ANNA UNIVERSITY, CHENNAI

UNDERGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: B.E - Electronics and Communication 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 – Laboratory Course

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.

Program Specific Outcomes:

1. To design and develop efficient electronic and modern communication systems for real-time applications.
2. To identify, formulate, and solve complex problems in the field of electronics and communication engineering using modern tools and techniques.
3. To keep pace with emerging technologies and demonstrate research aptitude, teamwork and ethical practices.

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.	EN25C01	English Essentials – I	T	2-0-0	2	2	HUM
3.	UC25H01	தமிழர் மரபு / Heritage of Tamils	T	1-0-0	1	1	HUM
4.	EE25C04	Basic Electronics and Electrical Engineering	T	2-1-0	3	3	ES (PC)
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.	CS25C01	Computer Programming: C	LIT	2-0-2	4	3	ES (G)
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.	MA25C02	Linear Algebra	T	3-1-0	4	4	BS
2.	UC25H02	தமிழர்களும் தொழில்நுட்பமும் / Tamils and Technology	T	1-0-0	1	1	HUM
3.	EN25C02	English Essentials – II	LIT	1-0-2	3	2	HUM
4.	EC25C01	Electron Devices	T	3-0-0	3	3	ES (PC)
5.	EC25C02	Circuits and Network Analysis	T	3-0-0	3	3	ES (PC)
6.	CS25C05	Data Structures using C++	LIT	3-0-2	5	4	ES (G)
7.	ME25C05	Re-Engineering for Innovation	L	0-0-4	4	2	SD
8.	UC25A03	Life Skills for Engineers – II	---	1-0-2	3	1	HUM
9.	EC25C03	Devices and Circuits Laboratory	L	0-0-4	4	2	ES (PC)
10.	UC25A04	Physical Education – II	---	0-0-4	4	1	HUM
11.		Foreign Language^	LIT	1-0-2	3	1	HUM
				Total Credits	**37**	**24**	

^ Deutsch / Japanese / Korean

Semester – III							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/ Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25C11	Probability, Statistical and Random Processes	T	3-1-0	4	4	BS
2.	EC25C04	Signals and Systems	T	3-1-0	4	4	ES (PC)
3.	EC25C05	Electronic Circuits and Analysis	T	3-0-0	3	3	ES (PC)
4.	EC25C06	Electro Magnetic Fields and Transmission Lines	T	3-0-0	3	3	ES (PC)
5.	EC25C07	Digital System Design	T	3-0-0	3	3	ES (PC)
6.	EC25C08	Digital System Design Laboratory	L	0-0-4	4	2	ES (PC)
7.	EC25C09	Electronic Circuits Laboratory	L	0-0-4	4	2	ES (PC)
8.		Skill Development Course-I	LIT	1-0-2	3	2	SD
9.	EN25C03	English Communication Skills Laboratory – I	L	0-0-2	2	1	HUM
				Total Credits	**30**	**24**	

Semester – IV							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods/ Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	EC25C10	Microcontroller and Peripheral Interfacing	T	3-0-0	3	3	ES (PC)
2.	EC25C11	Analog and Digital Communication	T	3-1-0	4	4	ES (PC)
3.	EC25C12	Control Systems	T	3-0-0	3	3	ES (PC)
4.	EC25401	Artificial Intelligence and Machine Learning	LIT	2-0-2	4	3	ES (PC)
5.		Industry-Oriented Course - I	LIT	1-0-2	3	1	SD
6.		Skill Development Course – II	LIT	1-0-2	3	2	SD
7.	EN25C04	English Communication Skills Laboratory – II	L	0-0-2	2	1	HUM
8.	EC25C13	Analog and Digital Communication Laboratory	L	0-0-4	4	2	ES (PC)
9.	EC25C14	Microcontroller and Peripheral Interfacing Laboratory	L	0-0-4	4	2	ES (PC)
			Total Credits		**30**	**21**	

Semester – V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.		Climate Change and Sustainability	T	2-0-0	2	2	HUM
2.		Introduction to Standards in Electronics and Communication	T	1-0-0	1	1	ES (PC)
3.		Linear Integrated Circuits	T	3-0-0	3	3	ES (PC)
4.		Digital Signal Processing	T	3-0-0	3	3	ES (PC)
5.		Computer Architecture and Organization	T	3-0-0	3	3	ES (PC)
6.		Programme Elective – I	T	3-0-0	3	3	ES (PE)
7.		Linear Integrated Circuits Laboratory	L	0-0-4	4	2	ES (PC)
8.		Digital Signal Processing Laboratory	L	0-0-4	4	2	ES (PC)
9.		Data Communication Networks	LIT	3-0-2	5	4	ES (PC)
10.		Skill Development Course – III	LIT	1-0-2	3	2	SD
			Total Credits		**31**	**25**	
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.		Programme Elective – II	T	3-0-0	3	3	ES (PE)
2.		Programme Elective – III	T	3-0-0	3	3	ES (PE)
3.		Open Elective	T	3-0-0	3	3	ES (OE)
4.		Antenna Design	T	3-0-0	3	3	ES (PC)
5.		VLSI Design	T	3-0-0	3	3	ES (PC)
6.		Embedded Technology and IoT.	T	3-0-0	3	3	ES (PC)
7.		Embedded Technology and IoT.Laboratory	L	0-0-4	4	2	ES (PC)
8.		VLSI Design Laboratory	L	0-0-4	4	2	ES (PC)
9.		Industry Oriented Course - II	LIT	1-0-2	3	2	SD
10.		Self-Learning Course	---	---	0	1	SL
				Total Credits	**29**	**25**	
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 Minor Degree							
1.		Minor Elective – III	T	3-0-0	3	3	
2.		Minor Elective – IV	T	3-0-0	3	3	

Semester – VII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Engineering Entrepreneurship Development	T	2-0-2	4	3	HUM
2.		Optical and Microwave Engineering	T	3-0-0	3	3	ES (PC)
3.		Wireless Communication	T	3-0-0	3	3	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.		Wireless Communication lab	I	0-0-4	4	2	ES (PC)
7.		Microwave and Optical Lab	L	0-0-4	4	2	ES (PC)
8.		Summer Internship*	---	---	---	1	SD
			Total Credits		**24**	**20**	
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 Periods - 170

Professional Elective Courses: VERTICALS					
Semiconductor Chip Design and Testing	**Signals and Image Processing**	**RF Technologies**	**Bio Medical and Sensor Technologies**	**Communication and Space Technologies**	**Emerging and Smart Technologies**
ASIC IC Design	Advanced Digital Signal Processing	RF Transceivers Design	Smart Sensors	Radar and Navigation Systems	Natural Language Processing
CAD for VLSI Design	Digital Image and Video Processing	Smart Antennas	Body Area Networks	Remote sensing	Block Chain Technology
Low Power IC Design	VLSI Signal Processing	Signal Integrity for High Speed Design	Medical Imaging Systems	Advanced wireless communication	Deep Learning
Mixed Signal IC Design	DSP Architecture and Programming	MICs and RF System Design	MEMS and NEMS Design	Satellite Communication	Edge and Cloud Computing
VLSI Testing and Design for Testability	Computer Vision	RFID System Design & Testing	Automotive Electronics	MIMO and Millimeter wave communication	Cyber security
Network on Chip design	Pattern Recognition	Electromagnetic Interference and Compatibility	Brain Computer Interface and Applications	Quantum Communication (New)	Robotics and Automation

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)

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)

UC25H01	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 ofArchaeology & 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: InternationalInstitute 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 ofArchaeology & 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.

EE25C04	Basic Electronics and Electrical Engineering	L	T	P	C
		2	1	0	3

Course Objectives:

- Students will understand the fundamentals and evolution of electronics, electrical systems

Basic Electronics: Passive and active components – Resistors, Capacitors, Inductors-Types, features and specification, Energy band diagram of conductors, semiconductor, insulator – Intrinsic & extrinsic semiconductor - types. PN junction diode – zener diode.

Activities: VI characteristics of PN junction and Zener diode.

Electrical Machines: Construction, Principle of Operation, Basic Equations and Applications - DC Generators, DC Motors, Single Phase Transformer, Single phase Induction Motor, Three phase Induction Motor, Three phase Alternator, Stepper and BLDC motors.

Activities: Demonstration of Electrical Machines.

Measurements and Instrumentation: Functional elements of an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.

