

NANDHA COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University Chennai)

Erode-52

www.nandhatech.org



REGULATIONS – 2025

CURRICULUM AND SYLLABUS

U.G- ELECTRONICS AND COMMUNICATION
ENGINEERING


Chairman - Board of Studies
Electronics and Communication Engineering
Nandha College of Technology (Autonomous)
Erode - 638 052.

UNDERGRADUATE CURRICULUM

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.



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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		


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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


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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


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Semester I

MA25C01	Applied Calculus	L	T	P	C
		3	1	0	4
Course Objectives: <ul style="list-style-type: none">• 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: <ol style="list-style-type: none">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_\(Stewart\)/](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: <ul style="list-style-type: none">Enhance learners' listening and speaking skills to understand and deliver speeches effectivelyEquip 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: <ol style="list-style-type: none">Miller, K. Q., & Wahl, S. T. (2023). <i>Business and Professional Communication: KEYS for Workplace Excellence</i> (5th ed.). SAGE Publications.Kumar, Sanjay & Pushpalatha. (2018). <i>English Language and Communication Skills for Engineers</i>. India: Oxford University Press.Sharma, S., & Mishra, B. (2024). <i>Communication Skills for Engineers and Scientists</i> (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
<p>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.</p>					
<p>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.</p>					
<p>நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.</p>					
<p>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.</p>					
<p>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, கையெழுத்துப்படிக்கல், தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.</p>					
<p>References:</p> <ol style="list-style-type: none"> 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. பொருளை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு) 5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print) 6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies. 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). 8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) 9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) 11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book. 					

UC25H01	Heritage of Tamils	L 1	T 0	P 0	C 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 Bharathiyaar 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, Leatherpuppetry, 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: <ol style="list-style-type: none"> 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. பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு) 5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) 6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies). 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). 8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) 9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) 11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book. 					

EE25C04	Basic Electronics and Electrical Engineering	L 2	T 1	P 0	C 3
Course Objectives: <ul style="list-style-type: none"> 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: <ol style="list-style-type: none"> Bell, D. (2008). <i>Electronic devices and circuits</i>. Oxford University Press. Tooley, M. A. (2006). <i>Electronic circuits: Fundamentals and applications</i>. Elsevier Limited. Malvino, A., & Bates, D. J. (2012). <i>Basic electronics: Problems and solutions</i>. 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): <ul style="list-style-type: none">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: <ul style="list-style-type: none">• 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 corruptions, 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: <ul style="list-style-type: none">• 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:					
<ul style="list-style-type: none">• 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					
<p>(A). Dis-assembly & Assembly Practices</p> <ul style="list-style-type: none">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. <p>(B). Welding Practices</p> <ul style="list-style-type: none">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 Steel plates / pipes, for fabrication of a simple part. <p>(C). Electrical Wiring Practices</p> <ul style="list-style-type: none">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. <p>(D). Electronics Components / Equipment Practices</p> <ul style="list-style-type: none">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. <p>(E). Contemporary Systems</p> <ul style="list-style-type: none">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: <ul style="list-style-type: none">• 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: <ol style="list-style-type: none">1. Khera, S. (2003). <i>You can win</i>. Macmillan.2. Levesque, H. (n.d.). <i>Life skills 101: A practical guide to leaving home and living on your own</i>. (Publication year not specified)3. Mitra, B. K. (2017). <i>Personality development & soft skills</i> (3rd impression). Oxford University Press.4. ICT Academy of Kerala. (2016). <i>Life skills for engineers</i>. 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: <ul style="list-style-type: none">• 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: <ol style="list-style-type: none">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). <i>Psychology of sports performance</i>. Sports Publication.					
E-resources: <ol style="list-style-type: none">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 Objective	<ul style="list-style-type: none"> 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. 				
Course Outcomes : The student will be able to		Cognitive Level			
CO1	Understand the basic concepts of vector spaces, subspaces, span, basis, and dimension.	K3			
CO2	Apply methods to test linear dependence/independence and find basis and dimension of vector spaces.	K4			
CO3	Compute null space, range, eigen values, and eigenvectors of matrices and analyze diagonalizability.	K3			
CO4	Use inner product concepts, norms, and Gram-Schmidt process in R^2 and R^3	K3			
CO5	Perform matrix decompositions such as diagonalization, QR decomposition, and SVD, and solve least squares problems using software tools	K3			

UNIT I - VECTOR SPACES	9+3
<p>Introduction to Vector Spaces, Examples, Subspaces, Linear Combinations, Span, Generating Sets, Linear Dependence and Independence, Basis and Dimension, Dimension of Subspaces.</p> <p>Activities: Open-Source software, exercises to test linear dependence and independence using rank, compute span and basis of a set of vectors, determine the dimension of subspaces, and illustrate the concept of subspace and basis in R^2 and R^3 with visualization.</p>	
UNIT II - LINEAR TRANSFORMATIONS AND DIAGONALIZATION	9+3
<p>Null space, Range, Dimension Theorem (statement only), Matrix representation of a linear transformation, Eigenvalues & Eigenvectors, Diagonalizability.</p> <p>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.</p>	
UNIT III - INNER PRODUCT SPACES	9+3
<p>Inner product, Norms, Cauchy, Schwarz inequality, Gram, Schmidt orthogonalization, Simple problems (up to R^3).</p> <p>Activities: Open-Source software, exercises to compute inner products and vector norms</p>	

UNIT IV - MATRIX DECOMPOSITION	9+3
Orthogonal transformation of a symmetric matrix to diagonal form - Positive definite matrices, QR decomposition. Activities: Open-Source software, exercises to check if a matrix is positive definite, perform QR decomposition using built-in functions.	
UNIT V - SINGULAR VALUE DECOMPOSITION AND LEAST SQUARES SOLUTIONS	9+3
Singular Value Decomposition (SVD), Least squares solutions- simple problems (up to 3×3 matrices). Activities: Open-Source software, exercises to check if a matrix is positive definite, perform singular value decomposition using built-in functions.	
TOTAL PERIODS	60

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.

E-RESOURCES:

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


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Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	-	1	-	-	-	-	-	-	-	-	-	-
2	3	3	1	2	-	-	-	-	-	-	-	-	-	-
3	2	3	-	1	-	-	-	-	-	-	-	-	-	-
4	3	3	1	2	1	-	-	-	-	-	-	-	-	-
5	3	3	2	2	2	-	-	-	-	-	1	-	-	-
CO (W.A)	2.8	2.8	1.3	1.6	1.0	-	-	-	-	-	1.0	-	-	-

UC25H02 - தமிழர்களும் தொழில்நுட்பமும்		L	T	P	C
		1	0	0	1
Course Objective	<ul style="list-style-type: none"> இலக்கியங்கள் மற்றும் தொல்லியல் சான்றுகளின் மூலம் பண்டைய தமிழர்களின் தொழில்நுட்ப பாரம்பரியத்தைப் புரிந்துகொள்ளுதல். அறிவியல் தமிழ் மற்றும் தமிழ் கணினியியலின் வளர்ச்சியை அறிந்து கொள்ளுதல். 				

UNIT I - நெசவு மற்றும் பாணைத் தொழில்நுட்பம்	3
சங்க காலத்தில் நெசவுத் தொழில், பாணைத் தொழில்நுட்பம், கருப்பு-சிவப்பு பாண்டங்கள், பாண்டங்களில் கீறல் குறியீடுகள்.	
UNIT II - வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள், சங்க காலத்தில் வீட்டுப் பொருட்களின் வடிவமைப்பு, சங்க காலக் கட்டுமானப் பொருட்கள் மற்றும் நடுகற்கள், சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள், மாமல்லபுரம் சிற்பங்களும் கோயில்களும், சோழர் காலப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள், நாயக்கர் காலக் கோயில்கள் மற்றும் அவற்றின் மாதிரி கட்டமைப்புகள், மதுரை மீனாட்சி அம்மன் ஆலயம், திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் தோன்றிய இந்தோ-சாரசெனிக் கட்டிடக்கலை.	
UNIT III - உற்பத்தித் தொழில்நுட்பம்	3
கப்பல் கட்டும் கலை, உலோகவியல், இரும்புத் தொழிற்சாலை, இரும்பை உருக்குதல், எஃகு தயாரித்தல், வரலாற்றுச் சான்றுகளாகச் செம்பு மற்றும் தங்க நாணயங்கள், நாணயங்கள் அச்சடித்தல், மணி உருவாக்கும் தொழிற்சாலைகள், கல்மணிகள், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்கு மணிகள், எலும்புத் துண்டுகள், தொல்லியல் சான்றுகள் மற்றும் சிலப்பதிகாரத்தில் குறிப்பிடப்படும் மணிகளின் வகைகள்.	
UNIT IV - வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்	3
அணை, ஏரி, குளங்கள், மதகு, சோழர் காலக் குமிழித் தூம்பின் முக்கியத்துவம், கால்நடை பராமரிப்பு, கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள், வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள், கடல்சார் அறிவு, மீன்வளம், முத்து மற்றும் முத்துக்குளித்தல், பெருங்கடல் குறித்த பண்டைய அறிவு, அறிவுசார் சமூகம்.	
UNIT V - அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	3
அறிவியல் தமிழின் வளர்ச்சி, கணித்தமிழின் வளர்ச்சி, தமிழ் நூல்களை மின்னூல்களாகப் பதிப்பித்தல், தமிழ் மென்பொருட்கள் உருவாக்கம், தமிழ் இணையக் கல்விக்கழகம், தமிழ் மின்னூலகம், இணையத்தில் தமிழ் அகராதிகள், சொற்குவைத் திட்டம்.	
TOTAL PERIODS	15

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. பொருளை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

UC25H02 - TAMILS AND TECHNOLOGY		L	T	P	C
		1	0	0	1
Course Objective	<ul style="list-style-type: none"> To understand the technological heritage of ancient Tamil society through literature and archaeological evidence. To explore the growth of Scientific Tamil and Tamil computing in the digital era. 				

