and diffusion capacitances – rectifiers – half wave and full wave rectifier with capacitor filter. Zener diode – reverse characteristics – Zener as voltage regulator. Display devices – LED, Laser diode, Photodiode.

BJT and Small Signal Amplifiers

BJT – structure, operation of NPN and PNP transistor, input and output characteristics of CE, CB and CC configurations. DC Load Line and operating point, need for biasing – bias stabilization – fixed and voltage divider biasing. Single stage BJT amplifiers – AC analysis of CE and CC amplifier with voltage divider bias using h-parameters – gain and frequency response.

Field Effect Transistors and Thyristors

JFET, MOSFET – structure, operation and characteristics, JFET biasing – self and voltage divider biasing. FET small signal model – analysis of CS, CG and source follower.

Differential Amplifiers and Large Signal Amplifiers

Cascade amplifier, BJT differential amplifier – DC and AC analysis of common mode gain, differential mode gain and CMRR. Single tuned amplifier – construction, operation and frequency response. Power amplifiers – class A, class B and class C (qualitative analysis only).

Feedback Amplifiers

Feedback concepts, feedback topologies – voltage/current, series/shunt feedback – transfer gain with feedback – effect of negative feedback on input and output resistances.

Oscillators

Conditions for oscillations, RC phase shift, Wien bridge, Hartley, Colpitts, and Crystal oscillators.

Tasks:

T1: Realize a Half wave / Full wave rectifier in hardware, along with filter and regulator. Obtain the line and load regulation for the circuit.
T2: Design a Common Emitter amplifier for a given Operating point. Obtain the AC voltage gain through hardware experiment.
T3: Design a controlled rectifier circuit for a given DC output voltage. Verify the output through hardware implementation.
T4: Construct a feedback amplifier with a given feedback topology.Compare the gain of the amplifier before and after inducing feedback theoretically. Verify the results through simulation.
T5: Select and design a suitable oscillator circuit for the given frequency. Design the circuit and verify the output through simulation.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Review of GATE questions (20%), Internal Examinations (40%).

References:

1. Bell, D. A. (2008). Electronic devices and circuits (5th ed.). Oxford University Press Higher Education.
2. Boylestad, R., & Nashelsky, L. (2017). Electronic device and circuit theory (11th ed.). Prentice Hall Pvt. Ltd.
3. Floyd, T. L. (2017). Electronic devices (conventional current version) (10th ed.). Pearson Prentice Hall.
4. Kumar, B., & Jain, S. B. (2014). Electronic devices and circuits (2nd ed.). PHI Learning Pvt. Ltd.
5. Millman, J., Halkias, C. C., & Jit, S. (2015). Electronic devices and circuits (4th ed.). McGraw Hill Education.
6. Salivahanan, S., & Suresh Kumar, N. (2017). Electronic devices and circuits (4th ed.). McGraw Hill Education (India) Pvt. Ltd.
7. Sedha, R. S. (2013). A textbook of applied electronics (Revised ed.). S. Chand & Company Ltd.
8. Sedra, A. S., & Smith, K. C. (2020). Microelectronic circuits (8th ed.). Oxford University Press.

	Description of CO	PO	PSO
CO1	Explain the structure, operation, and characteristics of PN junction devices including diodes, Zener diodes, LEDs, laser diodes, and photodiodes, and their applications in rectifiers and voltage regulation.	-	-
CO2	Analyze and design BJT and FET circuits, including biasing, small signal amplifiers, and single-stage CE, CB, CC, CS, CG, and source follower configurations.	PO2 PO3	PSO1(3)
CO3	Evaluate differential and large signal amplifier configurations, including cascade and power amplifiers, and analyze differential mode gain, common-mode gain, and CMRR.	PO2 PO4	PSO1(3)

CO4	Apply feedback concepts to design feedback amplifiers and assess the effect of negative feedback on gain, input, and output resistances.	PO3 PO5	PSO1(3)
CO5	Design and implement oscillators (RC, Wien bridge, Hartley, Colpitts, Crystal) and signal conditioning circuits for specified frequencies using simulation and hardware verification.	PO3 PO5	PSO1(3)

EI25C04	Electrical Machines Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

The objectives are to obtain the no-load and load characteristics of both D.C. and A.C. machines, and to study the speed characteristics of D.C. motors. Additionally, the aim includes determining the regulation characteristics of A.C. generators and transformers. The control aspects of special machines like stepper motors are also explored.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of self excited DC generator.
2. Open circuit and load characteristics of separately excited DC generator.
3. Speed control of separately excited DC shunt motor.
4. Load test on DC shunt and series motors.
5. Predetermination of efficiency and regulation of single phase transformer.
6. Load test on single phase transformer.
7. Load test on three phase induction motor.
8. Load test on single phase induction motor.
9. Study of AC drives.
10. Study of DC drives.
11. Thyrister based control.
12. Switching characteristics of MOSFET/IJBT.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Project (30%),Assignment (10%), Practical (30%), Internal Examinations (30%)

	Description of CO	PO	PSO
CO1	Explain and analyze the no-load and load characteristics of DC and AC machines, including generators, motors, and transformers.	-	-
CO2	Evaluate the performance, speed control, efficiency, and regulation of DC and AC machines through experimental testing.	PO2 PO3	PSO1(3)
CO3	Understand the control and operational aspects of special machines and drives, including stepper motors, AC drives, and DC drives.	PO3 PO5	PSO1(3)

EI25C05	Transducers Engineering Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To study, analyze, and design signal conditioning and measurement techniques for various electrical, thermal, mechanical, and magnetic sensors and transducers by evaluating their static and dynamic characteristics for engineering applications.