Activities: Demonstration of measuring equipment's

Basics of Power Systems: Power system structure -Generation, Transmission and distribution , Various voltage levels, Earthing – methods of earthing, protective devices-switch fuse unit- Miniature circuit breaker- moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

Activities: Demonstration of Earthing and safety precautions in electrical circuits

Sensors and Transducers

Solenoids, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors, Strain gauge, LVDT, piezo electric crystals, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers

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

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

References:

1. Bell, D. (2008). *Electronic devices and circuits*. Oxford University Press.
2. Tooley, M. A. (2006). *Electronic circuits: Fundamentals and applications*. Elsevier Limited.
3. Malvino, A., & Bates, D. J. (2012). *Basic electronics: Problems and solutions*. Tata McGraw-Hill Publishing Company Pvt. Ltd.

4. Hughes, E. (2016). *Electrical and electronic technology*. Pearson.
5. Theraja, B. L. (2014). *A textbook of electrical technology*. S. Chand & Company.

E- Resources:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science
2. https://www.khanacademy.org/science/electrical-engineering

	Description of CO	**PO**	**PSO**
CO1	Understand and explain basic electrical and electronic concepts.	---	-
CO2	Apply and analyse electrical circuits in real-time applications.	PO1 (3) PO2 (1)	PSO1(3)
CO3	Identify and utilise key electrical and electronic devices used in engineering applications	PO2 (3)	PSO2(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*. 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)

CS25C01	Computer Programming: C	L	T	P	C
		2	0	2	3

Course Objectives:

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

Introduction to C: Problem Solving, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudocode, program structure, Compilation & Execution process, Interactive and Script mode, Comments, Indentation, Error messages, Primitive data types, Constants, Variables, Reserved words, Arithmetic, Relational, Logical, Bitwise, Assignment, Conditional operators, Input/Output Functions, Built-in Functions.

Practical: Create Problem Analysis Charts, Flowcharts and Pseudocode for simple C programs (Minimum three).

Control Structures: if, if-else, nested if, switch-case, while, do-while, for, nested loops, Jump statements.

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

Functions: Function Declaration, Definition and Calling, Function Parameters and Return Types, Call by Value and Call by Reference, Recursive Functions, Scope and Lifetime of Variables, Header files and Modular Programming.

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

Strings & Pointers: One-dimensional and Multi-dimensional Arrays, Array operations and traversals, String Handling: String declaration, input/output, string library functions, Pointer arithmetic, Pointers and Arrays, Pointers to function, Dynamic memory allocation.

Practical: Programs using pointers, dynamic memory, pointer arithmetic, string manipulations, array operations. (Minimum three)

Structures & Unions: Defining and using structures, Array of structures, Pointers to structures, Unions and their uses, Enumerations.

Practical: Program to use structures and unions

File Operations: Open, read, write, close file operations, Binary vs Text files, File pointers, Error handling in file operations.

Practical: Programs reading/writing data in text and binary files (Minimum three).

Standard Libraries & Header Files: Using standard libraries like stdio.h, stdlib.h, string.h, math.h, Creating and using user-defined header files and libraries.

Practical: Use of standard and user-defined libraries in solving 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. Thareja, R. (2021). Programming in C . Oxford University Press.
2. Balagurusamy, E. (2019). Programming in ANSI C. McGraw Hill Education.
3. Kanetkar, Y. (2020). Let us C. BPB Publications.
4. Kalicharan, N. (2022). Learn to program with C: An introduction to programming using the C language. Apress.
5. Forouzan, B. A., & Afyouni, H. (2023). Computer science: A structured programming approach in C (4th ed.). Cengage.

E-resources:

1. Learn-C.org - https://www.learn-c.org/
2. GeeksforGeeks - C Programming - https://www.geeksforgeeks.org/c-programming-language/
3. GNU C Library Documentation - https://www.gnu.org/software/libc/manual/
4. “Introduction to C Programming”, Swayam MOOC Course, https://onlinecourses.swayam2.ac.in/imb25_mg71/

CO	Description of CO	PO	PSO
CO1	Explain the potential usage of ‘C’ in engineering applications	---	---
CO2	To apply the concepts of ‘C’ in solving engineering problems and formulate new projects.	PO1 (2) PO5 (2)	PSO1(3) PSO3(1)
CO3	To interpret the data and effectively communicate in groups.	PO2 (3) PO8 (1) PO9 (1)	PSO2(3) PSO3(1)
CO4	Adapt new programming concepts and technologies in the profession.	PO11 (1)	PSO2(1), PSO3(3)

ME25C04	Makerspace	L	T	P	C
		0	0	4	2

Course Objectives:

- To impart practical skills in the assembly, disassembly, and welding of components using appropriate tools and techniques.
- 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)

Course Outcomes:

	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:

1. **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

MA25C02	Linear Algebra	L	T	P	C
		3	1	0	4

Course Objectives:

- To impart foundational knowledge in linear algebra essential for analysing and solving problems in engineering applications.
- To provide the knowledge on computation using software and interpret key linear algebra concepts using software.

Vector Spaces Introduction to Vector Spaces, Examples, Subspaces, Linear Combinations, Span, Generating Sets, Linear Dependence and Independence, Basis and Dimension, Dimension of Subspaces.

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

Linear Transformations and Diagonalization: Null space, Range, Dimension Theorem (statement only), Matrix representation of a linear transformation, Eigenvalues & Eigenvectors, Diagonalizability.

Activities: Open-Source software, exercises to compute the matrix representation of a linear transformation, find the null space and range of a matrix, and compute eigenvalues and eigenvectors of a matrix.

Inner Product Spaces: Inner product, Norms, Cauchy, Schwarz inequality, Gram, Schmidt orthogonalization, Simple problems (up to $\boldsymbol{R^3}$).

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

Matrix Decomposition: Orthogonal transformation of a symmetric matrix to diagonal form - Positive definite matrices, QR decomposition, Singular Value Decomposition (SVD), Least squares solutions- simple problems (up to $3 \times 3\ matrices$).

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

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). *Linear algebra*. Pearson.
2. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). *Linear algebra and its applications with MATLAB*. Pearson.
3. Bronson, R. (2011). *Schaum's outline of matrix operations*. McGraw-Hill Education.
4. Strang, G., & Thomson, R. (2005). *Linear algebra and its applications*. Brooks/Cole.
5. Lipschutz, S., & Lipson, M. (2009). *Schaum's outline of linear algebra*. McGraw-Hill.

6. Kreyszig, E. (2018). *Advanced engineering mathematics*. Wiley India.

	Description of CO	PO	PSO
CO1	Explain the fundamental concepts of Linear Algebra.	---	
CO2	Compute and interpret eigenvalues and eigenvectors.	PO1(3)	PSO1(2)
CO3	Apply inner product concepts and perform orthogonalization.	PO1 (3)	PSO1(1)
CO4	Compute least squares solutions of linear system of equations.	PO1 (2) PO2 (2)	PSO3(1)
CO5	Use MATLAB to implement and validate key linear algebra concepts	PO5 (1) PO11 (1)	PSO2(2)

UC25H02	தமிழர்களும் தொழில்நுட்பமும் / Tamils and Technology	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%)

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: InternationalInstitute 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.

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		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%)

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 ofArchaeology & 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.

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)

EC25C01	Electron Devices	L	T	P	C
		3	0	0	3

Course Objective:

- To acquaint with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field Effect Transistors, Power control devices, LED, LCD and other Optoelectronic devices.

Semiconductor: Types, Conductivity, Electron energy levels and energy band diagram, Carrier concentration, Mass action law, Characteristics and behavior of intrinsic semiconductors, Variation in properties with temperature, Carrier drift and diffusion, Current density equation, Excess carrier generation and recombination rates, Carrier life time. Continuity equation.

Activity: Virtual demonstration of energy levels, Drift and diffusion current.

PN Junction Diodes: Energy band diagram of open-circuited PN junction, Forward and reverse bias characteristics, Diode resistance, Transition and diffusion capacitance, Effect of temperature on diode behavior, clipper, clamper-Applications of PN junction diodes.

Special Diodes: Zener diode – breakdown mechanisms and voltage regulation, Varactor diode, Tunnel diode, Photo diode – construction, operation, and applications.

Activities: Virtual demonstration of characteristics of junction diodes, Design of a constant voltage regulator using Zener Diode.

Bipolar Junction Transistors: Construction, working, characteristics in CB, CE, and CC configurations, regions of operation, current gain, input/output characteristics, Early effect. Other Devices: Multi-emitter transistor – construction and applications.

Field Effect Transistors: JFET – construction, working, characteristics, parameters. MOSFET, MOS capacitor, depletion and enhancement modes, nMOS and pMOS, threshold voltage, transfer and output characteristics. CMOS – introduction and basic operation.

Thyristors: Shockley diode, Silicon Controlled Rectifier (SCR), TRIAC and DIAC – operation and applications, Thyristor protection techniques**.**

Unijunction Transistor (UJT): Construction, characteristics and application as relaxation oscillator.