UNIT I - WEAVING AND CERAMIC TECHNOLOGY	3
Weaving Industry during Sangam Age, Ceramic technology, Black and Red Ware Potteries (BRW), Graffiti on Potteries.	
UNIT II - DESIGN AND CONSTRUCTION TECHNOLOGY	3
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 Nayakar Mahal -Chetti Nadu Houses, Indo-Saracenic architecture at Madras during British Period.	
UNIT III - MANUFACTURING TECHNOLOGY	3
Art of Ship Building - Metallurgical studies, Iron industry, Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins, Beads making-industries Stonebeads, Glass beads, Terracotta beads -Shell beads/ bone beads, Archeological evidences - Gem stone types described in Silappathikaram.	
UNIT IV - AGRICULTURE AND IRRIGATION TECHNOLOGY	3
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.	
UNIT V - SCIENTIFIC TAMIL & TAMIL COMPUTING	3
Development of Scientific Tamil, Tamil computing, Digitalization of Tamil Books, Development of Tamil Software, Tamil Virtual Academy, Tamil Digital Library, Online Tamil Dictionaries, Sorkuvai Project.	
TOTAL PERIODS	15

REFERENCES:

1. 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. பொருளை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
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8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)
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.

EN25C02 - English Essentials – II		L	T	P	C
		1	0	2	2
Course Objective	<ul style="list-style-type: none"> To integrate vocabulary and functional grammar into communication tasks to improve fluency and accuracy. To articulate ideas clearly and effectively in formal and informal spoken interactions and to construct well-organized written documents including summaries, reports, and emails relevant to academic and workplace contexts. 				
Course Outcomes: The Student will be able to		Cognitive Level			
CO1	Understand the importance of communication and drafting skills in engineering and technology.	K2			
CO2	Apply listening strategies to comprehend spoken English in various contexts.	K3			
CO3	Participate actively in group discussions by analyzing critically from different views.	K4			
CO4	Create written reports coherently for various purposes.	K3			
CO5	Adapt communication styles to global, multicultural environments.	K4			

UNIT I - FUNDAMENTALS OF COMMUNICATION AND MEDIA LITERACY	3
Communication: Types-Inter and Intra-personal Communication; Communication Barriers- Summarising Visuals, Media Terminology	
UNIT II - LISTENING SKILLS AND FORMAL ORAL COMMUNICATION	3
Rhetorical devices-TED Talks-Listening strategies	
UNIT III - PROFESSIONAL CORRESPONDENCE AND APPLICATIONS	3
Modal Verbs-Job Application Letters-Resume Writing; Statement of Purpose	
UNIT IV - ACADEMIC AND PROFESSIONAL WRITING SKILLS	3
Paraphrasing & Summarizing - Executive Summary-Proposal	
UNIT V - TEAM WORK, LEADERSHIP AND PROFESSIONAL DECISION MAKING	3
Decision Making; Recommendations-Team Leader, Quality of Team Leader-Leadership Model, Negotiations	
TOTAL PERIODS	15


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List of Experiments:	
1. Short presentation, Media based responses-Error detection; Activity: Worksheets 2. Speeches; Welcome Address-Vote of Thanks; Formal Speeches-Activity: Listen and respond to short podcast 3. Email writing-Submission of applications-Graphical summaries 4. Report on college events-Report preparation; Recommendation letters 5. SWOT Analysis; Activity: Mock meetings-Group discussions; Activity: Brainstorming sessions	
TOTAL PERIODS	30
REFERENCES:	
1. Kasap, S. O. (2007). Principles of electronic materials and devices. McGraw-Hill Education. 2. Bernhardt, C. (2019). Quantum computing for everyone. MIT Press. 3. Hanson, G. W. (2009). Fundamentals of nanoelectronics. Pearson Education.	
E-RESOURCES:	
1. Single electron Transistor : https://youtu.be/MTT729LtB-o?si=RGaEhGgmyWJWcZib 2. Basics of quantum computing - https://lab.quantum.flytrap.com	

Mapping of COs with POs/PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	2	-	-	-	-	-	1	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	2	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO (W.A)	3.0	2.0	-	-	-	-	-	1.0	2.0	-	1.0	-	-	-


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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.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Explain the behavior of Semiconductor physics and its applications in electron devices.	K2			
CO2	Apply the concepts and compare the different configuration of various electron devices.	K3			
CO3	Analyze and interpret the characteristics of various electron devices	K4			
CO4	Perform experiments to evaluate and compare the characteristics of electronic components.	K5			
CO5	Explain the operation and applications of thyristors, UJT, optoelectronic devices, and power MOSFETs.	K2			

UNIT I – SEMICONDUCTOR	(9)
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.	
UNIT II – PN JUNCTION DIODES & SPECIAL DIODES	(9)
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. Zener diode – breakdown mechanisms and voltage regulation, Varactor diode, Tunnel diode, Photo diode – construction, operation, and applications	
UNIT III - BIPOLAR JUNCTION TRANSISTORS	(9)
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.	
UNIT IV – FIELD EFFECT TRANSISTORS	(9)
FET – 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.	

UNIT V – THYRISTOR & OPTOELECTRONIC DEVICES	(9)
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	
TOTAL PERIODS	45

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.

Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
3	-	2	-	-	-	-	-	-	-	-	-	3	-	-
4	-	2	-	-	-	-	-	-	-	-	-	-	2	1
5	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO (W.A)	3	2	1	2	1	-	-	-	-	-	-	2	2	1.5

EC25C02- CIRCUITS AND NETWORK ANALYSIS		L	T	P	C
		3	0	0	3
Course Objective:	<ul style="list-style-type: none"> 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. 				
Course Outcomes					
The Student will be able to		Cognitive Level			
CO1	Apply basic electrical laws and principles to analyze simple DC and AC circuits using nodal and mesh analysis techniques.	K3			
CO2	Analyze linear electrical networks using network theorems such as Superposition, Thevenin's, Norton's, and Maximum Power Transfer theorem.	K3			
CO3	Determine steady-state and transient responses of RL, RC, and RLC circuits using phasor methods and Laplace transforms.	K4			
CO4	Evaluate resonance characteristics, quality factor, bandwidth, and analyze magnetically coupled circuits and transformers.	K4			
CO5	Analyze and model linear two-port networks using various parameter representations and assess their properties such as reciprocity and symmetry.	K4			

UNIT I – Circuit Laws	(9)
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.	
UNIT II - Network Theorems	(9)
Principle of linearity, Thevenin's and Norton's theorems, Superposition theorem, Maximum power transfer theorem, Reciprocity theorem.	
UNIT III - Steady-State and Transient Analysis of AC and DC Circuits	(9)
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, and RLC circuits using Laplace Transform.	
UNIT IV - Resonance and Coupled Circuits	(9)
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.	
UNIT V - Linear Two-Port Network Analysis	(9)
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.	
TOTAL PERIODS	45

REFERENCES:

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/videlectures/doku.php?id=ee2015_2017nk:start

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3	2	3	–	2	–	–	–	–	–	–	–	2	3	–
4	–	3	2	2	–	–	–	–	–	–	–	2	3	–
5	–	3	2	2	–	–	–	–	–	–	–	2	3	–
CO (W.A)	2	3	2	2	–	–	–	–	–	–	–	2	3	–

CS25C05 Data Structures using C++		L	T	P	C
		3	0	2	4
Course Objective:	<ul style="list-style-type: none"> This course aims to provide an understanding of object-oriented programming principles using C++. 				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Apply the concepts of data structures in various engineering applications.	K3			
CO2	Apply various Data Structure in real time	K3			
CO3	Develop suitable and interrupt the data in real world applications	K3			
CO4	Apply non-linear data structures like trees and graphs to represent data efficiently, perform traversals, implement union-find operations, and solve graph problems such as shortest path and minimum spanning tree using appropriate algorithms and standard template library concepts.	K3			
CO5	Analyze the working of searching and sorting algorithms such as Linear Search, Binary Search, Insertion Sort, Merge Sort, Quick Sort, and Heap Sort, and compare their time complexities.	K4			

UNIT I - DATA ABSTRACTION & OVERLOADING	(9 + 6)
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.	
UNIT II – INHERITANCE & POLYMORPHISM	(9 + 6)
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.	
UNIT III – LINEAR DATA STRUCTURES	(9 + 6)
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.	
UNIT IV – NON-LINEAR DATA STRUCTURE	(9 + 6)

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.

UNIT-V SEARCHING, SORTING AND COMPLEXITY ANALYSIS

(9 + 6)

Insertion sort, Merge sort, Quick sort, Heap sort, Linear Search, Binary Search.

List of Experiments:

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.
4. Program to implement various inheritances.
5. Program to implement virtual functions and dynamic binding.
6. Implementation of method overriding and operator overloading
7. Program to implement various operations on arrays and linked lists.
8. Program to implement various operations on stacks and queues using array and linked list.
9. Program to evaluate the infix expressions by converting into prefix and postfix expressions
10. Program to Implement Binary Tree Traversal and Graph Traversal Algorithm.
11. Program to Implement the Single Source Shortest Path Algorithm and All Pair Shortest Path Algorithm.
12. Program to find the Minimal Spanning Tree for a Graph.
13. Program to Implement Linear Search and Binary Search Algorithms.
14. Program to Implement Insertion Sort, Merge Sort, Quick Sort and Heap Sort Algorithms

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE REQUIRED:

- **Computer / Desktop / Laptop**
- **Processor:** Intel i3 / AMD equivalent or higher
- **RAM:** Minimum 4 GB (8 GB recommended)
- **Hard Disk:** Minimum 250 GB / SSD
- Monitor, Keyboard, and Mouse
- **Internet Connection** (for installing compilers and IDEs)

SOFTWARE REQUIRED:

- **Operating System:** Windows 10 / Windows 11 / Linux / Ubuntu / macOS
- **Programming Language:** C++
- **C++ Compiler:**
 - GCC / G++
 - MinGW
 - Turbo C++ (for basic labs, optional)
- **IDE / Code Editor:**
 - Code::Blocks

<ul style="list-style-type: none"> • Dev C++ • Visual Studio Code • Eclipse CDT 	
TOTAL PERIODS	75

TEXT BOOK:

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.