List Of Experiments

1. Interpretation of data sheets with respect to static and dynamic characteristics, Selection of sensors for applications, Familiarization with software tools (MATLAB, SCILAB, LABVIEW, Proteus, or equivalent open source), Measurement of inductance (Anderson), capacitance (Schering), and resistance (Kelvin double) using bridges.
2. Determination of static and dynamic characteristics of thermocouples (J, K, E) with and without thermowell, RTD and thermistor, flapper-nozzle system and resistive potentiometer.
3. Sensitivity analysis of strain gauge bridges (quarter, half and full), Characteristic study of load cell and pressure cell, Design of signal conditioning circuits for resistive sensors, Cold junction compensation for thermocouples and lead wire compensation for RTD.
4. Characteristic study of LVDT and Hall effect sensor, Synchros, Design of signal conditioning circuits for inductive sensors.
5. Characteristic study of capacitive transducer, Design of signal conditioning circuits for capacitive sensors.
6. Characteristic study of Piezoelectric transducer, Hall effect transducer and other transducers.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Project (30%),Assignment (10%), Practical (30%), Internal Examinations (30%)

	Description of CO	PO	PSO
CO1	Explain and analyze the no-load and load characteristics of DC and AC machines, including generators, motors, and transformers.	-	-
CO2	Evaluate the performance, speed control, efficiency, and regulation of DC and AC machines through experimental testing.	PO2, PO3	PSO1(3)
CO3	Understand and implement the control and operational aspects of special machines and drives, including stepper motors, AC drives, and DC drives.	PO3, PO5	PSO2(3)

EN25C03	English Communication Skills Laboratory– I	L	T	P	C
		0	0	2	1

Course Objectives:

The objectives of the course are to foster students' confidence and fluency in professional and social communication and to bridge the gap between academic English and industry expectations.

List of Activities

A. Elements of Effective Speaking and Listening

(i) Sharing life experience/ turning point in their life – SATORI
(ii) Situational Conversation – eg. Talking to a Senior about Internship Tips
(iii) Welcoming a Guest Speaker at a Seminar
(iv) Pictography to represent data using images or symbols
(v) B2-C1 Listening exercises include lectures, interviews, and discussions.

B. Mastering Presentations

(i) Presentation Skills – Non-verbal communication
(ii) Mini-Presentations: Topics like "My Dream Project," "Engineering in 2050,"3-minute technical pitches with logical flow
(iii) Technical Presentations with PPT

C. Group Discussion Strategies:

(i) Introduction to Group Discussions - Key skills for effective participation
(ii) Phases in a GD and Conversational Phrases in GD.
(iii) Group Discussions – Abstract and Factual topics

D. Resume & LinkedIn Optimization

(i) Building LinkedIn Profile – Drafting headlines and summaries
(ii) Social Media Optimisation
(iii) Preparing Video Resume

E. Podcast-Based Language Learning:

(i) Listening to podcast (motivational, career oriented, success stories)
(ii) Podcast Preparation – Purpose – Topic – Structure – Recording Tips - Publication of the Podcast

F. Mock Interviews and Communication Strategies:

(i) Listening – Job interview
(ii) Speaking – Mock interviews

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%.

Internal Assessment: 1. Listening (20 marks)
2. Video Resume (20 marks)
3. Creating a Podcast (30 marks)
4. Mock interview (30 marks)

End Semester Assessment: 1. Presentation with PPT (50 marks)
2. Group Discussion (50 marks)

References:

1. Floyd Kory, "Interpersonal Communication", McGraw Hill Publication, 2023.
2. Bharadwaj Apoorva, "Leadership Communication Skills for Intercultural Management: Strategies for Effective Intercultural Management

(Contemporary Themes in Business and Management)", Routledge India; 1st edition, 2024.

3. Helen Spencer-Oatey and DomnaLazidou**, "**Making Working Relationships Work: The TRIPS Toolkit for Handling Relationship Challenges and Promoting Rapport",Castledown Publishers,2023.
4. Presentations - Cambridge
5. Speaking Extra -
6. Listening Extra – Miles Craven by Cambridge University Press
7. CVs, Resumes, and LinkedIn: A Guide to Professional English – Springer International Publishing

E-resources:

1. Train your mind to perform under pressure- Simon Sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html
3. Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0

	Description of CO	**PO**	**PSO1**
CO1	Communicate effectively in everyday professional situations with confidence	-	-
CO2	Deliver well-organised and effective presentations.	PO9(3)	PSO1(1) PSO3(2)
CO3	Participate in group discussions and express ideas clearly and confidently.	PO8(2) PO9(3)	PSO3(2)
CO4	Create professional video resumes and participate in interviews effectively.	PO9(2)	PSO3(3)
CO5	Create, record and publish motivational podcasts.	PO9(2) PO11(1)	PSO2(2) PSO3(3)

Semester IV

MA25C13	Probability and Statistics	L	T	P	C
		3	1	0	4

Course Objectives: The Objectives of the course are to introduce data collection methods, classification techniques, and graphical representation of data using charts and plots, to explain the fundamental concepts of descriptive statistics, probability theory, random variables, and hypothesis testing for analyzing data and to demonstrate the application of statistical techniques such as experimental design and process control using R/Python for data-driven decision-making.