Optoelectronic Devices: LED, LCD, Photo transistor, Opto-coupler – principle, characteristics and applications. Power MOSFETs: Construction, switching characteristics and applications in power circuits.

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

Assessment Methodology: Quiz (15%), Assignments (30%), Flipped Class (5%), GATE Questions 10 % Internal Examinations (40%)

References:

1. Neamen, D. A. (2012). *Semiconductor physics and devices*. Tata McGraw-Hill.
2. Boylestad, R. L., & Nashelsky, L. (2008). *Electronic devices and circuit theory*. Pearson Prentice Hall.
3. Yang, C. Y. (1978). *Fundamentals of semiconductor devices*. McGraw-Hill International.
4. Salivahanan, S., Suresh Kumar, N., & Vallavaraj, A. (2008). *Electronic devices and circuits*. Tata McGraw-Hill.
5. Floyd, T. L. (2018). *Electronic Devices: Conventional Current Version*. Pearson.

E-Resources:

1. https://archive.nptel.ac.in/courses/108/108/108108122/
2. https://onlinecourses.nptel.ac.in/noc21_ee80/preview
3. Razavi Electronics 1, Lec 1, Intro., Charge Carriers, Doping
4. Semiconductor Devices: Fundamentals

	CO Description	PO	PSO
CO1	Explain the behavior of Semiconductor physics and its applications in electron devices.	---	
CO2	Apply the concepts and compare the different configuration of various electron devices.	PO1 (3)	PSO1(2)
CO3	Analyze and interpret the characteristics of various electron devices.	PO2 (2)	PSO1(3)
CO4	Perform experiments to evaluate and compare the characteristics of electronic components.	PO2 (2) PO4 (2)	PSO2(2) PSO3(1)

EC25C02	Circuits and Network Analysis	L	T	P	C

		3	0	0	3

Course Objectives:

- To impart the fundamental principles of circuit laws, network theorems, and analysis techniques for DC and AC circuits.
- To gain analytical and simulation skills for both steady-state and transient behaviors in AC and DC circuits.

Circuit Laws and Network Theorems: Basic electrical components, voltage, current, power, Network terminology- Node, Junction, Branch, Loop, Short and Open Circuits, DC and AC circuits, Ohm's Law, Kirchhoff's Laws, Resistors, inductors, and capacitors in series and parallel, voltage and current division rule, Mesh and Nodal Analysis for AC and DC circuits, Source transformation techniques, Star delta transformation techniques, principle of linearity, Thevenin's and Norton's theorems, Superposition theorem, Maximum power transfer theorem, Reciprocity theorem.

Steady-State and Transient Analysis of Ac and DC Circuits: Components behavior (R, L, and C) in AC and DC, Characteristics of sinusoids, Phasor relationship for R, L, and C, Phasor diagram, Natural and forced response, Steady-state and Transient analysis of RL, RC, RLC circuits using Laplace Transform.

Resonance and Coupled Circuits: Natural frequency and Damping ratio, Series resonance, Parallel resonance, Quality factor (Q), Bandwidth, Selectivity, Effect of Q on bandwidth and selectivity. Self-inductance, Mutual inductance, Dot conversion, Ideal Transformer.

Linear Two-Port Network Analysis: Introduction to two-port networks, Characterization in terms of impedance, admittance, hybrid, and transmission parameters, parameter conversions, Interconnection of two-port networks – Symmetry and Reciprocity.

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

Assessment Methodology: Quiz (15%), Assignments (30%), Flipped Class (5%), GATE Questions 10 % Internal Examinations (40%)

REFERENCE:

1. Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (2024). *Engineering circuit analysis*. McGraw Hill Education.
2. Boylestad, R. L. (2014). *Introductory circuit analysis*. Pearson Education India.
3. Alexander, C. K., & Sadiku, M. N. O. (2017). *Fundamentals of electric circuits*. McGraw Hill Education.
4. Kuo, F. F. (2012). *Network analysis and synthesis*. Wiley India.

E-Resources:

1. https://nptel.ac.in/courses/108102042
2. https://nptel.ac.in/courses/108105159
3. https://archive.nptel.ac.in/courses/108/104/108104139/
4. https://archive.nptel.ac.in/courses/117/106/117106108/
5. https://www.ee.iitm.ac.in/videolectures/doku.php?id=ee2015_2017nk:start

	CO Description	PO	PSO
CO1	Explain basic circuit laws, network theorems, and the behavior of circuit components	---	
CO2	Apply network analysis methods, such as mesh analysis and nodal analysis, for solving DC circuits.	PO1 (2) PO2 (3) PO4 (2)	PSO1(2) PSO2(3)
CO3	Analyze and evaluate the steady-state and transient behaviors of RL RC, RLC circuits and two-port networks.	PO2 (3) PO3 (2) PO4 (2)	PSO1(2) PSO2(3)

CS25C05	Data Structures using C++	L	T	P	C
		3	0	2	4

Course Objective:

- This course aims to provide an understanding of object-oriented programming principles using C++.

Data Abstraction & Overloading: Overview of C++, Structures, Class Scope and Accessing Class Members, Reference Variables, Initialization, Constructors, Destructors, Member Functions and Classes, Friend Function, Dynamic Memory Allocation, Static Class Members, Container Classes and Integrators, Proxy Classes, Overloading: Function overloading and Operator Overloading.

Practical:

1. Program to Implement Constructors and Destructors.
2. Program to implement Member Functions, Classes and Friend Functions.
3. Program to Implement Dynamic Memory Allocation and Overloading.

Inheritance & Polymorphism: Base Classes and Derived Classes, Protected Members, Casting Class pointers and Member Functions, Overriding, Public, Protected and Private Inheritance–Constructors and Destructors in derived Classes, Implicit Derived, Class Object to Base, Class Object Conversion, Composition Vs. Inheritance, Virtual functions, This Pointer, Abstract Base Classes and Concrete Classes, Virtual Destructors, Dynamic Binding.

Practical:

1. Program to Implement various inheritances.
2. Program to Implement virtual functions and dynamic binding.
3. Implementation of method overriding and operator overloading.

Linear Data Structures: Asymptotic Notations: Big-Oh, Omega and Theta, Best, Worst and Average case Analysis: Definition and an example, Arrays and its representations, Stacks and Queues, Linked lists, Linked list based implementation of Stacks and Queues, Evaluation of Expressions, Linked list based polynomial addition.

Practical:

1. Program to implement various operations on arrays and linked lists.
2. Program to implement various operations on stacks and queues using array and linked list.
3. Program to evaluate the infix expressions by converting into prefix and postfix expressions

Linear Data Structures: Asymptotic Notations: Big-Oh, Omega and Theta, Best, Worst and Average case Analysis: Definition and an example – Arrays and its representations, Stacks and Queues, linked lists, linked list based implementation of Stacks and Queues, Evaluation of Expressions, linked list based polynomial addition.

Practical:

1. Program to Implement Various Operations on Arrays and Linked Lists.
2. Program to Implement Various Operations on Stacks and Queues using Array and Linked List.
3. Program to Evaluate the Infix Expressions by converting into Prefix and Postfix Expressions.

Non-Linear Data Structures: Trees, Binary Trees, Binary tree representation and traversals, Threaded binary trees, Binary tree representation of trees, Application of trees: Set representation and Union, Find operations, Graph and its representations, Graph Traversals, Connected components. Standard template library.

Practical:

1. Program to Implement Binary Tree Traversal and Graph Traversal Algorithm.
2. Program to Implement the Single Source Shortest Path Algorithm and All Pair Shortest Path Algorithm.
3. Program to find the Minimal Spanning Tree for a Graph.

Searching, Sorting and Complexity Analysis: Insertion sort, Merge sort, Quicksort, Heapsort, Linear Search, Binary Search.

Practical:

1. Program to Implement Linear Search and Binary Search Algorithms.
2. Program to Implement Insertion Sort, Merge Sort, Quick Sort and Heap Sort Algorithms.

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

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

References

1. Deitel, P. J., & Deitel, H. M. (2005). *C++ how to program*. Pearson Education.
2. Ellis Horowitz, E., Sahni, S., & Mehta, D. (2007). *Fundamentals of data structures in C++*. Universities Press Pvt Ltd.
3. Weiss, M. A. (2007). *Data structures and algorithm analysis in C++*. Addison-Wesley.
4. Trivedi, B. (2010). *Programming with ANSI C++: A step-by-step approach*. Oxford University Press.
5. Goodrich, M. T., Tamassia, R., & Mount, D. (2004). *Data structures and algorithms in C++*. Wiley.