REFERENCES:

1. Weiss, M. A. (2007). Data structures and algorithm analysis in C++. AddisonWesley.
2. Trivedi, B. (2010). Programming with ANSI C++: A step-by-step approach. Oxford University Press.
3. Goodrich, M. T., Tamassia, R., & Mount, D. (2004). Data structures and algorithms in C++. Wiley.

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	1	3	-	-	-	1	1	2	1	3	2
2	3	3	2	2	3	-	-	-	1	1	2	1	3	2
3	3	3	2	2	3	-	-	-	1	1	2	1	3	2
4	3	3	1	2	3	-	-	-	-	1	2	-	3	1
5	2	2	2	2	3	-	-	-	2	2	3	2	3	3
CO (W.A)	2.8	2.6	1.8	1.8	3	-	-	-	1.25	1.2	2.2	1.25	3	2

1 - low, 2 - medium, 3 - high, '-' - no correlation


 Chairman-Board of Studies
 Computer Science and Engineering
 Nandha College of Technology (Autonomous)
 Erode, Tamil Nadu

ME25C05-RE-ENGINEERING FOR INNOVATION		L	T	P	C
		0	0	4	2
Course Objective	<ul style="list-style-type: none"> 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. 				
Course Outcomes : The student will be able to		Cognitive Level			
CO1	Understand the product development lifecycle, including stages such as concept generation, design, prototyping, and testing.	K2			
CO2	Apply reverse engineering techniques to analyze and document existing products.	K3			
CO3	Collaborate in teams to fabricate prototypes using appropriate tools.	K3			
CO4	Engage in independent learning and continuously adapt to emerging technologies in product design	K3			

BOOTCAMP 1	15
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	15
Embedded System Programming (Open-source platforms), Practice of interfacing sensors, reading data, automation in home, healthcare and agriculture.	
REVERSE ENGINEERING	30
Sketch and prototype alternative designs, Group brainstorming sessions, Manufacture prototype parts using 3D printing and / or workshop tools, Assemble prototype product.	
TOTAL PERIODS	60

REFERENCES:
<ol style="list-style-type: none"> 1. Wang, W. (2010). Reverse engineering: Mechanisms, structures, systems & materials. CRC Press. 2. Margolis, M. (2020). Arduino cookbook: Recipes to begin, expand, and enhance your projects (3rd ed.). O'Reilly Media.

E-RESOURCES:

1. Grab CAD – <https://grabcad.com/>
2. GitHub – <https://github.com>

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	1	2	2	-	-	-	1	-	-	3	2	1
2	2	2	3	1	3	-	-	-	-	1	-	3	3	1
3	3	2	3	2	3	1	1	-	-	-	-	2	3	2
4	2	2	3	3	3	1	1	-	3	2	2	3	3	3
CO (W.A)	2.5	2.3	2.5	2.0	2.8	1.0	1.0	-	2.0	1.5	2.0	2.8	2.8	1.8

UC25A03 –LIFE SKILLS FOR ENGINEERS – II		L	T	P	C
		1	0	2	1
Course Objective	<ul style="list-style-type: none"> To impart and cultivate analytical reasoning, innovative thinking, effective collaboration, and ethical leadership to prepare students for complex challenges in professional and personal environments. 				
Course Outcomes : The Student will be able to		Cognitive Level			
CO1	Explain creativity, innovation, and critical thinking concepts.	K2			
CO2	Apply thinking skills for problem-solving and decision-making.	K3			
CO3	Use analytical and logical reasoning to solve problems.	K3			
CO4	Demonstrate communication and teamwork skills.	K3			
CO5	Exhibit leadership and ethical decision-making skills.	K3			

UNIT I – CREATIVITY AND INNOVATION	9
Creativity – Imagination- Intuition- Experience- Sources of Creativity- Myths of Creativity. Activities: Two-Brainstorm Method -30 Circles Challenge -Creativity Myth Busters.	
UNIT II – CRITICAL AND LATERAL THINKING	9
Critical Thinking -Critical Thinking Vs Creative Thinking -Lateral Thinking -Convergent Thinking- Divergent Thinking -Critical Reading -Multiple Intelligence. Activities: Lateral Thinking Riddles and Puzzles -Fast vs. Slow Thinking Game -"What If?" Scenario Writing.	
UNIT III – PROBLEM SOLVING AND ANALYTICAL REASONING	9
Problem Solving Techniques -Six Thinking Hats -Mind Mapping -Forced Connections -Analytical Thinking -Numeric, Symbolic and Graphic Reasoning -Scientific Temperament -Logical Thinking. Activities: Case Study Analysis -Escape Room Challenge.	
UNIT IV – COLLABORATION AND COMMUNICATION	9
Collaboration -Communication -Active Listening -Teamwork and Delegation -Empathy -Conflict Management. Activities: Team-based Exercises -Communication Activities.	
UNIT V – LEADERSHIP AND DECISION MAKING	9
Leadership Styles and Self-Assessment -Decision Making -Responsibility -Integrity -Vision -Motivation – Goal Setting. Activities: Crisis Leadership Simulation -Tower Challenge -Leadership Dilemmas Role-Play -Team Vision Board	
TOTAL PERIODS	45

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

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	3	2	-	-	-	-	-	-	-	-	1	1	-
3	-	-	-	2	-	-	-	-	-	-	2	1	-	2
4	-	-	-	-	-	-	-	2	3	-	-	-	-	3
5	-	-	-	-	-	-	-	3	-	-	2	-	1	2
CO (W.A)	-	3.0	2.0	2.0	-	-	-	2.5	3.0	-	2.0	1.0	1.0	2.3

EC25C03- DEVICES AND CIRCUITS LABORATORY		L	T	P	C
		0	0	4	2
Course Objective:	<ul style="list-style-type: none"> 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. 				
Course Outcomes					Cognitive Level
The Student will be able to					
CO1	Perform experiments to evaluate and compare the characteristics of electronic components				K3
CO2	Apply the concepts and demonstrate the different configuration of various electron devices				K5
CO3	Experimentally analyze and interpret of various theorems				K4
CO4	Perform experiments to evaluate the electric and magnetic circuits.				K4
CO5	Analyze the transient and resonance behavior of electrical and electronic circuits through experimental verification.				K4

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.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE REQUIRED:

1. Regulated DC Power Supply (0-30V)-15 Nos
2. Digital Storage Oscilloscope (DSO)/CRO-15 Nos
3. Function Generator-15 Nos

4.Digital Multimeter-15Nos	
5.Breadboard-15Nos	
6.Resistors, Capacitors ,Decade Boxes as required.	
SOFTWARE REQUIRED:	
NIL	
TOTAL PERIODS	
60	

Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
3	-	2	-	-	-	-	-	-	-	-	-	3	-	-
4	-	2	-	2	-	-	-	-	-	-	-	3	-	-
5	3	-	-	2	-	-	-	-	-	-	-	2	-	-
CO (W.A)	3.0	2.0	-	2.0	-	-	-	-	-	-	-	2.5	-	-


Chairman - Board of Studies
Electronics and Communication Engineering
Nandha College of Technology (Autonomous)
Erode - 638 052.

UC25A04 - PHYSICAL EDUCATION - II		L	T	P	C
		0	0	4	1
Course Objective	<ul style="list-style-type: none"> To develop fundamental knowledge and practical skills in gymnastic exercises for improving physical fitness, flexibility, balance, and coordination. To enhance game-specific skills and promote continuous upskilling to meet the performance requirements of a selected sport or game. 				
Course Outcomes : The Student will be able to					Cognitive Level
CO1	Understand and explain the importance of physical activity for mental and physical health	K2			
CO2	Apply safety principles and methods during sports activities.	K3			
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	K3			
CO4	Demonstrate the advanced technical skills and strategic understanding in the game of their interest.	K3			
CO5	Demonstrate proficiency in gymnastic exercises and physical fitness activities to enhance strength, flexibility, endurance, and overall performance.	K3			

List of Practical Activities:

- 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, Discus 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.

REFERENCES:

- Singh, A., "Essentials of physical education", Kalyani Publishers, 2008.
- Kamlesh, M. L., "Psychology in physical education and sport", Metropolitan Book Co., 3rd Edition, 2006.
- Mangal, S. K., "Psychology of sports performance", Sports Publication, 2009.
- Kandappan, K., "Foundations of physical education", Friends Publications, 2004.