Descriptive Statistics: Collection of Data-Classification-Tabulation-Graphical Representation – Simple Bar Chart – Pie Chart -Measures of Central Tendency: Arithmetic Mean, Median and Mode – Measures of Variation: Range, Quartile Deviation - Standard Deviation and Coefficient of Variation – Five Number Summary – Box Plot Technique.

Activities: Application of descriptive statistics and data presentation methods using R/ Python programming and Analysing data using Box Plots using R/ Python programming.

Probability and Random Variables: Axioms of probability - Conditional probability – Total probability – Bayes' theorem Random variable – Distribution function – properties – Probability mass function – Probability density function – Moments - Standard Distributions - Binomial, Poisson and Normal Distributions-Problems, Uniform Distribution and Exponential Distribution (Simple Problems)

Activities*:* Application of various distributions using R/ Python programming.

Two-Dimensional Random Variables: Joint distributions – Marginal and conditional distributions – Expected values of functions of two variables– Correlation and regression (for discrete data only) - Central limit theorem – Statement and Simple Problems

Activities: Applications of Correlation and Regression using R/ Python programming.

Testing of Hypothesis: Large sample tests for single mean and difference of means – Small samples tests based on t and F distributions (single mean, difference of means, paired t- test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit.

Activities: Application of Student – t test, F test,Chi –s square test using R/ Python programming.

Design of Experiments: Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD)

Activities: Application and visualization of One-way ANOVA and Two -way ANOVA using R/ Python programming.

Weightage: Continuous Theory Assessment: 20%, Continuous Lab Assessment: 20%, End Semester Examinations: 60%

Assessment Methodology: Quiz - 10%, Assignments - 20%, Lab Manual - 15% Lab Examination - 15%, Internal Examinations - 40%

References:

1. Walpole R. E., Myers S.L. & Keying Ye, “Probability and Statistics for Engineers and Scientists”, Pearson Education Inc, 9th edition, 2024.
2. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, “An Introduction to Statistical Learning with Applications in R”, Springer, 2021.
3. Johnson R. A., Miller & Freund’s, “Probability and Statistics for Engineers”, 9th Edition, Pearson Education, Delhi, 2020.
4. Charles Henry Brase and Corrinne Pellillo Brase, “Understandable Statistics: Concepts and Methods”, Cengage Learning, 12th Edition, 2018.
5. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, 6th Edition, Pearson Education, Asia, 2012.
6. Anderson, T. W, “An Introduction to Multivariate Statistical Analysis”, 3rd edition, John Wiley and Sons, 2009.

E-resources:

1. NPTEL – Descriptive Statistics with R Software - https://onlinecourses.nptel.ac.in/noc22_mg87/preview
2. MIT OCW – Introduction to Probability and Statistics (18.05, Spring 2022) - https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/
3. MIT OCW – Statistics for Applications (18.650, Fall 2016) - https://ocw.mit.edu/courses/18-650-statistics-for-applications-fall-2016/
4. Control Charts – Coursera: https://www.coursera.org/learn/stability-and-capability-in-quality-improvement#modules

	CO Description	PO Mapping	PSO
CO1	Understand concepts of descriptive statistics, probability theory and testing of hypothesis.	-	-
CO2	Apply probability distributions and statistical methods to solve engineering problems	PO1(3)	PSO1(1)
CO3	Analyze data using correlation, regression, and probability models.	PO2(3)	PSO1(2) PSO3(1)
CO4	Utilize hypothesis testing, ANOVA for data-driven decision-making.	PO5 (3) PO11 (2)	PSO2(2)

EI25C06	Linear Integrated Circuits and Applications	L	T	P	C
		3	0	0	3

Course objective:

This course provides an understanding of IC fabrication techniques and the characteristics of operational amplifiers. It enables students to design basic Op-Amp applications and understand special and application-specific ICs. The course also introduces signal conditioning circuits with practical examples.

IC Fabrication

IC classification, fundamentals of monolithic IC technology, basic planar processes, fabrication of typical circuit, fabrication of diodes, resistance, capacitance, and FETs.

Characteristics And Applications of OP-AMP

Ideal Op-Amp, DC and AC characteristics, Basic applications of Op-Amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator, Op-Amp circuits using Diodes – peak detector, clippers, clampers, comparators, Schmitt trigger, multivibrators, waveform generators, First order and second order Low pass and High pass active filters.

Special ICs and Application ICs

555 Timer – Functional block, characteristics, IC NE/SE 566 Voltage Controlled Oscillator, IC NE/SE 565 Phase Locked Loop, Analog multiplier and Divider IC AD633, IC voltage regulators – LM78XX, LM79XX series voltage regulator, LM317, LM723 Variable voltage regulator, µA78S40 switching regulator, Switched Mode Power Supply, LM380 power amplifier, ICL8038 function generator IC, LM324 Quad Op-Amp.

Signal Conditioning Circuits

V/I and I/V converters, differential amplifier, Instrumentation amplifier, Sample and Hold circuit, DAC and ADC characteristics, D/A converter (R-2R ladder and weighted resistor types), A/D converter (Flash and Successive approximation types), Design of signal conditioning circuits for RTD and strain gauge.

Tasks:

T1: Design a two-way clipper for given clipping range and implement in hardware.
T2: Design PI/PD/PID controller using Op-Amp for the given specifications and implement it in hardware.
T3: Design an active band pass filter for the given specifications and realize it in hardware.
T4: Design an instrumentation amplifier using op-amp for variable gain.
T5: Design a signal conditioning circuit for temperature sensor.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Review of GATE questions (20%), Internal Examinations (40%).