E-Resources:

1. https://nptel.ac.in/courses/106/106/106106143/
2. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

	CO Description	**PO**	**PSO**
CO1	Explain the concepts and applications of Data Structure in various engineering applications		
CO2	Apply various Data Structure in real time	PO1(3)	PSO1(2)
CO3	Develop suitable and interrupt the data in real world applications	PO1(2) PO3(2)	PSO1(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)

EC25C03	Devices and Circuits Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:

- To learn the characteristics of basic electronic devices such as diode, BJT, FET, SCR & UJT.
- To gain hands on experience in KVL, KCL, Thevenin, Norton, Super position, Reciprocity and Maximum Power Transfer theorem.
- To understand the working of RL, RC and RLC Circuits.

List of Experiments:

1. Characteristics of PN junction & Zener Diode.
2. Input and Output Characteristics of BJT.
3. Drain and Transfer Characteristics of FET.
4. Design clipper and clamper circuits.
5. VI Characteristics of SCR & UJT.
6. Demonstration of rectifier Circuits.
7. Verification of KVL & KCL.
8. Verification of Thevenin and Norton theorem.
9. Verification of super position theorem & Reciprocity theorem.
10. Verification of Maximum power transfer theorem.
11. Determination of resonance frequency of series & parallel circuits.
12. Transient Analysis of RL and RC circuits.

TOTAL: 60 PERIODS

	CO Description	PO	PSO
CO1	Perform experiments to evaluate and compare the characteristics of electronic components.	---	
CO2	Apply the concepts and demonstrate the different configuration of various electron devices.	PO1 (3)	PSO1(2)
CO3	Experimentally analyze and interpret of various theorems.	PO2 (2)	PSO1(3)
CO4	Perform experiments to evaluate the electric and magnetic circuits.	PO2 (2) PO4 (2)	PSO2(2) PSO3(1)

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:

1. 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)

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. 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)

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

MA25C11	Probability, Statistical and Random Processes	L	T	P	C
		3	1	0	4

Course Objective:

To provide a rigorous mathematical foundation in statistical analysis and probability theory required for industrial quality control, semiconductor manufacturing, signal processing, and modern communication systems. The course emphasizes "small sampling theory" and stochastic processes essential for electronics R&D.

Descriptive and Bivariate Statistics:. Univariate Measures: Mean, Median, Mode, Variance, and Standard Deviation, Relative Variation: Coefficient of Variation (CV) for comparing component stability., Bivariate Statistics: Covariance and the Correlation Coefficient (r), Linear Regression: Method of Least Squares for sensor calibration and trend analysis

Probability Foundations and Distributions

Probability Theory: Axioms, Conditional Probability, and Bayes' Theorem (Signal Detection).

Random Variables: Discrete (Binomial, Poisson for shot noise) and Continuous (Uniform, Exponential).

The Normal Distribution: Properties of Gaussian distributions, Central Limit Theorem, and Z-scores.

- **Multivariate Gaussian:** Joint PDFs, independence, and correlation in vector random variables.

Statistical Inference and Small Sampling

Sampling Distributions: Population vs. Sample; Degrees of Freedom.

Small Sample Tests: Student's t-distribution (One-sample and Two-sample tests).

Variance Analysis: Chi-square distribution and F-distribution for comparing production batches.

Estimation: Confidence Intervals for mean and variance of device parameters.

Hypothesis Testing and Error Metrics

Testing Framework: Null (H0) and Alternative (H1) Hypotheses.

Decision Errors: Type I error (Alpha), Type II error (Beta), and Power of a test.

p-values: Interpretation of p-values in industrial datasheets and medical electronics.

Parametric & Non-Parametric: ANOVA basics and Chi-square Goodness-of-Fit tests.

Stochastic Processes and Signal Noise

Random Processes: Concept of Stationarity (WSS) and Ergodicity.

Correlation Dynamics: Auto-correlation and Cross-correlation functions.

Frequency Domain: Power Spectral Density (PSD) and Wiener-Khinchin Theorem.

LTI Systems: Response of linear circuits to random noise; Introduction to the Kalman Filter.

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

Mandated Activities with weightage: Assignments, MATLAB Activities, Tutorials, Quiz.

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

References:

1. Roy D Yates and David J Goodman, “Probability and Stochastic Processes”, Wiley India, New Delhi, 2021.
2. Douglas C Montgomery and George C Runger, “Applied Statistics and Probability for Engineers”, 7th edition, Wiley India, New Delhi, 2020.
3. Oliver C. Ibe, “Fundamentals of Applied Probability and Random Processes”, 1st Indian Reprint, Elsevier, 2014.
4. Saeed Ghahramani, “Fundamentals of Probability with Stochastic Processes”, 5th edition, CRC Press, USA, 2024.
5. Stark. H and Woods J.W, "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Asia, 2001.

CO	Description of CO	PO	PSO
CO1	Understand the basic concepts of probability, random variables, standard probability distributions, and random processes.	-	-
CO2	Apply joint distributions, correlation, regression, and transformation of random variables for real-world data analysis.	PO1(3)	PSO1(1), PSO2(2)
CO3	Model and simulate random phenomena using stochastic processes and analyze their long-term behavior.	PO2(3), PO5(3)	PSO2(2), PSO3(1)
CO4	Analyze spectral properties of random signals, including autocorrelation, cross-correlation, and spectral density functions.	PO2(3)	PSO2(2)
CO5	Examine linear time-invariant systems with random inputs using transfer function analysis and stochastic system modeling.	PO2(3), PO5(3)	PSO2(2)

EC25C04	Signals and Systems	L	T	P	C
		3	1	0	4

Course Objective:

The course builds foundational skills for analyzing continuous and discrete-time signals, including their classification and properties, and explores key transforms (Fourier, Laplace, Z, DTFT).

Introduction to Signals and Systems:

Definition of Signals and Systems, Classification of Signals, Operations on signals, Singularity functions and related functions. Analogy between vectors and signals, orthogonal signal space, complete set of orthogonal functions, Parseval's relations.

Fourier Series Analysis:

Fourier series representation of continuous time periodic signals, Trigonometric and Exponential Fourier series, Properties of Fourier series.

Fourier Transform & Laplace Transform:

Fourier transform of aperiodic signals, standard signals and periodic signals, Properties of Fourier transforms. Hilbert transform and its properties. Laplace transforms, RoC, properties. Inverse Laplace transform.

Continuous-Time LTI Systems:

Continuous time Systems and its properties. Linear time invariant (LTI) system, Impulse response. Convolution. Analysis of LTI System using Laplace and Fourier transforms.

Sampling, Quantization & Discrete-Time Systems:

Sampling and reconstruction of band limited signals. Low pass and band pass sampling theorems. Aliasing. Anti-aliasing filter. Practical Sampling-aperture effect. Quantization. Discrete-time signals and systems. Discrete Fourier series, DTFT, Z-transform and its properties. Analysis of LTI systems using Z – transform.

Suggested activities: Quiz based on competitive examination problems (GATE, IES), Simulation Assignment.

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1.Oppenheim, A. V., & Schafer, R. W. (2010). Discrete-time signal processing (3rd ed.). Pearson.

2.Haykin, S., & Van Veen, B. (2012). Signals and systems (2nd ed.). John Wiley & Sons.

3.Mitra, S. K. (2009). Digital signal processing: A computer-based approach (3rd ed.). Tata McGraw Hill.

4.Vaidyanathan, P.P.(2024). Signals, Systems ,and Signal Processing India, Cambridge University Press.

E-Resources:

1. NPTEL :: Electrical Engineering - Signals and Systems

2. https://onlinecourses.nptel.ac.in/noc21_ee28/preview

3. Principles of Signals and Systems - Course

CO	Description of CO	PO	PSO
CO1	Define and classify continuous-time and discrete-time signals, systems, and their fundamental properties.	-	-
CO2	Apply Fourier Series techniques to analyze periodic signals and interpret their frequency domain characteristics.	PO1 PO3	PSO1 (3) PSO2 (2)
CO3	Analyze Linear Time-Invariant (LTI) systems using convolution and transform methods.	PO2 PO3	PSO1 (3) PSO2 (2) PSO3 (2)
CO4	Develop and adapt solutions using sampling, quantization, and discrete-time signal processing techniques for real-world applications and continuous learning.	PO3, PO5	PSO2 (1) PSO3 (3)

EC25C05	Electronic Circuits and Analysis	L	T	P	C
		3	0	0	3

Course Objective:

Covers diode, BJT, and MOSFET circuits for designing amplifiers, feedback systems, and waveform generators using simulation and application-based problem solving.

Diode and Filter Circuits:

Diode circuits - clipper, clamper, voltage doubler, voltage quadrupler, half-wave rectifier, centre-tapped full-wave rectifier, and bridge rectifier circuits. Power supply design. Regulators – Voltage regulator circuits using Zener diode. Passive filters – analysis of RC, RL, RLC filters.