E-RESOURCES:

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

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-	-	1
3	-	-	-	-	-	-	-	3	-	-	-	-	-	2
4	-	-	-	-	-	-	-	-	-	-	1	-	-	2
5	-	-	-	-	2	-	-	-	-	2	-	-	-	3
CO (W.A)	3.0	-	-	-	2.0	-	-	3.0	-	2.0	1.0	-	-	2.0

FOREIGN LANGUAGE [^]				
UC25F01 - DEUTSCH – I			L	T
			P	C
			1	0
			2	1
Course Objective	<ul style="list-style-type: none"> To develop foundational skills in the German language, including reading, writing, listening, and speaking for basic communication. To familiarize learners with German pronunciation, vocabulary, grammar, and sentence structures to communicate effectively in everyday situations. 			
Course Outcomes: The Student will be able to			Cognitive Level	
CO1	Understand simple spoken Deutsch in everyday contexts.		K2	
CO2	Communicate with widely used Deutsch words effectively.		K3	
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Deutsch language.		K3	

UNIT I - BASICS & INTRODUCTION	5+10
<p>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).</p> <p>Activities: Alphabet spelling game, short skits, Use color-coded cards for SVO sentences.</p>	
UNIT II - GRAMMAR ESSENTIALS & EVERYDAY VOCABULARY	5+10
<p>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.</p> <p>Activities: Conjugate regular and irregular verbs, "Question Chain" game, Create a simple family tree.</p>	
UNIT III - EVERYDAY COMMUNICATION IN GERMAN	5+10
<p>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).</p> <p>Activities: Ordering food and drinks, Give directions, Formal / Informal greetings, Do's and Don'ts.</p>	
TOTAL PERIODS	45

REFERENCE:

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

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	2	-	-	-	-	2
3	-	-	-	-	-	-	-	-	-	-	1	-	-	2
CO (W.A)	-	-	-	-	-	-	-	-	2.0	-	1.0	-	-	2.0

UC25F02 - JAPANESE – I		L	T	P	C
		1	0	2	1
Course Objective	<ul style="list-style-type: none"> To develop fundamental proficiency in the Japanese language, including pronunciation, vocabulary, reading, writing systems (Hiragana, Katakana, and basic Kanji), and grammar. To enable learners to communicate effectively in basic everyday situations through listening, speaking, reading, and writing in Japanese. 				
Course Outcomes: The Student will be able to				Cognitive Level	
CO1	Understand simple spoken Japanese in everyday contexts				K2
CO2	Communicate with widely used Japanese words effectively				K3
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Japanese language.				K3

UNIT I - WRITING SYSTEMS & BASIC COMMUNICATION	5+10
<p>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.</p> <p>Activities: Flashcard games and writing drills, Self-introduction, Numbers & datematching, Greeting expressions, Listening to audio.</p>	
UNIT II - GRAMMAR & EVERYDAY VOCABULARY	5+10
<p>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.</p> <p>Activities: Verb conjugation drills, Guessing game, Picture description, “Shopping” with food vocab and counters.</p>	
UNIT III - CONVERSATION & CULTURAL ETIQUETTE	5+10
<p>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.</p> <p>Activities: Skits and role-plays, daily schedule, beginner-level dialogue, Group discussion on etiquette.</p>	

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

TOTAL PERIODS **45**

REFERENCES:

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

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	2	-	-	-	-	2
3	-	-	-	-	-	-	-	-	-	-	1	-	-	2
CO (W.A)	-	-	-	-	-	-	-	-	2.0	-	1.0	-	-	2.0

UC25F01 - KOREAN - I		L	T	P	C
		1	0	2	1
Course Objective	<ul style="list-style-type: none"> To develop fundamental proficiency in the Korean language, including Hangul reading and writing, pronunciation, vocabulary, and basic grammar. To enable learners to communicate effectively in everyday situations through listening, speaking, reading, and writing in Korean. 				
Course Outcomes: The Student will be able to				Cognitive Level	
CO1	Understand simple spoken Korean in everyday contexts.				K2
CO2	Communicate with widely used Korean words effectively.				K3
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Korean language.				K3

UNIT I – FUNDAMENTALS OF KOREAN	5+10
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 (SubjectObject-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.	
UNIT II – ESSENTIAL GRAMMAR & VOCABULARY	5+10
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.	
UNIT III - EVERYDAY KOREAN COMMUNICATION	5+10
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.	
TOTAL PERIODS	45

REFERENCE:

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

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	2	-	-	-	-	2
3	-	-	-	-	-	-	-	-	-	-	1	-	-	2
CO (W.A)	-	-	-	-	-	-	-	-	2.0	-	1.0	-	-	2.0

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.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Understand the basic concepts of probability, random variables, standard probability distributions, and random processes.	K2			
CO2	Apply joint distributions, correlation, regression, and transformation of random variables for real-world data analysis.	K3			
CO3	Model and simulate random phenomena using stochastic processes and analyze their long-term behavior.	K3			
CO4	Analyze spectral properties of random signals, including autocorrelation, cross-correlation, and spectral density functions.	K4			
CO5	Examine linear time-invariant systems with random inputs using transfer function analysis and stochastic system modeling.	K4			

UNIT I – DESCRIPTIVE AND BIVARIATE STATISTICS	(9+3)
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.	
UNIT II – PROBABILITY FOUNDATIONS AND DISTRIBUTIONS	(9+3)
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.	
UNIT III – STATISTICAL INFERENCE AND SMALL SAMPLING	(9+3)
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.	

UNIT IV – HYPOTHESIS TESTING AND ERROR METRICS	(9+3)
Testing Framework: Null(H_0) and Alternative(H_1) Hypotheses. Decision Errors: Type I error(α), Type II error (β), and Power of a test. p-values: Interpretation of p values in industrial data sheets and medical electronics. Parametric & Non-Parametric: ANOVA basics and Chi-square Goodness-of-Fit tests.	
UNIT V – STOCHASTIC PROCESSES AND SIGNAL NOISE	(9+3)
Random Processes: Concept of Stationarity (WSS) and Ergodicity. Correlation Dynamics: Autocorrelation 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.	
TOTAL PERIODS	60

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.

Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	2	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	1	2	-
3	-	3	-	-	3	-	-	-	-	-	-	-	2	1
4	-	3	-	-	-	-	-	-	-	-	-	-	2	-
5	-	3	-	-	3	-	-	-	-	-	-	-	2	-
CO (W.A)	3.00	2.75	-	-	3	-	-	-	-	-	-	1	2	1

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).				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Define and classify continuous-time and discrete-time signals, systems, and their fundamental properties.	K1			
CO2	Apply Fourier Series techniques to analyze periodic signals - and interpret their frequency domain characteristics.	K3			
CO3	Apply Fourier Transform & Laplace Transform techniques to analyze periodic signals - and interpret their frequency domain characteristics.	K3			
CO4	Analyze Linear Time-Invariant (LTI) systems using convolution and transform methods.	K4			
CO5	Develop and adapt solutions using sampling, quantization, and discrete-time signal processing techniques for real-world applications and continuous learning.	K4			

UNIT I – INTRODUCTION TO SIGNALS AND SYSTEMS	(12)
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.	
UNIT II – FOURIER SERIES ANALYSIS	(12)
Fourier series representation of continuous time periodic signals, Trigonometric and Exponential Fourier series, Properties of Fourier series.	
UNIT III – FOURIER TRANSFORM & LAPLACE TRANSFORM	(12)
Fourier transform of a periodic signals, standard signals and periodic signals, Properties of Fourier transforms. Hilbert transform and its properties. Laplace transforms, RoC, properties. Inverse Laplace transform.	
UNIT IV – CONTINUOUS-TIME LTI SYSTEMS	(12)
Continuous time Systems and its properties. Linear time invariant (LTI) system, Impulse response. Convolution. Analysis of LTI System using Laplace and Fourier transforms.	
UNIT V –SAMPLING, QUANTIZATION & DISCRETE-TIME SYSTEMS	(12)
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.	
TOTAL PERIODS	60

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.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1														
2	3		3									3	2	
3	3		3									3	2	
4		3	3									3	2	2
5			3		3								1	3
CO (W.A)	3	3	3	-	3	-	-	-	-	-	-	3	1.7	2.5


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EC25C05 – ELECTRONIC CIRCUITS AND ANALYSIS		L	T	P	C
		3	0	0	3
Course Objective:	To provide knowledge on diode, BJT, and MOSFET circuits for the analysis and design of amplifiers, feedback systems, oscillators, and power amplifiers using appropriate circuit models and practical applications				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Explain the operating principles and characteristics of diode circuits, rectifiers, voltage regulator circuits, and passive filter circuits.	K2			
CO2	Analyze BJT and MOSFET biasing circuits, multistage amplifiers, current mirror circuits, and MOSFET amplifier configurations.	K4			
CO3	Evaluate the frequency response characteristics of BJT and FET amplifiers using Hybrid- π equivalent circuits and wideband amplifier techniques.	K5			
CO4	Analyze feedback amplifier topologies and oscillator circuits based on feedback principles and stability criteria.	K4			
CO5	Analyze the performance of multivibrators and power amplifiers with respect to efficiency, distortion, and thermal considerations.	K4			

UNIT I – DIODE CIRCUITS AND FILTERS	(9)
Diode circuits - Clipper circuits - Clamper circuits - Voltage doubler - Voltage quadrupler - Half-wave rectifier - Centre-tapped full-wave rectifier - Bridge rectifier circuits - Power supply design - Voltage regulator circuits using Zener diode - Passive RC filters - Passive RL filters - Passive RLC filters.	
UNIT II – BJT AND MOSFET CIRCUITS	(9)
Load-line analysis - Different biasing techniques of BJT - Bias stabilization - Early effect - RC-coupled multistage amplifiers - Transformer-coupled multistage amplifiers - Current mirror circuits - Biasing by fixing VGS - Biasing by fixing VG - Source resistor bias - Drain-to-gate feedback bias - Current source bias - Common Source amplifier - Common Drain amplifier - Common Gate amplifier - Analysis and design of MOSFET amplifier configurations.	
UNIT III – FREQUENCY RESPONSE OF AMPLIFIERS	(9)
Low-frequency response of BJT amplifiers - Low-frequency response of FET amplifiers - Lower cutoff frequency - Hybrid- π equivalent circuit of BJT - High-frequency response of BJT amplifiers - Upper cutoff frequency - Transition frequency - Miller effect - High-frequency response of FET amplifiers - Wideband amplifiers - Widebanding techniques - CC-CE cascade amplifier - CD-CS cascade amplifier - Cascode amplifier - Darlington pair.	