References:

1. Fiore. (2018). Op-amps & linear integrated circuits: Concepts & applications. Cengage.
2. Franco, S. (2016). Design with operational amplifiers and analog integrated circuits. McGraw Hill.
3. Millman, J., Halkias, C., & Parikh, C. D. (2017). Integrated electronics: Analog and digital circuits system (2nd ed.). McGraw Hill.
4. Floyd, T., & Buchla, R. (2013). Fundamentals of analog circuits. Pearson.
5. Coughlin, R. F., & Driscoll, F. F. (2012). Op-amp and linear ICs (6th ed.). Pearson.
6. Choudhury, D. R., & Jain, S. B. (2018). Linear integrated circuits (5th ed.). New Age.
7. Gayakward, R. A. (2015). Op–amps and linear integrated circuits (4th ed.). PHI.
8. Bell, D. A. (2013). Operational amplifiers and linear ICs. Oxford Higher Education.

Nptel Courses:

1. https://nptel.ac.in/courses/108103378
2. https://nptel.ac.in/courses/108108111

	Description of CO	**PO**	**PSO**
CO1	Explain IC fabrication techniques, IC classification, and the characteristics of monolithic ICs including diodes, resistors, capacitors, and FETs.	-	-
CO2	Interpret IC datasheets and demonstrate understanding of fabrication process through simulations and software tools	PO1 PO2	PSO1(3)
CO3	Analyze and design basic Op-Amp circuits including inverting/non-inverting amplifiers, summer, differentiator, integrator, and waveform generators.	PO2 PO3	PSO1(3)
CO4	Explain and implement special ICs such as timers, VCOs, PLLs, voltage regulators, analog multipliers, power amplifiers, and function generators in practical circuits.	PO3 PO5,	PSO1(3)
CO5	Design and implement signal conditioning circuits including V/I and I/V converters, differential and instrumentation amplifiers, DACs, ADCs, and circuits for RTD and strain gauges.	PO3 PO5,	PSO2(3)

EI25401	Automatic Control Systems	L	T	P	C
		3	0	0	3

Course objective:

This course introduces the components and mathematical modeling of control systems using transfer functions and their graphical representations. It enables analysis in time and frequency domains, explores system stability using classical and state-space methods, and provides a foundation in compensator design techniques relevant to real-time industrial systems.

System Components and their Representation

Control System: Terminology and basic structure, Feedforward and feedback control theory, Electrical and mechanical transfer function models, Block diagram models, Signal flow graph models, DC and AC servo systems.

Activities:

Identification and modeling of mechanical and electrical systems using transfer functions, Development of block diagram models using simulation tools, Realization of signal flow graphs.

Time Response Analysis

Transient response, Steady state response, Measure of performance of the standard first-order and second-order systems, Time domain specifications, Effect of an additional zero and an additional pole, Steady state error, Type number, PID control, Effect of PD, PI, PID control systems.

Activities:

Time response analysis of first-order and second-order systems, Implementation of PID controllers using simulation tools, Evaluation of steady-state error for standard inputs, Real-time response analysis using software tools.

Frequency Response Analysis

Closed-loop frequency response, Performance specification in frequency domain, Bode plot, Polar plot

Activities:

Bode plot analysis of open-loop systems, Frequency domain specification validation, Polar plot construction, and interpretation.

System Analysis

Design of compensators using Bode plots, Cascade lead compensation, Cascade lag compensation, Cascade lag-lead compensation.

Activities:
Design and verification of lead, lag, and lag-lead compensators using simulation software.

Concepts of Stability Analysis

Concept of stability, Bounded-input bounded-output stability, Routh–Hurwitz stability criterion, Relative stability, Root locus concept, Guidelines for sketching root locus, Nyquist stability criterion.

Activities:

Routh–Hurwitz criterion implementation using symbolic computation tools, Root locus plot and analysis using control design software, Nyquist plot generation and stability assessment, Simulation of stable and unstable systems.

Control System Analysis Using State Variable Method

State variable representation, Conversion of state variable models to transfer functions, Conversion of transfer functions to state variable models, Solution of state equations, Concepts of controllability and observability, Equivalence between transfer function and state variable representations.

Activities:

State-space modeling, Simulation of state response for different inputs, Evaluation of controllability and observability using software, Comparison of transfer function and state-space results.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Solving of GATE questions (20%), Internal Examinations (40%).

Tasks:

T1: Model an electrical and mechanical system using transfer function and state-space representations and analyze its time-domain response.
T2: Design a P, PI, and PID controllers for the process, also evaluate and compare its performance in terms of transient and steady-state specifications.
T3: Analyze the frequency domain specifications of the system using Bode plot and polar plot.
T4: Design a lead, lag, or lag–lead compensators using Bode plots to meet the desired performance criteria
T5: Investigate the stability of the system using Routh–Hurwitz criterion, Root Locus technique, and Nyquist stability criterion.
T6: Examine the controllability and observability of the system for designing a state feedback controller and observer.

References:

1. Agashe, S. D. (n.d.). Control engineering [Video lectures]. NPTEL, IIT Bombay.
2. D'Azzo, J. J., Houpis, C. H., & Sheldon, S. N. (2009). Linear control system analysis and design with MATLAB. CRC Taylor & Francis.