BJT Circuits:

Load-line analysis, different biasing techniques of BJT, bias stabilization, and early effect, RC-coupled and transformer-coupled multistage amplifiers, and current mirror circuits.

MOSFET Circuits:

Biasing by fixing V_{GS}, biasing by fixing V_G, and connecting a resistor in the source, Biasing using a drain-to-gate feedback resistor, and biasing using a current source. Analysis and design of common source, common drain, common gate amplifier configurations.

Frequency Response of Amplifiers:

Frequency response of amplifiers – Low frequency response of BJT and FET amplifiers, lower cut off frequency - hybrid π equivalent circuit of BJT - high frequency response of BJT amplifiers –upper cut off frequency – transition frequency - Miller effect, high frequency response of FET amplifiers. Wide band amplifiers - Wide banding techniques – CC–CE /CD-CS cascade, cascode amplifier, Darlington pair.

Feedback Amplifiers and Waveform Generators:

Feedback and stability- negative and positive feedback in amplifiers, analysis of four feedback topologies, loop gain. Oscillators - Barkhausen criterion, effect of feedback on amplifier poles, Bode plots, gain and phase margins; positive feedback and sinusoidal oscillators using BJT - Wein bridge oscillator, RC phase shift oscillator, Hartley and Colpitts oscillators. Multivibrators using BJT – Astable, Monostable, and bistable circuits.

Power Amplifiers and Wideband Techniques:

Power amplifiers –Analysis of Class A, B, AB, C, D & S power amplifiers, Conversion efficiency and relative performance, Total Harmonic Distortion (THD), Relationship Between Total Power and THD, Heat sinks.

Suggested activities: Quiz, problem-solving assignments, circuit simulation using SPICE tools.

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. Sedra, A. S., & Smith, K. C. (2020). Microelectronic circuits (8th ed.). Oxford University Press.

2. Neamen, D. A. (2021). Microelectronics: Circuit analysis and design (5th ed.). McGraw-Hill Education.
3. Razavi, B. (2016). Fundamentals of microelectronics (2nd ed.). Wiley.
4. Bell, D. A. (2008). Electronic devices and circuits (5th ed.). Oxford University Press.
5. Boylestad, R. L., & Nashelsky, L. (2021). Electronic devices and circuit theory. Pearson Education.

E-resources

1. https://nptel.ac.in/courses/108102112
2. MIT OpenCourseWare – Circuits and Electronics.
3. All About Circuits (www.allaboutcircuits.com).
4. LTspice /NGspice simulation tools https://ngspice.sourceforge.io/

CO	Description of CO	PO	PSO
CO1	Define and explain diode circuits, BJT and MOSFET circuits, amplifier characteristics, feedback, oscillators, and power amplifiers.	-	-
CO2	Apply circuit analysis techniques to design and solve problems involving rectifiers, filters, biasing circuits, amplifiers, and oscillators	PO1, PO3	PSO1(3)
CO3	Analyze frequency response, feedback mechanisms, stability, and performance parameters of electronic circuits using appropriate models and methods.	PO2 PO3	PSO1(3
CO4	Design and develop analog circuits and adapt to modern tools and emerging technologies for real-world applications.	PO2, PO3, PO5	PSO1(3

EC25C06	Electromagnetic Fields and Transmission Lines	L	T	P	C
		3	0	0	3

Course objective:

Covers static electric and magnetic field laws, Maxwell's equations, and electromagnetic wave propagation across media, transmission lines, and waveguides.

Coordinate Systems

Fundamentals of scalars and vectors, Coordinate systems.

Electrostatics:

Coulomb's Law, Gauss's Law, Electric Scalar Potential, Electric Boundary Conditions, Capacitance, Electrostatic Potential Energy.

Magnetostatic:

Ampere Circuital law- Biot–Savart Law, Magnetic Forces and Torques, Maxwell's Magnetostatic Equations, Vector Magnetic Potential, Magnetic Boundary Conditions, Inductance, Magnetic Energy.

Maxwell's equations:

Equation of continuity, Maxwell's equations for time varying fields, boundary conditions. Wave equation, EM waves in conducting medium and dielectric medium , Uniform plane wave equation.

Transmission Lines

Transmission Lines, types, two-wire line-Equivalent circuit , characteristic impedance, propagation constant, input impedance, VSWR, reflection and transmission coefficients, return loss, quarter-wave transformer -impedance matching using smith chart.

Waveguide

Parallel plate, TEM-TM-TE-Cut off frequency, rectangular waveguide, parameters related to waveguides.

Suggested activities: GATE Questions, Assignments, and Project-based learning

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 2002.
2. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015.
3. Edward C. Jordan & Keith G. Balmain,Electromagnetic waves and Radiating Systems, Second Edition, Prentice-Hall Electrical Engineering Series, 2012.

4. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006 3. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011. **5.** B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011.
E-Resources: 1.https://onlinecourses.nptel.ac.in/noc21_ee83/ 2.https://www.feynmanlectures.caltech.edu/I_toc.html 3.http://www.digimat.in/nptel/courses/video/117101056/L10.html

CO	Description of CO	PO	PSO
CO1	Define and explain the fundamental concepts of electrostatics and magnetostatics including Coulomb's law, Gauss's law, Ampere's law, and Biot–Savart law.	-	-
CO2	Apply Maxwell's equations and boundary conditions to analyze electric and magnetic fields in static and time-varying conditions.	PO1 PO3	PSO1 (3), PSO2 (2)
CO3	Analyze electromagnetic wave propagation in conducting and dielectric media using wave equations and uniform plane wave concepts and determine modes (TEM, TE, TM) and cutoff frequencies for rectangular waveguides	PO2, PO5	PSO2 (3), PSO3 (2)
CO4	Use modern engineering tools (simulation software/field visualization tools) to model electrostatic and magnetostatic problems.	PO5	PSO3 (3)

EC25C07	Digital System Design	L	T	P	C
		3	0	0	3

Course Objective:

This course aims to create a strong foundation for Digital Electronics. The students are taught the basic components of digital systems and the processes of their implementation. The students are also taught Boolean algebra, logic gates, the basics of memories, and the implementation of combinational and sequential digital circuits using logic gates. Students are trained to employ the principles of digital electronics to implement digital design for the given problem.

Boolean Algebra:

Revisiting Boolean algebra and minimization, 4-variable Karnaugh Maps, SOP and POS Minimization using Karnaugh Maps-Introduction to Verilog HDL, Data Types and Operators-Different types of Modeling

Combinational Digital Circuits:

Introduction to combinational circuits, realization of logic expressions using AOI, NOR, and NAND gates. Adders, Subtractors, Multiplexers, De-multiplexers, Encoders, Decoders, Priority encoders, Arithmetic circuits, such as multipliers, Ripple adders, Code-converters –Programming using Verilog HDL.

Sequential Digital Circuits:

Introduction to sequential circuits, Moore and Mealy machine, Flip-flops and Latches, realization of flip-flops using S-R flip-flop, master slave flip-flop, JK flip-flop, T and D flip-flops, Realization of flip-flops using logic gates, introduction to shift registers, realization of different types of shift registers, introduction to counters, realization of different types of counters, Introduction to different types of memories Programming using Verilog HDL.

Finite State Machines:

Need for FSM, Elements of FSM, Components in FSM, FSM in HDL, Issues in FSM design, Case studies: Sequence detector, Odd parity Checker, Vending Machine

FPGA Architecture:

Introduction to FPGA Architecture, Components of FPGA Architectures – Programming Technologies, Logic elements and Look-up Tables, Dedicated multipliers, Distributed RAM, Shift registers, Digital Clock Managers, Altera FPGA and AMD Xilinx FPGA architectures and design flow-AMD Spartan, Virtex, Altera Cyclone, Arria and Agilex architectures-Introduction to IP Cores- AMD Microblaze V and Altera NIOS V Soft core processors

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. Fletcher, W. I. (2015). An engineering approach to digital design (1st ed.). Pearson Education India.

2. Floyd, T. L. (2015). Digital fundamentals (11th ed., Global ed.). Pearson.
3. Mano, M. M., & Ciletti, M. D. (2019). Digital design: With an introduction to the Verilog HDL, VHDL, and SystemVerilog (6th ed., Global ed.). Pearson.
4. Roth, C. H., Jr., Kinney, L. L., & John, E. B. (2019). Fundamentals of logic design (7th ed.). Cengage.
5. Tocci, R. J., Widmer, N. S., & Moss, G. L. (2010). Digital systems: Principles and applications (11th ed.). Pearson Education.
6. Wakerly, J. F. (2018). Digital design: Principles and practices (5th ed.). Pearson Education.