UNIT IV – FEEDBACK AMPLIFIERS AND OSCILLATORS	(9)
Feedback and stability - Negative feedback - Positive feedback - Analysis of four feedback topologies - Loop gain - Barkhausen criterion - Effect of feedback on amplifier poles - Bode plots - Gain margin - Phase margin - Wien Bridge oscillator - RC Phase Shift oscillator - Hartley oscillator - Colpitts oscillator.	
UNIT V – MULTIVIBRATORS AND POWER AMPLIFIERS	(9)
Astable multivibrator using BJT - Monostable multivibrator using BJT - Bistable multivibrator using BJT - Class A power amplifier - Class B power amplifier - Class AB power amplifier - Class C power amplifier - Class D power amplifier - Class S power amplifier - Conversion efficiency - Relative performance - Total Harmonic Distortion (THD) - Relationship between Total Power and THD - Heat sinks.	
TOTAL PERIODS	45

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	–	–	–	–	–	–	3	2	–
CO2	3	3	3	2	2	–	–	–	–	–	–	3	3	2
CO3	3	3	2	3	3	–	–	–	–	–	–	3	3	2
CO4	2	3	3	2	2	–	–	–	–	–	–	3	2	3
CO5	2	3	3	2	2	–	–	–	–	–	1	2	3	3
WA	20	20	20	15	15	0	0	0	0	0	0	5	3	2

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.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Understand coordinate systems, electrostatic fields, potential, Gauss's law, capacitance, and boundary conditions for electrostatic problems.	K2			
CO2	Apply Biot-Savart law, Ampere's law, magnetic flux, inductance, magnetic forces, and boundary conditions to solve magnetostatic problems.	K3			
CO3	Apply Maxwell's equations to analyze time-varying fields, electromagnetic waves, and Poynting theorem.	K3			
CO4	Analyze uniform plane waves, propagation in different media, reflection, polarization, and normal-incidence wave interaction.	K4			
CO5	Analyze transmission lines, standing waves, impedance matching, Smith chart, and impedance transformation for communication applications.	K4			

UNIT I – COORDINATE SYSTEMS AND ELECTROSTATICS	(9)
Fundamentals of scalars and vectors, Coordinate systems, Coulomb's Law, Gauss's Law, Electric Scalar Potential, Electric Boundary Conditions, Capacitance, Electrostatic Potential Energy.	
UNIT II – MAGNETOSTATIC	(9)
Ampere Circuital law- Biot-Savart Law, Magnetic Forces and Torques, Maxwell's Magnetostatic Equations, Vector Magnetic Potential, Magnetic Boundary Conditions, Inductance, Magnetic Energy.	
UNIT III – MAXWELL'S EQUATIONS	(9)
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.	
UNIT IV – TRANSMISSION LINES	(9)
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.	
UNIT V – WAVEGUIDE	(9)
Parallel plate, TEM-TM-TE-Cut off frequency, rectangular waveguide, parameters related to waveguides.	
TOTAL PERIODS	45

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.

Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	–	–	–	–	–	–	–	–	1	2	1	–
2	3	3	–	–	2	–	–	–	–	–	1	2	3	–
3	3	3	–	–	3	–	–	–	–	–	2	3	3	1
4	3	3	2	–	3	–	–	–	–	–	2	3	3	1
5	3	3	2	–	3	–	–	–	–	–	2	3	3	2
CO (W.A)	3.00	2.80	2.00	–	2.75	–	–	–	–	–	1.20	2.60	2.60	1.33


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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.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Explain fundamental concepts of digital electronics, including Boolean algebra, logic gates, and digital circuit classifications.	K1			
CO2	Apply logic design techniques and minimization methods to develop optimized solutions for digital circuits.	K3			
CO3	Analyze practical problems and design appropriate digital solutions using components such as multiplexers, encoders, latches, counters, and code converters.	K4			
CO4	To analyze the structure and operation of Finite State Machines, sequence detectors, and parity checkers.	K4			
CO5	Develop and verify digital circuit designs using digital trainer kits and Hardware Description Language (HDL) programming.	K4			

UNIT I – BOOLEAN ALGEBRA	(09)
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	
UNIT II- COMBINATIONAL DIGITAL CIRCUITS	(09)
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.	
UNIT III- SEQUENTIAL DIGITAL CIRCUITS	(09)
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.	
UNIT IV- FINITE STATE MACHINES	(09)
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	

UNIT V- FPGA ARCHITECTURE	(09)
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.	
TOTAL PERIODS	45

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.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	–	–	–	–	–	–	–	–	–	–	–
2	3	3	3	–	3	–	–	–	–	–	–	3	2	–
3	2	3	3	–	3	–	–	–	2	–	–	–	3	2
4	3	3	3	2	2	–	–	–	2	–	–	3	2	–
5	2	2	3	2	3	–	–	–	2	–	–	–	–	3
CO (W.A)	3	3	3	2	3	–	–	–	2	–	–	3	2	3


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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.				
Course Outcomes : The Student will be able to					Cognitive Level
CO1	Explain the operation and verify the truth tables of basic logic gates, universal gates, combinational circuits, and flip-flops used in digital systems.				K2
CO2	Apply Boolean algebra and digital design principles to implement and verify code converters, multiplexers, demultiplexers, encoders, decoders, and magnitude comparators.				K3
CO3	Analyze the functional behavior of latches, flip-flops, counters, adders, and other digital circuits using appropriate hardware and simulation techniques.				K4
CO4	Design combinational and sequential digital circuits using ICs and Verilog HDL according to specified functional requirements.				K6
CO5	Implement and validate digital system designs using EDA/HDL simulation tools and hardware platforms, and interpret the resulting waveforms and experimental outputs.				K6

List of Experiments:	
<ol style="list-style-type: none"> 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 	
TOTAL PERIODS	
60	
REFERENCES:	
<ol style="list-style-type: none"> 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_ce39/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.

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	-	2	2	-	-	-	1	-	1	2	2	1
2	3	3	2	2	3	-	-	1	1	-	1	3	3	2
3	3	3	2	3	3	-	-	1	1	-	2	3	3	2
4	3	3	3	2	3	1	-	2	1	1	2	3	3	3
5	3	3	3	3	3	1	1	2	2	1	3	3	3	3
CO (W.A)	3.00	2.80	2.50	2.40	2.80	1.00	1.00	1.50	1.20	1.00	1.80	2.80	2.80	2.20

EC25C09 - ELECTRONIC CIRCUIT LABORATORY		L	T	P	C
		0	0	4	2
Course Objective	To develop hands-on skills in designing, implementing, analyzing, and evaluating electronic circuits including rectifiers, amplifiers, oscillators, and power amplifiers using laboratory instruments and simulation tools..				
Course Outcomes : The Student will be able to		Cognitive Level			
CO1	Perform the design and analysis of diode circuits, rectifiers, filters, voltage regulators, and power supply circuits.	K3			
CO2	Design, implement, and analyze BJT and MOSFET biasing circuits and amplifier configurations using laboratory instruments and simulation tools.	K4			
CO3	Analyze the frequency response characteristics of BJT and FET amplifiers using experimental and simulation techniques.	K4			
CO4	Design and evaluate oscillator and multivibrator circuits for waveform generation and frequency measurement.	K5			
CO5	Analyze the performance of power amplifiers based on efficiency and practical operating characteristics.	K4			

List of Experiments:	
<ol style="list-style-type: none"> 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. 	
TOTAL PERIODS	
60	
Tools Required:	
Diodes, IC- Resistors, Capacitor, LT spice open-source software, Regulated power supply, Digital storage oscilloscope.	
REFERENCES:	
<ol style="list-style-type: none"> 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

Mapping of COs with POs / PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	-	2	-	-	-	-	-	2	3	3	2
2	2	2	3	2	3	-	-	2	2	-	3	3	3	3
3	3	3	2	3	2	-	-	-	2	-	2	2	3	3
4	2	3	3	2	3	2	2	3	3	2	3	3	3	3
CO (W.A)	2.50	2.75	2.50	2.33	2.50	2.00	2.00	2.50	2.33	2.00	2.50	2.75	3.00	2.75

SD25C301- NUMERICAL AND SIGNAL PROCESSING PRACTICE THROUGH PYTHON		L	T	P	C
		1	0	2	2
Course Objective:	<ul style="list-style-type: none"> To understand and implement numerical methods and signal processing concepts using Python programming tools. To develop practical skills in analyzing, processing, and visualizing engineering data and signals using Python libraries such as NumPy, SciPy, and Mat plot lib. 				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Develop and execute simple Python programs.	K3			
CO2	Apply the best features available in Python to solve the situational problems	K3			
CO3	Develop code for numerical methods computation using Python	K3			
CO4	Generate and analyse the basic signals using Python	K4			
CO5	Perform sampling and spectral analysis of signals using Python-based computational tools and interpret the results.	K4			

List of Experiments:

1. Getting Started with Python and using the Plot command
2. Load data from files and Plotting data
3. Getting Started with Lists
4. Getting started with for, If, While loops
5. Getting started with files and arrays
6. Statistics using Python
7. Linear combination of vectors and Computation of determinant, rank of a matrix
8. Lower - Upper Decomposition of vectors
9. Gauss-Seidel Method
10. Solve Systems of Linear Equations in Python
11. Eigen values and eigenvectors in Python
12. Generation of basic sequences using Python
13. Spectral analysis of signals
14. Sampling of continuous-time signals

Mini Project List:

1. Student Performance Analysis and Visualization
2. Weather Data Analysis using Python
3. Smart Agriculture Data Monitoring System

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE REQUIRED:

- Personal Computer/Laptop with minimum Intel i3 processor or equivalent
- 4 GB RAM or higher
- 20 GB free storage space
- Internet connectivity for package installation and updates

SOFTWARE REQUIRED:

- Operating System: Windows/Linux/macOS
- Python (Version 3.x)
- Jupyter Notebook / Anaconda
- Python libraries: NumPy, SciPy, Matplotlib, Pandas
- Any Python IDE such as PyCharm or Visual Studio Code