3. Gopal, M. (2012). Control systems: Principles and design. McGraw Hill Education.
4. Kuo, B. C. (2014). Automatic control systems. Wiley.
5. Nagarath, I. J., & Gopal, M. (2017). Control systems engineering. New Age International Publishers.
6. Ogata, K. (2015). Modern control engineering. Pearson.
7. Panda, R. C., & Thyagarajan, T. (2017). An introduction to process modelling, identification and control for engineers. Narosa Publishing House.
8. Dorf, R. C., & Bishop, R. H. (2009). Modern control systems. Pearson Education..

List of Open Source Software / Learning Websites:

1. https://nptel.ac.in/courses/112107240
2. https://onlinecourses.nptel.ac.in/noc20_me25/preview
3. https://onlinecourses.nptel.ac.in/noc20_ee90/preview
4. https://www.classcentral.com/course/swayam-automatic-control-9850
5. https://nptel.ac.in/courses/107106081
6. https://nptel.ac.in/courses/108103007

CO	Description of CO	PO	PSO
CO1	Explain the components, modeling, and representations of control systems including transfer functions, block diagrams, and signal flow graphs.	-	-
CO2	Analyze and evaluate the time and frequency domain response of control systems, including the effect of PID, PI, and PD controllers.	PO2 PO3	PSO1(3)
CO3	Assess system stability using classical methods (Routh–Hurwitz, root locus, Nyquist) and design compensators (lead, lag, lag-lead) to meet performance specifications.	PO3 PO4	PSO1(3)
CO4	Model, simulate, and analyze control systems using state-space methods, and evaluate controllability and observability of MIMO systems.	PO3 PO5	PSO2(3)

EI25402	Applied Machine Learning	L	T	P	C
		3	0	0	3

Course objective:

This course introduces foundational concepts and methods in machine learning, emphasizing supervised and unsupervised learning, regression, and classification. It equips students with practical skills in data preprocessing, algorithm development, and neural networks. The course also provides exposure to handling real-world datasets and understanding clustering and dimensionality reduction techniques.

Introduction to Machine Learning

Objectives of machine learning, human learning vs machine learning, types of machine learning: supervised learning, unsupervised learning, regression, classification. The machine learning process: data collection and preparation, feature selection, algorithm choice, parameter and model selection, training, evaluation, bias-variance tradeoff, underfitting and overfitting problems.

Activity Based Learning

• Explore machine learning applications in real-world scenarios, compare human learning vs machine learning through examples, simulate bias-variance tradeoff using sample datasets.

Data Preprocessing

Data quality, data preprocessing: data cleaning, handling missing data and noisy data, data integration, redundancy and correlation analysis, continuous and categorical variables. Data reduction: dimensionality reduction using Linear Discriminant Analysis and Principal Components Analysis.

Activity Based Learning

• Perform data cleaning on raw datasets, handle missing and noisy values, apply dimensionality reduction techniques such as PCA and LDA, analyze correlation between features in real datasets.

Supervised Learning and Unsupervised Learning

Linearly separable and non-linearly separable populations, logistic regression, support vector machines: kernels, risk and loss functions, support vector machine algorithm, multi-class classification, support vector regression. Introduction to clustering, partitioning methods: K-means algorithm, mean shift clustering, hierarchical clustering, clustering using Gaussian Mixture Models. Clustering high-dimensional data: problems and challenges.

Activity Based Learning

• Build and evaluate logistic regression models, implement and visualize support vector machines with different kernels, develop classification and regression models using SVM.

• Implement K-means and mean shift clustering on real-world datasets, perform hierarchical clustering and visualize dendrograms, cluster using Gaussian Mixture Models, explore challenges in high-dimensional clustering.

Neural Networks

Multi-layer perceptron, backpropagation learning algorithm, neural network fundamentals, activation functions, types of loss function, radial basis function network. Optimization: gradient descent algorithm, stochastic gradient descent, one case study.

Activity Based Learning

• Develop a neural network model using a multi-layer perceptron, implement backpropagation and activation functions, apply optimization techniques like SGD, build and evaluate a neural network-based controller for a selected application.

Tasks:

T1: Develop a machine learning model using a public dataset available for an application of your choice.
T2: Carry out data preprocessing tasks such as handling missing/outliers, dimensionality reduction, etc., on the public raw datasets available.
T3: Perform the correlation analysis between the various inputs and outputs of a system.
T4: Carry out the clustering on real-world datasets using any two popular clustering algorithms and comment on their performance.
T5: Build a multilayer neural network-based controller for a simulated nonlinear process of your choice.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Solving of GATE questions (20%), Internal Examinations (40%).

REFERENCES:

1. Alpaydin, E. (2004). Introduction to machine learning (Adaptive Computation and Machine Learning). The MIT Press.
2. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical learning with applications in R. Springer.
3. Marsland, S. (2009). Machine learning: An algorithmic perspective. CRC Press.
4. Runkler, T. A. (2016). Data analytics: Models and algorithms for intelligent data analysis (2nd ed.). Springer Vieweg.
5. Laurene Fausett, (1993). Fundamentals Of Neural Networks, Pearson India.