E-Resources:

https://www.altera.com/fpga
https://fpgacademy.org/

CO	CO Description	PO	PSO
CO1	Explain fundamental concepts of digital electronics, including Boolean algebra, logic gates, and digital circuit classifications.	-	-
CO2	Apply logic design techniques and minimization methods to develop optimized solutions for digital circuits.	PO1 PO2, PO3	PSO1 (3), PSO2 (2)
CO3	Analyze practical problems and design appropriate digital solutions using components such as multiplexers, encoders, latches, counters, and code converters.	PO2, PO3, PO5	PSO2 (3), PSO3 (2)
CO4	Develop and verify digital circuit designs using digital trainer kits and Hardware Description Language (HDL) programming.	PO3, PO5	PSO3 (3)

EC25C08	Digital System Design Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To develop hands-on skills in designing, implementing, and verifying combinational and sequential digital circuits using HDL and hardware platforms for real-world applications.

List of Experiments:

1. Verification of De Morgan's Theorem, sum-of product and product-of- sum expressions using basic and universal gates.
2. Design, construction and verification of a BCD to Excess-3 and Excess-3 to BCD code converters
3. Design, construction and verification of a Binary to Gray and Gray to Binary code converters
4. Design and implementation of Multiplexer and De-multiplexer circuits using ICs and verification of their functions
5. Design and implementation of an encoder and decoder circuit using ICs.
6. Design and construction of Magnitude Comparator using appropriate IC
7. Construction and verification of the functions of S-R latch, S-R, J-K, T and D Flip-Flops using NAND and NOR gates.
8. Design and verify 3 bit counter using Verilog HDL
9. Design and verify 3-bit Ripple carry adder using Verilog HDL

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

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

References:

1. Fletcher, W. I. (2015). An engineering approach to digital design (1st ed.). Pearson Education India.
2. Floyd, T. L. (2015). Digital fundamentals (11th ed., Global ed.). Pearson.
3. Mano, M. M., & Ciletti, M. D. (2019). Digital design: With an introduction to the Verilog HDL, VHDL, and SystemVerilog (6th ed., Global ed.). Pearson.
4. Roth, C. H., Jr., Kinney, L. L., & John, E. B. (2019). Fundamentals of logic design (7th ed.). Cengage.
5. Tocci, R. J., Widmer, N. S., & Moss, G. L. (2010). Digital systems: Principles and applications (11th ed.). Pearson Education.
6. Wakerly, J. F. (2018). Digital design: Principles and practices (5th ed.). Pearson Education.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee39/preview
2. https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/digital-system-design-and-testing/?v=c86ee0d9d7ed
3. https://archive.nptel.ac.in/courses/117/105/117105080/
4. W1_L1_Introduction

Task

T1 Design and verify combinational logic circuits for De Morgan's theorem, SOP, and POS expressions using basic and universal gates.

T2 Design and implement code converter circuits for BCD-to-Excess-3, Excess-3-to-BCD, Binary-to-Gray, and Gray-to-Binary conversions.

T3 Design and implement data routing and coding circuits using Multiplexers, Demultiplexers, Encoders, and Decoders with standard ICs.
T4 Design and verify sequential logic circuits including S-R Latch, S-R Flip-Flop, J-K Flip-Flop, T Flip-Flop, and D Flip-Flop using NAND and NOR gates.
T5 Design, implement, and verify a 3-bit Ripple Carry Adder and a 3-bit Counter using Verilog HDL and simulation tools.

CO	CO Description	PO	PSO
CO1	Define and explain the operation of basic logic gates, combinational circuits, sequential circuits, and CMOS/PLD-based digital systems.	-	-
CO2	Apply HDL/simulation tools to implement combinational and sequential circuits for given specifications.	PO1, PO2, PO3, PO4	PSO3 (3)
CO3	Analyze the behavior and performance of digital circuits including FSMs, counters, hazards, and timing issues using appropriate methods.	PO1, PO2, PO4	PSO2 (3)
CO4	Design and realize digital systems using modern EDA tools and hardware platforms for real-world applications.	PO3, PO4, PO5	PSO3 (3)

EC25C09	Electronic Circuit Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To develop hands-on skills in designing and analyzing electronic circuits including amplifiers, oscillators, and related applications.

List of Experiments

1. Study and simulation of clipper and clamper circuits.
2. Design and analysis of rectifiers (HWR, FWR, Bridge) with filters.
3. Design of Zener diode voltage regulator and power supply.
4. Design and analysis of BJT biasing circuits and RC-coupled amplifier.
5. Design and analysis of MOSFET biasing circuits.
6. Implementation of common source (CS), common drain (CD), and common gate (CG) amplifiers.
7. Frequency response analysis of BJT/FET amplifiers.
8. Design and simulation of RC phase shift and Wien bridge oscillators.
9. Study of multivibrator circuits (Astable and Monostable).
10. Analysis of Class A and Class B power amplifiers with efficiency calculation.

Tools Required: Diodes, IC- Resistors, Capacitor, LT spice open-source software, Regulated power supply, Digital storage oscilloscope.

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

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

References:

1. Sedra, A. S., & Smith, K. C. – Microelectronic Circuits (Oxford University Press)
2. Boylestad, R. L., & Nashelsky, L. – Electronic Devices and Circuit Theory (Pearson)
3. Neamen, D. A. – Microelectronics: Circuit Analysis and Design (McGraw-Hill)
4. Razavi, B. – Fundamentals of Microelectronics (Wiley)

E-Resources:

1. https://nptel.ac.in/courses/108102112
2. MIT OpenCourseWare – Circuits and Electronics.
3. All About Circuits (www.allaboutcircuits.com).
4. LTspice /N spice simulation tools https://ngspice.sourceforge.io/

Task

T1. Design a power supply circuit for mobile phone charging applications

T2. Design an overheat protection circuit

T3. Design wave shaping circuit for signal conditioning applications.

T4. Design surge protection circuit in consumer electronics

CO	CO Description	PO	PSO
CO1	Define and explain the operation of diode circuits, transistor biasing, amplifiers, feedback systems, oscillators, and power amplifiers.	-	-
CO2	Apply circuit principles to design and implement rectifiers, filters, biasing circuits, amplifiers, and oscillators using simulation tools.	PO1,	PSO1 (3), PSO3 (2)
CO3	Analyze the performance of electronic circuits in terms of gain, frequency response, stability, and efficiency.	PO1,	PSO2 (3)
CO4	Design and evaluate advanced circuit behavior, including feedback effects, distortion, and power amplifier performance under practical conditions.	PO3, PO4, PO5	PSO3 (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.

Group Discussions – Abstract and Factual topics

D. Resume & LinkedIn Optimization

(i) Building LinkedIn Profile – Drafting headlines and summaries

(ii) Social Media Optimisation

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

CO	Description of CO	PO	PSO
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

EC25C10	Microcontroller and Peripheral Interfacing	L	T	P	C
		3	0	0	3

Course Objective:

To equip students with the knowledge of embedded systems, ARM-based architectures, peripheral interfacing, and emerging AI processor technologies for designing modern intelligent electronic systems.

Introduction to Microprocessor, Microcontroller and Embedded System

Introduction to Microprocessor and Microcontrollers, comparison and usage of Microprocessor and Microcontroller. Introduction to embedded systems, understanding of code region, data region – and various components of an embedded system.

Understanding of Embedded Processor Architecture and Memory Technology

RISC vs. CISC, Harvard vs. Von Neumann, brief on RISC-V, Memory Technologies: SRAM, DRAM, NOR/NAND Flash, EEPROM and its usage in embedded system.

Eight-bit Microcontroller and Introduction to Embedded C programming

8051 Architecture & Memory Map - I/O, Pin Functions and basic understanding of assembly instructions.Embedded C Programming Basics - Data types, control structures - Bitwise operators - Memory qualifiers (volatile, static, etc.) - Pointer basics and structures - Storage class in C (auto, static, extern, register) , C-program Qualifiers (const, volatile), Understanding of C program Memory map

ARM Processor and Architecture

Cortex-M Programmer's Model (M23/ARMv8-M) - Registers, memory map, stack, vector table - secure and non-secure mode of processor, understanding of the access permission between these zones. - Understand details about Oscillators, PLL and peripheral clocks distributions. Timers & DMA Overview - Interrupt Handling & NVIC - Understanding of interrupts – General interrupt mechanism (example narrate 8051) and interrupt working on ARM in presence of Interrupt controller. Understand the need of special interrupt controller – use case NVIC

Peripheral Interfacing – GPIO, Clocks, UART

GPIO - Usage as an Analog pin, Digital pin, General purpose I/O, Concept of GPIO port block. Clock system module in PIC32CM LSx or equivalent STM32 ARM Cortex-M3 based core- UART Fundamentals - Baud rate, framing, register configuration, understand internal registers of UART in the processor, configure and demonstrate the UART transmission of data between two devices for various baud rates like 9600,115200 etc. Advantages and disadvantages of UART.