TOTAL PERIODS**45****REFERENCES**

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021
2. Qingkai Kong, Timmy Siau and Alexandre M. Bayen, "Python Programming and Numerical Methods", Elsevier Academic Press, 2021
3. Fatos Tunay Yarman Vural, and Emre Akbas, "Signals and Systems: Theory and Practical Explorations with Python", John Wiley, 2024

Mapping of COs with POs / PSOs

Cos	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	-	1	3	-	-	-	-	-	1	2	2	-
2	3	3	-	2	3	-	-	-	-	-	1	2	3	-
3	3	3	1	3	3	-	-	-	-	-	1	2	3	-
4	3	3	1	3	3	2	-	-	-	-	2	3	3	1
5	3	3	1	3	3						2	3	3	1
CO (W.A)	3	2.8	0.6	2.4	3.0		-	-	-	-	1.4	2.4	2.8	0.4

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.				
Course Outcomes: The student will be able to		Cognitive Level			
CO1	Communicate effectively in everyday professional situations with confidence	K3			
CO2	Deliver well-organised and effective presentations.	K3			
CO3	Participate in group discussions and express ideas clearly and confidently.	K3			
CO4	Create professional video resumes and participate in interviews effectively.	K4			
CO5	Create, record and publish motivational podcasts.	K3			

List of Activities:

A. Elements of Effective Speaking and Listening

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

B. Mastering Presentations

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

C. Group Discussion Strategies:

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

<p>D. Resume & LinkedIn Optimization:</p> <p>(i) Building LinkedIn Profile – Drafting headlines and summaries</p> <p>(ii) Social Media Optimisation</p> <p>(iii) Preparing Video Resume</p>
<p>E. Podcast-Based Language Learning:</p> <p>(i) Listening to podcast (motivational, career oriented, success stories)</p> <p>(ii) Podcast Preparation – Purpose – Topic – Structure – Recording Tips - Publication of the Podcast</p>
<p>F. Mock Interviews and Communication Strategies:</p> <p>(i) Listening – Job interview</p> <p>(ii) Speaking – Mock interviews</p>
<p>Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%.</p>
<p>Internal Assessment:</p> <ol style="list-style-type: none"> 1. Listening (20 marks) 2. Video Resume (20 marks) 3. Creating a Podcast (30 marks) 4. Mock interview (30 marks) <p>End Semester Assessment:</p> <ol style="list-style-type: none"> 1. Presentation with PPT (50 marks) 2. Group Discussion (50 marks)
<p>References:</p> <ol style="list-style-type: none"> 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 Domna Lazidou, “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 <p>E-resources:</p> <ol style="list-style-type: none"> 1. Train your mind to perform under pressure- Simon Sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-underpressure-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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:**HARDWARE REQUIRED:**

Computer System with minimum Intel Core i5 Processor – 30 (1 per student)

RAM: Minimum 4 GB

LAN / Internet Connectivity

Headphones with microphone – 30 (for listening & speaking tasks)

Audio system / Speakers – 1 set (for group listening activities)

LCD Projector / Smart Board – 1 (for demonstrations & presentations)

Web Camera (Integrated or External) – 30 (for video résumé and mock interview activities).

SOFTWARE REQUIRED:

Operating System: Windows 10/11 or Linux (Ubuntu)

Web Browsers: Google Chrome / Mozilla Firefox / Microsoft Edge

Presentation Software: MS PowerPoint / Google Slides

Office Suite: MS Word / LibreOffice

TOTAL PERIODS 30**Mapping of COs with POs / PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	3	-	-	1	-	2
3	-	-	-	-	-	-	-	2	3	-	-	-	-	2
4	-	-	-	-	-	-	-	-	2	-	-	-	-	3
5	-	-	-	-	-	-	-	-	2	-	1	-	2	3
CO (W.A)	-	-	-	-	-	-	-	2.0	2.5	-	1.0	1.0	2.0	2.5

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.				
Course Outcomes: The Student will be able to		Cognitive Level			
CO1	Explain the fundamentals of microprocessors, microcontrollers, embedded system architectures (RISC/CISC, Harvard/Von Neumann), and memory technologies (SRAM, DRAM, Flash, EEPROM).	K2			
CO2	Apply Embedded C programming concepts, storage classes, qualifiers, memory layout, and 8051 architecture to build basic embedded control software.	K3			
CO3	Analyze ARM Cortex-M architecture, programmer's model, clock distribution, DMA, NVIC-based interrupt handling, and TrustZone security mechanisms.	K4			
CO4	Design peripheral interfacing solutions using GPIO, internal clock system modules, and UART serial communication across varying baud rates.	K5			
CO5	Evaluate modern AI processor architectures (GPU, NPU, FPGA), acceleration techniques, High Bandwidth Memory (HBM), Matrix Multiplication Units, and future trends.	K5			

UNIT I: EMBEDDED SYSTEM FOUNDATIONS AND PROCESSOR ARCHITECTURE	(9)
Introduction to Microprocessors and Microcontrollers – Comparison and usage. Introduction to embedded systems, code region, data region, and core components of an embedded system. Embedded Processor Architectures: RISC vs. CISC, Harvard vs. Von Neumann, brief on RISC-V. Memory Technologies: SRAM, DRAM, NOR/NAND Flash, EEPROM, and their usage in embedded systems.	
UNIT II: 8-BIT MICROCONTROLLER AND EMBEDDED C PROGRAMMING	(9)
8051 Architecture & Memory Map – I/O, Pin Functions, and basic assembly instructions. Embedded C Programming Basics – Data types, control structures, bitwise operators, memory qualifiers (volatile, static, const), pointer basics, structures, storage classes in C (auto, static, extern, register), and understanding C program memory mapping.	
UNIT III: ARM CORTEX-M ARCHITECTURE, TIMERS AND INTERRUPTS	(9)
Cortex-M Programmer's Model (M23/ARMv8-M) – Registers, memory map, stack, vector table, secure and non-secure modes (TrustZone), and access permissions between zones. Oscillators, PLL, and peripheral clock distributions. Timers & DMA overview. Interrupt Handling & NVIC – General interrupt mechanism (8051 example), interrupt handling in ARM, and the necessity/working of NVIC.	

UNIT IV: PERIPHERAL INTERFACING – GPIO, CLOCKS, AND UART	(9)
GPIO – Usage as Analog pin, Digital pin, General Purpose I/O, and concept of GPIO port block. Clock system module in PIC32CM LSx or equivalent STM32 ARM Cortex-M3 core. UART Fundamentals – Baud rate generation, framing, register configurations, internal UART registers, and demonstration of UART data transmission (e.g., 9600, 115200 bps). Advantages and limitations of UART.	
UNIT V: INTRODUCTION TO AI PROCESSOR TECHNOLOGY	(9)
Traditional CPU vs. AI Processor – Need for AI processing. AI processor types: GPU, Neural Processing Unit (NPU), and Field Programmable Gate Arrays (FPGA). Components of an AI processor and acceleration mechanisms. Fast memory technologies: High Bandwidth Memory (HBM). Overview of Matrix Multiplication Units (MMU), future trends, and industry application areas of AI processors.	
TOTAL PERIODS	45

REFERENCES:

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

Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	1	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	1	-	-	-	-	-	-	-	-	3	-	1
3	3	3	2	1	-	-	-	-	-	-	-	3	-	2
4	3	3	3	2	3	-	-	-	-	-	-	3	-	2
5	3	2	-	2	3	-	-	-	-	-	-	1	-	3
CO (W.A)	2.8	2.2	1.2	1	1.2	0	0	0	0	0	0	2.4	0	1.6

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.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Explain the fundamental concepts, principles, and signal representations used in analog and digital communication systems.	K1			
CO2	Analyze analog modulation and demodulation techniques, including AM, DSBSC, SSBSC, VSB, and FM, along with their spectral characteristics.	K4			
CO3	Analyze sampling, quantization, PCM, DPCM, ADPCM, DM, ADM, and digital baseband signaling techniques for efficient signal representation and transmission.	K4			
CO4	Evaluate source coding, channel coding, and band pass signaling techniques based on information efficiency, error performance, bandwidth, and power requirements.	K4			
CO5	Design and assess suitable communication system modules using line coding, pulse shaping, modulation, coding, and signal processing techniques for reliable data transmission.	K4			

UNIT I – ANALOG MODULATION	(12)
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.	
UNIT II – DIGITAL BASEBAND MODULATION	(12)
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.	
UNIT III – SOURCE CODING AND CHANNEL CODING	(12)
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.	
UNIT IV – BASE BAND SIGNALING	(12)
Line codes: RZ, NRZ, Manchester, Binary N-zero substitution codes - PSDs, ISI, Pulse shaping, Eye diagram.	
UNIT V – BAND PASS SIGNALING	(12)
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.	
TOTAL PERIODS	60

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.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1														
2	3				3								3	
3			3		3								3	
4			3		3								3	
5		3	3		3									3
CO (W.A)	3	3	3	-	3	-	-	-	-	-	-	-	3	3


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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.				
Course Outcomes: The Student will be able to		Cognitive Level			
CO1	Explain the fundamental concepts of control systems and model electrical and mechanical physical systems using transfer functions, block diagrams and signal flow graphs.	K2			
CO2	Analyze the time-domain response of control systems using standard test inputs, time-domain specifications, steady-state error, error constants and system type.	K4			
CO3	Analyze the stability of control systems using pole locations, Routh-Hurwitz criterion and root locus techniques.	K4			
CO4	Analyze the frequency-domain characteristics and stability of control systems using Bode plots, Polar plots and Nyquist criterion.	K4			
CO5	Design controllers and compensators and apply state-space techniques for the analysis of controllability and observability of control systems.	K5			

