



# ANNA UNIVERSITY, CHENNAI

## UNDERGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

**Programme:** B.E., Biomedical 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)

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	---	HUM
10.	UC25A02	Physical Education – I*	---	0-0-4	4	1	HUM
11.		NCC / NSS / NSO	---	---	---	---	---
Total Credits					33	22	

\*Audit Course

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.	ME25C02	Engineering Mechanics	T	3-1-0	4	4	ES (G)
4.	PH25C07	Medical Physics	T	2-1-0	3	3	BS
5.	BM25C01	Anatomy and Physiology	LIT	3-0-2	5	4	ES (PC)
6.	BM25C02	Biosciences for Medical Engineering	LIT	3-0-2	5	4	ES (PC)
7.	EN25C02	English Essentials – II	LIT	1-0-2	3	2	HUM
8.	UC25A03	Life Skills for Engineers – II*	---	1-0-2	3	---	HUM
9.	UC25A04	Physical Education – II*	---	0-0-4	4	1	HUM
10.	ME25C05	Re-Engineering for Innovation	L	0-0-4	4	2	SD
11.		Foreign Language^	L	1-0-2	3	---	HUM
Total Credits					35	25	

^ Deutsch / Japanese / Korean

\*Audit Course

Semester – III							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1.		Electric Circuit Analysis	LIT	2-1-2	5	4	ES (PC)
2.		Electronic Devices and Circuits	T	3-0-0	3	3	ES (PC)
3.		Sensors and Measurements	LIT	3-0-2	5	4	ES (PC)
4.		Skill Development Course – I	LIT	1-0-2	3	2	SD
5.		Devices and Circuits Laboratory	L	0-0-4	4	2	ES (PC)
6.		English Communication Skills Laboratory – II	L	0-0-2	2	1	HUM
Total Credits					22	16	

Semester – IV							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1.		Probability and Random Processes	T	3-1-0	4	4	BS
2.		Biomedical Instrumentation	T	3-0-0	3	3	ES (PC)
3.		Analog and Digital Integrated Circuits	T	3-0-0	3	3	ES (PC)
4.		Biocontrol Systems	T	3-0-0	3	3	ES (PC)
5.		Medical Ethics and Regulatory Standards	T	3-0-0	3	3	ES (PC)
6.		Healthcare Data Analytics	LIT	2-0-2	4	3	ES (PC)
7.		Skill Development Course – II	LIT	1-0-2	3	2	SD
8.		English Communication Skills Laboratory – III	L	0-0-2	2	1	HUM
9.		Analog and Digital Integrated Circuits Laboratory	L	0-0-4	4	2	ES (PC)
Total Credits					29	24	

Semester – V							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1.		Diagnostic and Therapeutic Equipment	T	3-0-0	3	3	ES (PC)
2.		Radiological Equipment	T	3-0-0	3	3	ES (PC)
3.		Programme Elective – I	T	3-0-0	3	3	ES (PE)
4.		Programme Elective – II	T	3-0-0	3	3	ES (PE)
5.		Microcontrollers and Embedded Systems	LIT	3-0-2	5	4	ES (PC)
6.		Discrete Time Signal Processing	LIT	3-0-2	5	4	ES (PC)
7.		Skill Development Course – III	LIT	1-0-2	3	2	SD
8.		Industry Oriented Course – I	LIT	1-0-2	3	1	SD
9.		Summer Internship	LIT	0-0-4	4	2	SD
Total Credits					32	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	
<b>For Minor Degree</b>							
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.		Advanced Diagnostic and therapeutic equipment	T	3-0-0	3	3	ES (PC)
2.		Biomechanics	T	3-0-0	3	3	ES (PC)
3.		Open Elective	T	3-0-0	3	3	ES (OE)
4.		Programme Elective – III	LIT	3-0-2	5	4	ES (PE)
5.		Industry Oriented Course – II	LIT	1-0-2	3	1	SD
6.		Biomedical System Modeling Laboratory	L	0-0-4	4	2	ES (PC)
7.		Diagnostic and Therapeutic Equipment Laboratory	L	0-0-4	4	2	ES (PC)
8.		Self-Learning Course	---	---	0	1	SL
Total Credits					25	19	
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		Climate Change and Sustainability	T	2-0-0	2	2	HUM
2		Programme Elective – IV	T	3-0-0	3	3	ES (PE)
3		Programme Elective – V	T	3-0-0	3	3	ES (PE)
4		Hospital Management	T	3-0-0	3	3	HUM
5		Wearable Systems	T	3-0-0	3	3	ES (PC)
6		Innovation and Entrepreneurship in Healthcare	LIT	2-0-2	4	3	---
7		Medical Image Processing	LIT	3-0-2	5	4	ES (PC)
8		Hospital Training*	---	---	--	2	SD
Total Credits					23	23	
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	