Intro to AI Processor Technology

Traditional CPU vs AI Processor – Need of AI Processor - AI processors and its types- GPU, Neural Processing Unit (NPU) and Introduction to Field Programmable Gate Arrays (FPGA). Components of an AI processor, Overview of AI processors and how fast computation is accomplished in AI accelerator or AI processor – Emergence of new fast memory – Overview of High Bandwidth Memory (HBM), Overview about the Matrix Multiplication Unit and future trends in AI Processor - Application areas of AI processors in the market.

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. A Beginner's Guide to Designing Embedded System Applications on Arm Cortex-M Microcontrollers by Ariel Lutenberg, Pablo Gomez, Eric Pernia Published ARM Education media, 1st Edition 2022 https://www.arm.com/resources/education/books/designing-embedded-systems
2. *Computer Architecture: A Quantitative Approach* – John L. Hennessy and David A. Patterson (Reference for AI Processor Technology module), 6th Edition, Elsevier India Publishers, 2017
3. Embedded Systems Made Easy: From Basics to AI Hardware by Dr. Dinesh Murugan, Vijay Nicole Publishers 1st Edition, 2026

e- Resources

1. Fundamentals of System-on-Chip Design on Arm Cortex-M Microcontrollers René Beuchat, Florian Depraz, Andrea Guerrieri, Sahand Kashani https://www.arm.com/resources/education/books
2. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach by Dr Alexander G. Dean, FRDM-KL25Z Edition https://www.arm.com/resources/education/books/efficient-embedded-systems

CO	Description of CO	PO	PSO
CO1	Define the fundamentals of microprocessors, microcontrollers, embedded systems, processor architectures, memory technologies, and their applications in embedded systems. Understand AI processors, AI accelerator types, future trends, and applications.	–	–
CO2	Apply Embedded C programming concepts, 8051 architecture, memory organization, and basic assembly instructions to develop simple embedded applications.	PO1	PSO3 (3)
CO3	Analyze ARM Cortex-M architecture, memory map, interrupt handling, clock systems, DMA, and security features for embedded system design.	PO2	PSO2 (3), PSO4 (2)
CO4	Design and implement peripheral interfacing solutions using GPIO, UART, timers, clocks, and communication protocols for embedded applications.	PO3, PO5	PSO3 (3)

EC25C11	Analog and Digital Communication	L	T	P	C
		3	1	0	4

Course Objective:

To impart knowledge in analog and digital modulation and demodulation techniques, and to introduce the applications of communication systems.

Analog Modulation

Review of Fourier and Hilbert Transforms-Amplitude Modulation – AM, DSBSC, SSBSC, VSB– Spectral analysis of modulated signal, Angle modulation and demodulation: Narrow band, Wideband FM - Spectral analysis of modulated signal.

Digital Baseband Modulation

Schematic of digital communication systems, Sampling - Quantization – Uniform and non-uniform quantization – Quantization noise– Speech Coders: Companding laws of speech signals, PCM, DPCM, ADPCM, DM, ADM.

Source Coding and Channel Coding

Measure of information – Entropy – Source Coding: Source coding theorem, Shannon-Fano coding, Huffman Coding - Channel Coding: Shannon-Hartley law, Linear block codes, Cyclic codes, syndrome decoding, Convolutional codes, Viterbi decoding

Base Band Signaling

Line codes: RZ, NRZ, Manchester, Binary N-zero substitution codes - PSDs, ISI, Pulse shaping, Eye diagram

Band Pass Signaling

Generation and detection of coherent schemes: BPSK, BFSK, QPSK- BER and Power Spectral Density Comparison- Generation and detection of non-coherent schemes: BFSK, DPSK, Overview of QAM, MSK.

Suggested Activities: Quiz, simulations, assignment, project.

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. Hsu, H. P. (2006). Analog and digital communications (Schaum's outline series). Tata McGraw-Hill.
2. Sklar, B. (2007). Digital communications: Fundamentals and applications (2nd ed.). Pearson Education.
3. Roddy, D., & Coolen, J. (2006). Electronic communications (4th ed.). Prentice Hall of India.
4. Chandra Sekar, V. (2012). Analog communication. Oxford University Press.

CO	Description of CO	PO	PSO
CO1	Define and explain the fundamental concepts, principles, and signal representations used in analog and digital communication systems.	-	-
CO2	Analyze analog modulation techniques (AM, FM, PM), digital baseband schemes, and signal characteristics to understand system performance in communication systems.	PO1 PO5	PSO2 (3)
CO3	Evaluate source coding, channel coding, and bandpass signaling techniques to assess their effectiveness in reliable data transmission.	PO3, PO5	PSO2 (3)
CO4	Design communication system modules by selecting appropriate modulation schemes, coding techniques, and signal processing methods for real-world applications.	PO2, PO3, PO5	PSO3 (3)

EC25C12	Control Systems	L	T	P	C
		3	0	0	3

Course objective:

Model physical systems using differential equations, transfer functions, and state-space, then analyze time/frequency behavior to design stable, high-performance controllers.

Introduction To Control System

Fundamental concepts of Control Systems: open loop and closed loop systems – Control system Terminology – Applications.

Modelling of Physical Systems:

Transfer function – Modelling of Electric systems, Translational and rotational mechanical systems, Electrical analogous systems. Block diagram reduction, signal flow graphs, multivariable control system.

Time Domain Response

Transient and Steady state response - Standard test inputs - Time response of first and second order systems - Time domain specifications. Effect of moving the pole in the s-plane, Effect of adding real pole and zero. Steady state error, error constants and system type.

Stability Analysis

Concept of stability, characteristic equation, location of poles. Routh Hurwitz stability criterion - Root locus technique.

Frequency Domain Response

Frequency response: Frequency response of standard second order system - Frequency domain specifications - Relationship between Frequency and time domain specifications – Plots: Bode and Polar - Nyquist stability criterion.

Controller and Compensator Design

Controllers: P, PI, PD, PID - Analytical design of controllers. Compensators: needs and its types - Design of lag, lead, lag-lead compensators using root locus and bode plot.

State Space Representation

Concept of state, state variable and state model. Conversion: Transfer function from state equation, State equation to Transfer function. Solutions of state equations, Controllability and Observability.

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

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

Suggested Activities: Competitive Problem-Solving (GATE & Beyond), Hands-On Simulation & Hardware, Collaborative Assignments & Research & Modern Trends.

References:

1. Dukkipati, R. V. (2022). MATLAB for control system engineers (2nd ed.). New Age International Publishers.
2. Golnaraghi, F., & Kuo, B. C. (2017). Automatic control systems (10th ed.). McGraw-Hill Education.
3. Nagrath, J., & Gopal, M. (2021). Control system engineering (7th ed.). New Age International Publishers.
4. Nise, N. S. (2019). Control systems engineering. John Wiley & Sons.
5. Ogata, K. (2020). Modern control engineering (5th ed.). Pearson Education India.
6. Shankar Ram, C. S. (n.d.). Control systems [Video lectures]. NPTEL, IIT Madras.

E-Resources:

1. NPTEL :: Engineering Design - NOC:Control systems
2. Control engineering - Course
3. All Control System Lecture Videos - YouTube
4. Control System (Video Lectures for GATE) - Books, Notes, Tests 2025-2026 Syllabus

CO	CO Description	PO	PSO
CO1	Define and Explain fundamental concepts of control systems and model physical systems using transfer functions, block diagrams, and signal flow graphs.	-	-
CO2	Apply the concepts of time domain response, steady-state error, and system performance using standard test signals and specifications.	PO1	PSO1 (3)
CO3	Analyze system stability using Routh-Hurwitz criterion, root locus, and frequency domain techniques like Bode and Nyquist plots.	PO2, PO3	PSO2 (3)
CO4	Design controllers and compensators and apply state-space techniques for modern control system analysis and design.	PO3, PO5	PSO3 (3)

EC25401	Artificial Intelligence and Machine Learning	L	T	P	C
		2	0	2	3

Course objective:

To provide foundational AI/ML knowledge covering core techniques and enable real-world application using modern tools and frameworks.

Introduction To AI

Artificial Intelligence: Introduction, Applications, Problem types. Problem formulation, Intelligent Agents: Types, Architectures, and Environments, PEAS framework. Reasoning and Logic: Propositional Logic, First-order Logic, Inference techniques including Forward and Backward Chaining

Search Strategies

Solving problems by searching, Design issues in search algorithms. Uninformed Search: BFS, DFS. Heuristic Search: Generate-and-Test, Hill Climbing, Best-First Search, A*, Alpha-Beta pruning. Advanced methods: Problem Reduction, AO* Algorithm, Constraint Satisfaction, Means-Ends Analysis.