List of Open Source Software / Learning Websites:

- https://lecturenotes.in/materials/64801-machine-learning-for-engineering-and-
  science-applications

- https://nptel.ac.in/courses/106105152
- https://nptel.ac.in/courses/106106139
- https://nptel.ac.in/courses/106106202
- https://nptel.ac.in/courses/110101145
- https://nptel.ac.in/courses/106106139
- https://nptel.ac.in/courses/106106236
- https://nptel.ac.in/courses/

CO	Description of CO	PO	PSO
CO1	Explain the fundamental concepts and processes of machine learning, including supervised and unsupervised learning, regression, classification, and bias-variance tradeoff.	-	-
CO2	Preprocess and analyze datasets, handling missing/noisy data, feature selection, and dimensionality reduction using techniques like PCA and LDA.	PO2 PO3	PSO1(3)
CO3	Design, implement, and evaluate supervised and unsupervised learning models, including logistic regression, SVMs, and clustering algorithms such as K-means and hierarchical clustering.	PO2 PO3 PO5	PSO2(3)
CO4	Develop and train neural network models using multi-layer perceptrons, backpropagation, and optimization techniques for classification and regression applications.	PO3 PO5	PSO2(3)

EI25C07	Embedded Systems	L	T	P	C
		3	0	0	3

Course objective:

This course introduces the architecture and functioning of embedded systems, covering hardware components and embedded programming using C and Python. It provides hands-on experience with development tools and communication protocols, and emphasizes the design of embedded applications using real-time operating systems (RTOS) and peripheral interfacing.

Embedded Hardware Architecture

CISC Architecture: Introduction to MCS51 Family, 8051 Microcontroller – Architecture, Timers, Interrupts, Serial Data Communication.

RISC Architecture: Overview of PIC16F487x family, PIC16F877A – Architecture, Timers, Interrupts, Serial ports.

ARM and Embedded Software Development Tools

Introduction to ARM – LPC4088 Architecture. Software Development Tools: IDE Tools, ISP Tools, ARM Development Tools.

Wired Communication Interfaces

Wired Communication Protocols: Serial – RS232, RS485, I2C, SPI, USB; Parallel – IEEE 488.

Wireless Communication Interfaces

Wireless Communication Protocols: Bluetooth Classic, BLE, IEEE 802.15.4, Zigbee, IEEE 802.11, LoRaWAN.

Real-Time Operating System

Operating System Basics: The Kernel and its subsystems, Kernel Space and User Space.Types and Functions of RTOS: Task, Process and Threads, Interrupt Handling, Multiprocessing and Multitasking, Task Scheduling. Comparative study of various RTOS.

Embedded Programming and Peripheral Interfacing

Embedded C and Python Programming for Embedded Applications. Peripheral Interfacing: Input and Output Devices, ADC, DAC, PWM Generation, Sensor Interface.

Tasks:

T1: Design a system that takes user input through buttons to convert a given binary code sequence into its equivalent gray code and display the result on LEDs using 8051.

T2: Design an 8051-based system to generate a ripple pattern on LEDs at a desired time interval.

T3: Design a microcontroller based temperature measurement system using suitable

data acquisition system and display unit.
T4: Design an on/off control strategy for a temperature process using suitable data acquisition system and display unit.
T5: Design a LoRa-based point-to-point communication system between two remote stations.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Review of GATE questions (20%), Internal Examinations (40%).

References:

1. Huang, H.-W. (2009). Embedded system design using C8051. Cengage Learning.
2. Mall, R. (2007). Real-time systems: Theory and practice. Pearson Education.
3. Noergaard, T. (2006). Embedded systems architecture. Elsevier.
4. Peckol, J. (2010). Embedded system design. John Wiley.
5. Rajkamal. (2011). Embedded system: Architecture, programming, design. Tata McGraw Hill.
6. Shibu, K. V. (2009). Introduction to embedded systems. Tata McGraw Hill.

Learning Resources / Open Source Software:

1. https://nptel.ac.in/courses/108105057
2. https://nptel.ac.in/courses/106105193
3. https://nptel.ac.in/courses/106105172
4. https://nptel.ac.in/courses/106105193
5. https://nptel.ac.in/courses/106105159

CO	Description of CO	PO	PSO
CO1	Explain the architecture, hardware components, and operating principles of embedded systems including 8051, PIC16F877A, and ARM LPC4088 microcontrollers.	-	-
CO2	Develop embedded software using C and Python, implement tasks using timers, interrupts, and peripheral interfaces for practical applications.	PO2 PO3	PSO1(3)
CO3	Design and implement wired communication interfaces such as UART, I2C, SPI, RS232/RS485, and USB for data exchange between embedded devices.	PO2 PO3	PSO1(3)
CO4	Implement wireless communication protocols including Zigbee, Bluetooth, BLE, and LoRaWAN in embedded applications.	PO3 PO5	PSO2(3)
CO5	Apply Real-Time Operating System (RTOS) concepts including multitasking, task scheduling, and interrupt handling to design and verify real-time embedded applications.	PO3 PO5	PSO2(3)

EI25C08	Digital System Design and Applications	L	T	P	C
		3	0	0	3

Course Objective:

This course introduces number systems, Boolean algebra, and gate-level minimization for digital logic design. It emphasizes the design and analysis of combinational and sequential logic circuits including both synchronous and asynchronous types. It also covers programmable logic devices, digital simulation, and VHDL-based implementation for practical applications.

Boolean Algebra and Gate Level Minimization

Review of number systems, types and conversion, binary codes, error detection and correction codes (Parity and Hamming code). Boolean theorems and properties, Boolean functions, logic gates. Gate-level minimization using Karnaugh Map, SOP & POS simplification, Don't care conditions. Implementations of logic functions using gates – NAND, NOR implementations.