**PROGRAMME ELECTIVE COURSES: STREAMS**

<b>Bio Engineering</b>	<b>Digital Health</b>	<b>Medical Device Development</b>	<b>Assistive Technology</b>	<b>Management Healthcare</b>
Biomaterials	Biosignal Processing	Foundation Skills in Integrated Product Development	Extended Reality in Healthcare	Clinical Engineering
Artificial Organs and Implants	Telehealth Technology	Medical Device Design	Rehabilitation Engineering	Hospital Planning and Management
Neural Engineering	Brain Computer Interface and Applications	Advancements in Healthcare Technology	Physiological Modelling	Medical Waste Management
Principles of Tissue Engineering	Biometrics	Rapid Prototyping	Assistive Technology and devices	Economics and Management for Engineers
Health informatics	Soft Computing and its applications	Internet of Medical Things	Robotics in Medicine	Forensic Science in Healthcare
BIOMEMS	Deep Learning	Biomedical Optics and Photonics	Sports Engineering and Technology	Quality Management in Hospital

# Semester I

MA25C01	Applied Calculus	L	T	P	C
		3	1	0	4
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>To provide technical competence of modelling engineering problems using calculus.</li><li>To apply the calculus concepts in solving engineering problems using analytical methods and computational tools.</li></ul>					
<b>Differential Calculus:</b> 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. <b>Activities:</b> Visualization of the functions, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).					
<b>Functions of Several Variables:</b> Partial derivatives, Chain rule, Total derivative, Maxima and minima of functions of two variables, Method of Lagrange's Multipliers, Application problems in engineering. <b>Activities:</b> Partial Derivatives with two or three variables, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).					
<b>Integral Calculus:</b> Fundamental theorem of Calculus, Indefinite integrals and the Net Change Theorem, Improper integrals, Arc Length, Area of Region, Area of surface of revolution. <b>Activities:</b> Definite and Indefinite Integrals, Determination of Area, Solving of Competitive Examination questions (Ex. GATE).					
<b>Multiple Integrals:</b> 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. <b>Activities:</b> Double integrals and triple integrals using open-source software, Solving of Competitive Examination questions (Ex. GATE).					
<b>Weightage:</b> Continuous Assessment: 40%, End Semester Examinations: 60%.					
<b>Assessment Methodology:</b> Assignments (20%), Solution to application-oriented problems using software (20%), Solving of GATE questions (20%), Internal Examinations (40%).					
<b>References:</b> 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%3ACalculus\\_Early\\_Transcendentals\\_\(Stewart\)/](https://math.libretexts.org/Bookshelves/Calculus/Map%3ACalculus_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	PSO1	PSO2	PSO3
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)			
CO3	Analyze the behavior of single and multivariable functions using derivatives and partial derivatives.	PO2(3)			
CO4	Utilize modern computational software and online platforms to deepen understanding, perform complex calculations, and visualize mathematical concepts.	PO5(2) PO11(1)			