Artificial Neural Networks

Introduction to Neural Networks, Activation Functions, Optimization Algorithms: Gradient Descent. Architectures: Perceptrons, Adaline, Multilayer Perceptrons. Training: Backpropagation, Procedures, Network Tuning.

Machine Learning Basics

Machine Learning: Basics, Applications. Comparison with Data Mining and Big Data Analytics. Supervised Learning: Naive Bayes, KNN, Decision Trees. Unsupervised Learning: k-means clustering. Introduction to Reinforcement Learning.

Forecasting, Advanced Learning & Ensemble Methods

Forecasting: Non-linear and Logistic Regression, Random Forests, Bayesian Networks, Bias-Variance Tradeoff, Tuning and Model Selection. Clustering: EM Algorithm, Hierarchical Clustering, Post-Clustering Supervised Learning. Kernel Methods: SVM, Soft Margins, Kernel Trick. Ensemble Methods: Bagging, Boosting, Stacking, AdaBoost, Cross-Validation. Dimensionality Reduction: PCA, LDA, MDS, Feature Selection Techniques.

Suggested Experiments:

1.Implementation of a simple intelligent agent simulation

2. Solving AI problems using BFS and DFS algorithms

3. Implementing heuristic search strategies (A*, Hill Climbing)

4. Design and train a perceptron for basic classification

5. Building a multi-layer neural network using backpropagation

6. Data preprocessing and feature selection for ML tasks

7.Apply supervised learning algorithms (Naive Bayes, Decision Tree, KNN)

8. Unsupervised learning using k-means and Apriori algorithms

9. Regression techniques and Random Forest model implementation

10.Dimensionality reduction using PCA and LDA with visualization

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

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

References:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2021.
2. Tom M. Mitchell, Machine Learning, McGraw Hill Education, 2017.
3. Ian Goodfellow, YoshuaBengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
4. Pattern Recognition and Machine Learning. By Christopher M. Bishop, Springer, 2006.
5. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. By AurélienGéron, O'Reilly Media, 2022

E-Resources:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville (MIT Press)
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by AurélienGéron (O'Reilly)
3. Think Python by Allen B. Downey (Green Tea Press)
4. Coursera – Machine Learning by Andrew Ng (Stanford University)

CO	CO Description	PO	PSO
CO1	Explain fundamental concepts of control systems and model physical systems using transfer functions, block diagrams, and signal flow graphs.	-	-
CO2	Analyze time domain response, steady-state error, and system performance using standard test signals and specifications.	PO2, PO4	PSO1 (3)
CO3	Analyze system stability using Routh-Hurwitz criterion, root locus, and frequency domain techniques like Bode and Nyquist plots.	PO2, PO4	PSO2 (3)
CO4	Design controllers and compensators and apply state-space techniques for modern control system analysis and design.	PO3, PO5, PO11	PSO3 (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)

EC25C13	Analog and Digital Communication Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

Demonstrate communication link architecture and technique comparison via case studies, simulations, policies, and socio-economic impact.

List of Experiments

1. AM / FM Modulator and Demodulator
2. Time Division Multiplexing
3. Signal Sampling and reconstruction
4. Pulse Code Modulation and Demodulation
5. Delta Modulation and Demodulation
6. Line coding schemes (Simulation)
7. FSK, PSK and DPSK schemes (Simulation)
8. Error control coding schemes (Simulation)
9. Symbol Timing Synchronization
10. Spread spectrum communication (Simulation)
11. Communication link simulation

Tools Required : GNU Radio software , MATLAB or Equivalent S/w – 15 User License

Task

T1 Design and simulate AM/FM communication systems including modulation and demodulation techniques for reliable signal transmission and reception.

T2 Design a multiplexed communication system using Time Division Multiplexing (TDM) and analyze channel sharing efficiency.

T3 Design and implement digital communication systems using Sampling, Pulse Code Modulation (PCM), and Delta Modulation (DM) techniques for signal transmission and reconstruction.

T4 Design and simulate digital data transmission schemes using Line Coding, FSK, PSK, and DPSK modulation techniques, and compare their performance.

T5 Design and evaluate a complete communication link incorporating Error Control Coding, Symbol Timing Synchronization, and Spread Spectrum Communication techniques through simulation.

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

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

CO	Description	PO	PSO
CO1	Explain fundamental concepts of control systems and model physical systems using transfer functions, block diagrams, and signal flow graphs.		-
CO2	Apply time domain response, steady-state error, and system performance using standard test signals and specifications.	PO1, PO2, PO4	PSO1 (3)
CO3	Analyze system stability using Routh-Hurwitz criterion, root locus, and frequency domain techniques like Bode and Nyquist plots.	PO2, PO4	PSO2 (3)

EC25C14	Microcontroller and Peripheral Interfacing Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

To develop practical skills in embedded system programming, debugging, peripheral interfacing, interrupt handling, DMA, security mechanisms, and UART communication using ARM-based microcontrollers and development tools.

List of Experiments

1. Understand and explore the Integrated Development Environment (IDE) of a particular family of Microcontrollers and try to create a project and compile for a 32 bit environment.
2. Write an embedded system program using a infinite while loop, perform a simple mathematical computation, and understand the compilation process including the compiler used, output generated like elf file, map file, lst file (if generated) and understand address mapping of the functions.
3. Write an embedded system program using an infinite while loop, perform a simple Mathematical computation, and demonstrate single stepping, watch and try modifying the variables contents in data memory region and examine the outcome. Also examine the assembly code of the C program.
4. Write a C program function to swap two number using call by value and call by reference. Examine the difference of these functions in assembly code, and explain the difference the way code is generated internally on any ARM 32bit IDE.
5. a) Write a C program function and demonstrate the behaviour of post and pre-increment of a variable with appropriate values. Examine and explain the behaviour with a right example on any ARM 32bit IDE.
   b) Describe the purpose of the volatile qualifier in C. Using an example program, illustrate how the behaviour differs when a variable is declared with and without volatile, and examine the generated assembly code to justify the difference on any ARM 32bit IDE.
6. Train students to read datasheets and identify pin functions
   Identify LED pin mapping.
   Distinguish analog vs digital pins
   Introduce basic GPIO programming and timing via software loops. Toggle LEDs with 500 ms delay using for-loops
7. Configure the timer registers to generate a 500 ms delay and use the hardware timer to toggle an LED. Explain how precise delays are achieved when compared to hardware timers Vs software delays
8. Generate a 1ms interrupts, blink LED by using sysTick for system programming. Ask questions about sysTick and its significance.
9. Transfer data from a specified memory to UART using DMA. Demonstrate with a program.
10. Demonstrate access violation between secure/non-secure zones and show valid operations within same zone.
11. Explain how a switch state is read using GPIO pins and displayed using an LED. Describe the switch debouncing problem and the methods used to handle it.
12. UART Polling Mode, Configure UART on at 9600 bps, transmit/receive characters, and echo back

13. *UART Interrupt Mode, Configure UART on at 9600 bps, transmit " ABC", using interrupt mode. Ask Students to explain about NVIC and its working on ARM processor.*

Task

T1 Understand and explore the Integrated Development Environment (IDE) of a particular ARM 32-bit microcontroller family and create a project, compile it, and analyze the build output.

T2 Write an embedded system program using an infinite while loop to perform a simple mathematical computation, and analyze the compilation process including ELF, MAP, and LST files along with function address mapping.

T3 Write a C program to demonstrate debugging techniques including single stepping, watch window usage, and modification of variables in data memory, and examine the corresponding assembly code.

T4 Develop embedded C programs to implement GPIO-based LED control using software delay and hardware timer (500 ms delay), and compare accuracy between software and hardware timing methods.

T5 Configure UART communication at 9600 bps and implement both polling and interrupt-based transmission/reception, including echo functionality and analysis of NVIC-based interrupt handling.

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

Assessment Methodology: Evaluation of Students' work, Observation, Record.

CO	Description of CO	PO	PSO
CO1	Describe the architecture, development environment, compilation process, memory organization, and debugging features of ARM-based microcontrollers and embedded systems.	-	-
CO2	Analyze embedded C programs involving functions, pointers, variable qualifiers, memory access, and assembly-level execution to understand software–hardware interaction.	PO1, PO2, PO4	PSO1 (3)
CO3	Implement and evaluate GPIO, timer, SysTick, and interrupt-based applications for real-time embedded system operation.	PO2, PO3, PO4, PO5	PSO3 (3)
CO4	Design and develop peripheral interfacing applications using UART, DMA, and interrupt-driven communication techniques for efficient embedded system communication.	PO2, PO3, PO5	PSO3 (3)