Combinational Logic

Design of adders, subtractors, multiplexers. Combinational logic design using multiplexers. Demultiplexers and their use in combinational logic design. 2-bit magnitude comparator, code converters – BCD to Binary and Binary to BCD, encoder, priority encoder – Decimal to BCD, Octal to Binary, decoders – BCD to Decimal and BCD to Seven Segment Display Decoder.

Synchronous Sequential Logic

Sequential logic – SR, JK, JKMS, D and T flip-flops, characteristics and excitation table, level triggering and edge triggering, counters – asynchronous and synchronous type, modulo counters, shift registers. Design of synchronous sequential circuits – Moore and Mealy models, state diagram, state reduction, state assignment.

Asynchronous Sequential Circuits

Asynchronous sequential logic circuits – transition and flow table, race conditions, hazards, and errors in digital circuits, analysis of asynchronous sequential logic circuits.

Memory and Logic Families

Memories: PROM, PLA, PAL, CPLD, FPGA. Digital logic gate realization and characteristics of TTL, ECL, and CMOS families.

VHDL

RTL Design – combinational logic, sequential circuit, operators. Introduction to packages, subprograms, testbench.

(Simulation/Tutorial Examples: adders, counters, flip-flops, multiplexers & demultiplexers)

Tasks:

T1:Apply mathematical knowledge of number systems, Boolean expressions/functions to simplify and realize logical expressions.

T2:Design and verify combinational logic circuits

T3:Design and verify synchronous sequential logic circuits.

T4:Analyze and design asynchronous sequential logic circuits.

T5:Understand memory types and gain knowledge on building blocks of different Programmable Logic devices and make use of appropriate software such as VHDL for electronic prototyping and modeling of digital systems.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Review of GATE questions (20%), Internal Examinations (40%).

References:

1. Bignel, J. W. (2007). Digital electronics (5th ed.). Cengage Learning.
2. Comer. (2016). Digital logic & state machine design (3rd ed.). Oxford.
3. Kamal, R. (2012). Digital systems: Principles and design. Pearson Education India.
4. Keitz, W. (2013). Digital electronics: A practical approach with VHDL. Pearson.
5. Kothari, D. P., & Dhillon, J. S. (2016). Digital circuits and design. Pearson Education.
6. Mandal. (2013). Digital electronics: Principles & application. McGraw Hill.
7. Mano, M., & Ciletti, M. D. (2018). Digital design: With an introduction to the Verilog HDL, VHDL, and System Verilog (6th ed.). Pearson India.

List of Open Source Software / Learning Websites:

1. https://nptel.ac.in/courses/117106114
2. https://nptel.ac.in/courses/117106086
3. https://nptel.ac.in/courses/106102181
4. https://archive.nptel.ac.in/courses/108/105/108105132/
5. https://nptel.ac.in/courses/108106177

CO	Description of CO	PO	PSO
CO1	Explain number systems, binary codes, Boolean algebra, logic gates, and gate-level minimization techniques including SOP, POS, K-Map simplification, and NAND/NOR realizations.	-	-
CO2	Design and analyze combinational logic circuits including adders, subtractors, multiplexers, demultiplexers, encoders, decoders, and code converters.	PO2 PO3	PSO1(3)
CO3	Design, simulate, and implement synchronous sequential circuits including flip-flops, counters, shift registers, and sequence detectors using Moore and Mealy models.	PO2 PO3	PSO1(3)

CO4	Analyze and design asynchronous sequential circuits, identify race conditions, hazards, and errors, and implement solutions for reliable operation.	PO3 PO4	PSO2(3)
CO5	Apply VHDL for RTL design and simulation of combinational and sequential circuits, including testbench creation, and implement memory and programmable logic devices (PLA, PAL, CPLD, FPGA) in practical applications.	PO3 PO5	PSO2(3)

EI25C09	Linear Integrated Circuits Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To understand, design, analyze, and implement linear integrated circuit-based analog systems including operational amplifier applications, signal conditioning circuits, oscillators, regulators, and data conversion techniques using ICs and simulation tools.

List of Experiments

1. Fabrication process demonstration using videos/simulations,
2. Identification and interpretation of IC datasheets,
3. Demo of monolithic components using software tools.
4. Design and analysis of inverting and non-inverting amplifiers, Summer and subtractor using Op-Amp, Differentiator and integrator circuits, Clippers and clampers using Op-Amp, Schmitt trigger and waveform generators, Active filter design and verification.
5. Timer-based delay and pulse generation using IC 555, VCO using IC 566, PLL design using IC 565, Analog multiplication and division using IC AD633.
6. Design of voltage regulator circuits using LM78XX, LM79XX, LM317, LM723, Audio amplifier using LM380, Function generator using ICL8038, Practical circuits using LM324.
7. V/I and I/V conversion circuits, Differential and instrumentation amplifier design, DAC implementation using R-2R and weighted resistor networks, ADC implementation using Flash and SAR techniques, Signal conditioning circuits for RTD and strain gauge.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Project (30%),Assignment (10%), Practical (30%), Internal Examinations (30%)

CO	Description of CO	PO	PSO
CO1	Understand fabrication processes, interpret IC datasheets, and analyze basic linear IC building blocks such as op-amp circuits and signal conditioning circuits.	-	-
CO2	Design, analyze, and implement analog circuits including amplifiers, waveform generators, filters, oscillators, and IC 555/PLL/VCO based systems.	PO2, PO3, PO5	PSO1(3)
CO3	Apply integrated circuit concepts to design power supplies, data conversion systems (ADC/DAC), and sensor interfacing circuits for real-world applications.	PO3, PO5	PSO1(3)

EI25403	Embedded Systems Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To develop the ability to design, program, interface, and analyze embedded systems using microcontrollers, communication protocols, and real-time operating systems for real-world applications.