UNIT I – INTRODUCTION AND MODELLING OF CONTROL SYSTEMS	(9)
Fundamental Concepts of Control Systems: Open-loop and closed-loop systems – Control system terminology – Applications of control systems. Modelling of Physical Systems: Transfer function – Modelling of electrical systems – Translational and rotational mechanical systems – Electrical analogous systems – Block diagram reduction – Signal flow graphs – Multivariable control systems.	
UNIT II – TIME DOMAIN ANALYSIS	(9)
Time Domain Response: Transient and steady-state response – Standard test inputs – Time response of first-order systems – Time response of second-order systems – Time domain specifications – Effect of moving poles in the s-plane – Effect of adding real poles and zeros. Steady-State Analysis: Steady-state error – Error constants – System type – Evaluation of steady-state error for standard test inputs.	
UNIT III – STABILITY ANALYSIS	(9)
Concepts of Stability: Stability concept – Characteristic equation – Location of poles in the s-plane – Necessary conditions for stability. Stability Techniques: Routh-Hurwitz stability criterion – Root locus technique – Construction and analysis of root locus – Effect of addition of poles and zeros on system stability and performance.	
UNIT IV – FREQUENCY DOMAIN ANALYSIS	(9)
Frequency Response: Frequency response of standard second-order systems – Frequency domain specifications – Relationship between frequency-domain and time-domain specifications. Frequency Response Plots and Stability: Bode plots – Polar plots – Nyquist stability criterion – Stability analysis using frequency response techniques.	
UNIT V – CONTROLLER, COMPENSATOR AND STATE-SPACE DESIGN	(9)

Controllers: P, PI, PD and PID controllers – Analytical design of controllers. Compensators: Need for compensation – Types of compensators – Design of lag, lead and lag-lead compensators using root locus and Bode plot techniques. State Space Representation: Concept of state, state variables and state model – Conversion of transfer function to state-space representation – Conversion of state equations to transfer function – Solution of state equations – Controllability and observability.

TOTAL PERIODS

45

REFERENCES:

1. Dukkupati, 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.

Mapping of Cos with POs/PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3		-	-	-	-	-	-	-	-	-	3	-	-
2	3	2	-	-	-	-	-	-	-	-	-	3	-	-
3	-	3	3	-	-	-	-	-	-	-	-	-	3	-
4	-	3	3	-	-	-	-	-	-	-	-	-	3	-
5	-	-	3	-	3	-	-	-	-	-	-	-	-	3
CO (W.A)	1.2	1.6	1.8	0	0.6	0	0	0	0	0	0	1.2	1.2	0.6


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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.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Explain the fundamental concepts of Artificial Intelligence, intelligent agents, logic, and inference techniques.	K2			
CO2	Apply uninformed, heuristic, adversarial, and advanced search strategies to solve AI problems.	K3			
CO3	Analyze the suitability of different neural network architectures, activation functions, and optimization techniques for solving AI problems.	K4			
CO4	Apply supervised, unsupervised, and reinforcement learning techniques to analyze and solve real-world problems.	K4			
CO5	Analyze advanced machine learning, forecasting, clustering, kernel, ensemble, model selection, and dimensionality reduction techniques for solving complex problems.	K4			

UNIT I – INTRODUCTION TO AI	(5)
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	
UNIT II – SEARCH STRATEGIES	(5)
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.	
UNIT III – ARTIFICIAL NEURAL NETWORKS	(5)
Introduction to Neural Networks, Activation Functions, Optimization Algorithms: Gradient Descent. Architectures: Perceptrons, Adaline, Multilayer Perceptrons. Training: Backpropagation, Procedures, Network Tuning.	
UNIT IV – MACHINE LEARNING BASICS	(5)
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.	

UNIT V – FORECASTING, ADVANCED LEARNING & ENSEMBLE METHODS	(5)
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.	
TOTAL PERIODS	30

List of 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

TOTAL PERIODS **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, Yoshua Bengio, 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 Aurélien Géron, 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 Aurélien Géron (O'Reilly)
3. Think Python by Allen B. Downey (Green Tea Press)
4. Coursera – Machine Learning by Andrew Ng (Stanford University)

Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	-	1	2	-	-	-	-	-	2	1	2	2
2	3	3	2	2	3	-	-	-	-	-	2	2	3	2
3	3	3	2	2	3	-	-	-	-	-	2	2	3	3
4	3	3	2	2	3	1	-	-	-	-	2	2	3	3
5	3	3	2	3	3	1	-	-	-	-	3	2	3	3
CO (W.A)	3	2.80	2.00	2.00	2.80	1.00	-	-	-	-	2.20	1.80	2.80	2.60


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IO25C401-PCB DESIGN & HARDWARE PROTOTYPING		L	T	P	C
		1	0	2	1
Course Objective:	<ul style="list-style-type: none"> •To develop practical skills in PCB schematic design, component selection, layout, routing, high-speed signal integrity, thermal management, and manufacturing file generation. •To equip students with hands-on knowledge of PCB assembly, soldering, troubleshooting, and testing using multimeters and oscilloscopes. 				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Create schematics and component footprints using PCB software.	K3			
CO2	Design error-free 2-layer PCB layouts using proper routing rules.	K4			
CO3	Reduce noise and heat issues in high-speed circuit designs	K4			
CO4	Generate industrial Gerber files for PCB manufacturing	K6			
CO5	Solder, assemble, and test populated PCB hardware	K5			

UNIT I - Circuit Schematics & Components	(3)
Through-Hole vs. Surface Mount (SMD) components; Introduction to KiCad/Altium software; Drawing circuit schematics; Creating custom symbols and footprint libraries; Generating Bill of Materials (BOM).	
UNIT II - PCB Layout & Trace Routing	(3)
Board shape and size setup; Component placement rules; setting up Design Rules (trace thickness, spacing, via sizes); Manual and automatic routing; Ground planes and power connections.	
UNIT III - High-Speed Signals & Heat Control	(3)
Signal noise (crosstalk and reflections); 50 Ohm impedance matching for high-speed data traces; Serpentine trace matching; Thermal relief pads and heat sinks.	
UNIT IV - PCB Manufacturing Files	(3)
Steps in PCB manufacturing (etching, plating, solder mask, silk screen); Exporting Gerber files, NC Drill files, and Pick-and-Place data; Board finishes (HASL, ENIG).	
UNIT V - Soldering, Assembly & Testing	(3)
SMT assembly line setup; Hand soldering and hot-air rework techniques; Finding short circuits and broken connections; Testing signals with multimeters and oscilloscopes.	
TOTAL PERIODS	15

List of Experiments:

1. Study and Identification of Through-Hole and Surface Mount Components
2. Design of Circuit Schematic using KiCad/Altium Designer
3. Creation of Custom Symbols, Footprints and Bill of Materials (BOM)
4. Design of PCB Layout with Component Placement and Design Rule Setup
5. PCB Trace Routing with Power and Ground Plane Connections
6. Design and Analysis of High-Speed PCB Traces for Signal Integrity
7. Design of Thermal Management Techniques using Thermal Reliefs, Thermal Vias and Heat Sinks
8. Generation and Verification of Gerber, NC Drill and Pick-and-Place Files
9. PCB Assembly, Hand Soldering, SMD Soldering and Hot-Air Rework
10. PCB Testing, Fault Finding and Signal Measurement using Multimeter and Oscilloscope

TOTAL PERIODS	30
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Text Book:

1. **R. S. Khandpur**, *Printed Circuit Boards: Design, Fabrication, Assembly and Testing*, McGraw Hill. (Covers fabrication, SMT assembly, and board testing)
2. **Jon Adams**, *PCB Design using KiCad*, Elektor. (Hands-on guide for EDA software, schematics, and Gerber output)

REFERENCES:

1. **Mark I. Montrose**, *EMC and the Printed Circuit Board*, IEEE Press/Wiley. (Focuses on signal integrity, grounding, and EMI/EMC)
2. **IPC-2221 Standards**, *Generic Standard on Printed Board Design*, IPC. (Industry rules for trace clearance, current capacity, and footprints)

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2		3							2		
2	3	3	3		3							2		
3	3	3	2		2							2		
4	2	2	3		3							3		
5	3	2	3		3							3		
CO (W.A)	2.8	2.4	2.6		2.8							3		

SD25C401 – IoT AND SENSOR INTERFACING		L	T	P	C
		1	0	2	2
Course Objective:	To provide hands-on knowledge of IoT, Arduino/ESP32, sensor interfacing, wireless connectivity, and cloud-based monitoring for developing real-time IoT applications.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Understand the fundamentals of IoT, Arduino/ESP32 architecture, GPIO and basic interfacing techniques.	K2			
CO2	Explain the working principles and interfacing of temperature, humidity and light sensors.	K2			
CO3	Apply sensor interfacing techniques for object detection, distance measurement, soil moisture and rainfall monitoring.	K3			
CO4	Implement gas/smoke sensing and Wi-Fi connectivity for IoT-based sensor data transmission.	K3			
CO5	Develop IoT-based monitoring and control applications using cloud platforms and multiple sensors.	K5			

UNIT I: ARDUINO/ESP32 BASICS	(3)
Introduction to IoT and Embedded Systems - Arduino and ESP32 Architecture - Arduino IDE and Programming - GPIO Interfacing - Analog Input and ADC - LED, Push Button and Buzzer Interfacing	
UNIT II: ENVIRONMENTAL SENSORS	(3)
Temperature Sensors - Humidity Sensors - DHT11/DHT22 Interfacing - LDR Sensor - Light Intensity Measurement - Analog Sensor Data Acquisition	
UNIT III: SENSOR INTERFACING	(3)
IR Sensor Interfacing - Object Detection - Ultrasonic Sensor - Distance Measurement - Soil Moisture and Rain Sensors - Automatic Irrigation and Alert Systems	
UNIT IV: GAS SENSORS AND IOT CONNECTIVITY	(3)
Gas and Smoke Sensors - MQ-Series Sensor Interfacing - Gas Leakage Detection - ESP32/ESP8266 Wi-Fi Connectivity - Sensor Data Transmission - IoT Communication	
UNIT V: IoT MONITORING AND APPLICATIONS	(3)
ThingSpeak Platform - Cloud-Based Monitoring - Multi-Sensor IoT Systems - IoT Dashboard - Remote Monitoring and Control - IoT Mini Project	
TOTAL PERIODS	15