List of Experiments

1. Implementation of specific tasks using Embedded C/Python programming,
2. Interfacing input devices with 8051/PIC16F877A/LPC4088,
3. Interfacing output devices with 8051/PIC16F877A/LPC4088.
4. Familiarization with development environments and simulation of embedded programs,
5. Design and implementation of ON/OFF control strategy, S
6. election of microcontroller for applications.
7. Establishing serial data transmission through UART,
8. Establishing serial data communication using I2C and SPI protocols.
9. Wireless data communication using Zigbee.
10. Multitasking using RTOS,
11. Design and verification of RTOS applications in simulation tools,
12. Realization of embedded and RTOS in hardware.
13. Implementation of recurring tasks using timers and interrupts of 8051/PIC microcontroller/LPC4088,
14. Interfacing ADC and DAC with 8051 microcontroller,
15. PWM generation using PIC16F877A/LPC4088,
16. Interfacing RTC with microcontroller.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Project (30%),Assignment (10%), Practical (30%), Internal Examinations (30%)

CO	Description of CO	PO	PSO
CO1	Understand microcontroller architecture, development environments, and implement basic embedded programs using Embedded C/Python along with simulation tools.	-	-
CO2	Design, implement, and analyze interfacing of input/output devices, timers, interrupts, ADC/DAC, PWM, and control applications using microcontrollers.	PO2, PO3, PO5	PSO1(3)
CO3	Develop and evaluate communication systems and real-time embedded applications using UART, I2C, SPI, Zigbee, and RTOS concepts.	PO3, PO5	PSO2(3)

EN25C04	English Communication Skills Laboratory– II	L	T	P	C
		0	0	2	1

Course Objectives:

The objectives of the course are to build students' advanced communication skills for workplace readiness and develop intercultural competence for effective collaboration in global and virtual teams. Prepare students for competitive exams with focused skill-building and test-oriented practice.

List of Activities

Stage Ready – Impactful Public Speaking .

(i) Simulate a formal event such as an academic conference, convocation, or awards ceremony, where students roles including Master of Ceremonies (MC), Role as a dignitary, and a Commentator

(ii) Visual Prompt Storytelling: Use random images to create spontaneous stories, focusing on plot, setting, and character,

(iii) **Digital Presentation - Record** a short video explaining a project or technical concept, using slides, voiceover, and visual aids (to be uploaded using google classroom or drive link)

Professional and Application-Oriented Writing

(i) Résumé Preparation: Design ATS-friendly résumés tailored to various job descriptions, using action verbs and quantifiable impact.

(ii) Design engaging content for poster presentation relevant to their domain.

Receptive Skills in Workplace Communication·

(i) Reading articles related to their domain and discuss in groups

(ii) Visit company websites, make inferences and present in the class

(iii) Listen to recorded mock interviews and take detailed notes. Summarise key points and action items in a professional format and make a presentation.

Intercultural Communication

(i) Assertive vs Aggressive communication

(ii) Role play activities – workplace communication in intercultural/crosscultural contexts

From Campus to Career: Industry Skills and Global Exam Preparation

(i) Participate in HR interviews using AI tools or peer interviewers, responding to behavioural questions using methods like STAR (Situation, Task, Action, Result)

(ii) Practice Verbal Ability in competitive exams like UPSC, SSC, CDS, TNPSC, etc.

Weightage: Continuous Assessment: 60%, End Semester Lab Examinations: 40%.

Internal Assessment Methodology: 1. Oral story telling using visual prompts (30 marks)
2. Poster presentation (40 marks)
3. ATS resume writing (30 marks)

End Semester Assessment:

1. Interview (50 marks)
2. Verbal Ability test (50 marks)

(students must bring the resume but evaluation must be done based on the

performance in the interview)

References:

1. Lucas, Stephen, and Paul Stob. The Art of Public Speaking. Thirteenth edition, McGraw- Hill Education, 2020.
2. Abrahams, Matt. Think Faster, Talk Smarter: How to Speak Successfully When You're Put on the Spot. Simon & Schuster, 2023.
3.. Beshara, Tony. Powerful Phrases for Successful Interviews, Rev. ed., McGraw-Hill, 2023.
4. Papalia, Anna. Interviewology: The New Science of Interviewing. Harper Business, 2024.
5. Verbal Ability and Reading Comprehension by Ajay Singh McGraw Hill Education 2020

E-resources:

1. Purdue OWL – Online Writing Lab (Academic and professional writing help) https://owl.purdue.edu/
2. Canva Resume Builder (Creative, ATS-friendly resume design) https://www.canva.com/resumes/
3. BBC Learning English – Pronunciation https://www.bbc.co.uk/learningenglish/english/features/pronunciation
4. India Bix website

	Description of CO	PO	PSO1
CO1	Understand basic industry-related reading materials.	-	-
CO2	Design and present a domain specific poster	PO9(3)	PSO1(2) PSO3(3)
CO3	Deliver effective digital presentations	PO9(3)	PSO2(1)
CO4	Communicate appropriately in intercultural/cross cultural contexts	PO9(3)& PO11(1)	PSO3(3)
CO5	Perform in interviews and competitive exams successfully	PO9(3)	PSO3(1)