List of Experiments:

1. Introduction to Arduino/ESP32 and GPIO Interfacing – Write a program to interface LED, push button and buzzer and demonstrate digital input/output operations.
2. Temperature and Humidity Sensor Interfacing – Interface DHT11/DHT22 with Arduino/ESP32 and display the measured temperature and humidity values.
3. Light Intensity Measurement using LDR – Interface an LDR sensor, acquire the analog signal and control an LED based on the measured light intensity.
4. IR Sensor-based Object Detection – Interface an IR sensor with Arduino/ESP32 and detect the presence of an object.
5. Ultrasonic Sensor for Distance Measurement – Interface an HC-SR04 ultrasonic sensor and calculate the distance of an object.
6. Soil Moisture Sensor Interfacing – Measure soil moisture and develop an automatic irrigation control using a relay/mini water pump.
7. Rain Sensor Interfacing and Alert System – Detect rainfall using a rain sensor and generate a visual/audio alert.
8. Gas/Smoke Sensor Interfacing – Interface an MQ-series gas sensor and develop a gas-leakage/smoke detection alert system.
9. ESP32/ESP8266 Wi-Fi Connectivity – Connect the controller to a Wi-Fi network and transmit sensor data to an IoT platform.
10. IoT-based Temperature Monitoring using ThingSpeak – Acquire temperature data using LM35/DHT11 and upload the readings to ThingSpeak for remote monitoring.
11. IoT-based Multi-Sensor Monitoring System – Interface two or more sensors and transmit their real-time readings through Wi-Fi to an IoT dashboard.
12. Mini Project – IoT-based Smart Monitoring and Control System – Design and implement an application such as smart irrigation, environmental monitoring, smart home monitoring or air-quality monitoring.

TOTAL PERIODS	30
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HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:**HARDWARE REQUIRED:**

- Personal Computer/Laptop with minimum Intel i3 processor or equivalent
- 4 GB RAM or higher
- 20 GB free storage space
- Arduino Uno boards – 10 Nos.
- ESP32 development boards – 10 Nos.
- ESP8266 NodeMCU boards – 5 Nos. (*optional*)
- Breadboards – 10 Nos.
- USB cables – 10 Nos.
- Jumper wires – Male-to-Male, Male-to-Female and Female-to-Female
- LEDs and 220 Ω resistors
- Push buttons and 10 k Ω resistors
- Buzzer modules
- DHT11/DHT22 temperature and humidity sensors
- LDR sensors and 10 k Ω resistors
- IR obstacle detection sensor modules
- HC-SR04 ultrasonic sensors

- Soil moisture sensor modules
- Relay modules
- Mini DC water pumps
- Rain sensor modules
- MQ-2/MQ-series gas/smoke sensor modules
- LM35 temperature sensors
- OLED/LCD display modules
- DC power supply/adapters
- Digital multimeters
- Internet/Wi-Fi connectivity for IoT experiments

SOFTWARE REQUIRED:

- Operating System: Windows/Linux/macOS
- Arduino IDE
- Arduino AVR Board Package
- ESP32 Board Package
- ESP8266 Board Package
- Arduino C/C++ programming environment
- DHT Sensor Library
- Adafruit Unified Sensor Library
- Wi-Fi Library for ESP32/ESP8266
- ThingSpeak IoT Platform
- ThingSpeak Arduino Library
- Serial Monitor/Serial Plotter
- Blynk IoT Platform / MQTT platform (*for IoT-based applications, if required*)
- USB drivers for Arduino/ESP32/ESP8266 boards

TOTAL PERIODS

45

REFERENCES

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015.
2. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill Education, 2017.
3. Charles Bell, Beginning Sensor Networks with Arduino and Raspberry Pi, Apress, 2013.
4. Simon Monk, Programming Arduino: Getting Started with Sketches, McGraw Hill Education.
5. Neil Kolban, Kolban's Book on ESP32, Leanpub.

Mapping of COs with POs / PSOs														
Cos	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	-	1	3	-	-	-	-	-	1	2	2	-
2	3	3	-	2	3	-	-	-	-	-	1	2	3	-
3	3	3	1	3	3	-	-	-	-	-	1	2	3	-
4	3	3	1	3	3	2	-	-	-	-	2	3	3	1
5	3	3	1	3	3						2	3	3	1
CO (W.A)	3	2.8	0.6	2.4	3.0		-	-	-	-	1.4	2.4	2.8	0.4


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EN25C04-ENGLISH COMMUNICATION SKILLS LABORATORY-II		L	T	P	C
		0	0	2	1
Course Objectives	<ul style="list-style-type: none"> To build students' advanced communication skills for workplace readiness and develop intercultural competence for effective collaboration in global and virtual teams. To prepare students for competitive exams with focused skill-building and test-oriented practice. 				
Course Outcomes: The student will be able to					Cognitive Level
CO1	Understand basic industry-related reading materials.	K2			
CO2	Design and present a domain specific poster.	K6			
CO3	Deliver effective digital presentations	K3			
CO4	Communicate appropriately in intercultural/cross cultural contexts	K3			
CO5	Perform in interviews and competitive exams successfully.	K3			

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/cross-cultural 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.

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

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

HARDWARE REQUIRED:

Computer System with minimum Intel Core i5 Processor – 30 (1 per student)

RAM: Minimum 4 GB

LAN / Internet Connectivity

Headphones with microphone – 30 (for listening & speaking tasks)

Audio system / Speakers – 1 set (for group listening activities)

LCD Projector / Smart Board – 1 (for demonstrations & presentations)

Web Camera (Integrated or External) – 30 (for video résumé and mock interview activities).

SOFTWARE REQUIRED:

Operating System: Windows 10/11 or Linux (Ubuntu)

Web Browsers: Google Chrome / Mozilla Firefox / Microsoft Edge

Presentation Software: MS PowerPoint / Google Slides

Office Suite: MS Word / LibreOffice

TOTAL PERIODS 30**Mapping of COs with POs / PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	3	-	-	2	-	3
3	-	-	-	-	-	-	-	-	3	-	-	-	1	-
4	-	-	-	-	-	-	-	-	3	-	1	-	-	3
5	-	-	-	-	-	-	-	-	3	-	-	-	-	1
CO (W.A)	-	-	-	-	-	-	-	-	3.0	-	1.0	2.0	1.0	2.3

EC25C13 - ANALOG AND DIGITAL COMMUNICATION LABORATORY		L	T	P	C
		0	0	4	2
Course Objective:	To Demonstrate communication link architecture and technique comparison via case studies, simulations, policies, and socio-economic impact.				
Course Outcomes		Cognitive Level			
The Student will be able to					
CO1	Explain the fundamental concepts and principles of analog and digital communication systems.	K2			
CO2	Apply analog modulation and demodulation techniques for generation and recovery of communication signals.	K3			
CO3	Analyze digital modulation and demodulation techniques and their performance parameters.	K4			
CO4	Implement sampling, quantization, PCM, line coding, and pulse shaping techniques using simulation or laboratory hardware.	K3			
CO5	Evaluate communication system performance using bandwidth, power spectral density, SNR, BER, and experimental results.	K5			

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

TOTAL PERIODS **60**


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COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1														
2	3	3		3								3		
3	3	3		3								3		
4		3		3									3	
5		3		3									3	
CO (W.A)	3	3	-	3	-	-	-	-	-	-	-	3	3	-


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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				
Course Outcomes: The Student will be able to		Cognitive Level			
CO1	Describe the architecture, IDE, compilation process (ELF, MAP, LST files), memory organization, and debugging features of ARM 32-bit microcontrollers.	K2			
CO2	Analyze embedded C programming features including parameter passing, variable qualifiers, pointers, memory access, and assembly-level code generation.	K4			
CO3	Design and implement GPIO interfacing, hardware timers, SysTick interrupts, and switch debouncing techniques for precise timing and control applications.	K4			
CO4	Develop peripheral communication modules using UART in polling and interrupt-driven modes with NVIC integration and DMA-based memory transfers.	K5			
CO5	Evaluate access control mechanisms, zone security operations, and memory protection between secure and non-secure execution environments.	K5			

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 an 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 numbers using call by value and call by reference. Examine the difference of these functions in assembly code, and explain the difference in the way code is generated internally on any ARM 32-bit 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 32-bit 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 32-bit 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 1 ms interrupt, 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 the 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 at 9600 bps, transmit/receive characters, and echo back.
13. UART Interrupt Mode, Configure UART at 9600 bps, transmit "ABC" using interrupt mode. Ask students to explain about NVIC and its working on ARM processor.

TOTAL PERIODS

60

REFERENCES:

1. Valvano, J. W. – Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, Volume 2, CreateSpace Independent Publishing Platform.
2. Yiu, J. – The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, 3rd Edition, Newnes / Elsevier.
3. Zhu, Y. – Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C, 3rd Edition, E-Man Press.
4. Naimi, S., Naimi, S., & Mazidi, M. A. – TI MSP432 ARM Programming for Embedded Systems: Using C Project-Based Approach, MicroDigitalEd.
5. ARM Limited – ARM Architecture Reference Manual & Technical Reference Manuals for ARM Cortex-M Series.

Mapping of COs with POs / PSOs														
COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	1	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	1	-	-	-	-	-	-	-	-	3	-	1
3	3	3	2	1	-	-	-	-	-	-	-	3	-	2
4	3	3	3	2	3	-	-	-	-	-	-	3	-	2
5	3	2	-	2	3	-	-	-	-	-	-	1	-	3
CO (W.A)	2.8	2.2	1.2	1	1.2	0	0	0	0	0	0	2.4	0	1.6


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