EN25C01	English Essentials – I	L	T	P	C
		2	0	0	2
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>Enhance learners’ listening and speaking skills to understand and deliver speeches effectively</li><li>Equip students with the skills to write clear, coherent, and grammatically correct texts for various purposes.</li><li>Strengthen the ability to comprehend, interpret, and analyse written English across diverse contexts.</li></ul>					
<b>Speaking Skills:</b> Self-Introduction (Tenses, Adjectives) Expressing opinions (Subject-Verb Agreement), Participating in Conversations (Speech Acts - agreeing & disagreeing – synonyms and antonyms) <b>Suggested Activities:</b> Self-Introduction, Just a Minute (JAM) Video recording, Situational role plays, Spell Bee, Word Substitution, Usage of Apps.					
<b>Listening Skills:</b> Listening to Simple Conversations (Understanding tone and intent), Short Speeches / Stories, Extracting information, Pronunciation, Listening to Various Accents. <b>Suggested Activities:</b> Listening and Repeating, Gap fill exercises, Note-taking					
<b>Reading Skills:</b> Reading Strategies – (Skimming, scanning, predicting) intensive reading - short passages and long passages on suggested themes (Sentence Patterns, Prefixes and suffixes, idioms and phrases). <b>Activities:</b> Reading - newspaper and digital articles, Cloze, Reading comprehension, note making and summarising,					
<b>Writing Skills:</b> Word Substitution, Sentence Formation, Hints Development (Guided Writing), Writing Different Types of Paragraphs - (Sentence Structure) – Letter Writing / Emails (Informal) <b>Activities:</b> Error Detection, Picture and poster description, Descriptive, Narrative and Comparative paragraphs, Brainstorming and Mind Mapping - Informal letters/ Emails					
<b>Weightage:</b> Continuous Assessment: 40%, End Semester Examinations: 60%					
<b>Assessment Methodology:</b> Quiz (10%), Assignments (20%), Speaking Task (10%), Reading Task (10%), Writing Task (10%), Internal Examinations (40%).					
<b>References:</b> <ol style="list-style-type: none"><li>Miller, K. Q., &amp; Wahl, S. T. (2023). <i>Business and Professional Communication: KEYS for Workplace Excellence</i> (5th ed.). SAGE Publications.</li><li>Kumar, Sanjay &amp; Pushpalatha. (2018). <i>English Language and Communication Skills for Engineers</i>. India: Oxford University Press.</li><li>Sharma, S., &amp; Mishra, B. (2024). <i>Communication Skills for Engineers and Scientists</i> (2nd ed.). PHI Learning.</li></ol>					
<b>E-resources:</b> <ol style="list-style-type: none"><li>Cambridge English – <a href="https://www.cambridgeenglish.org/learning-english/grammar-and-vocabulary/">https://www.cambridgeenglish.org/learning-english/grammar-and-vocabulary/</a></li></ol>					

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/>

	<b>Description of CO</b>	<b>PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
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)			
CO3	Analyze texts in different contexts using appropriate reading strategies.	PO2(2)			
CO4	Communicate thoughts and ideas in real life situations.	PO9(2)			
CO5	Develop communication skills relevant to engineering and technology.	PO11(1)			

UC25H01	தமிழர் மரபு	L	T	P	C
		1	0	0	1
<p><b>மொழி மற்றும் இலக்கியம்:</b> 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><b>மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:</b> 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><b>நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:</b> தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.</p>					
<p><b>தமிழர்களின் திணைக் கோட்பாடுகள்:</b> 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><b>இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:</b> இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு, இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம், சுயமரியாதை இயக்கம், இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள், தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.</p>					
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).</li> <li>2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).</li> <li>3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)</li> <li>4. பொருறை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)</li> <li>5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB &amp; ESC and RMRL - (in print)</li> <li>6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.</li> <li>7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).</li> <li>8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)</li> <li>9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology &amp; Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</li> <li>10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)</li> </ol>					

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
<b>Language and Literature:</b> Language Families in India, Dravidian Languages, Tamil as a Classical Language, Classical Literature in Tamil, Secular Nature of Sangam Literature, Distributive Justice in Sangam Literature, Management Principles in Thirukural, Tamil Epics and Impact of Buddhism & Jainism in Tamil Land, Bakthi Literature Azhwars and Nayanmars, Forms of minor Poetry, Development of Modern literature in Tamil, Contribution of Bharathiyar and Bharathidhasan.					
<b>Heritage - Rock Art Paintings to Modern Art – Sculpture:</b> 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.					
<b>Folk and Martial Arts:</b> Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance, Sports and Games of Tamils.					
<b>Thinai Concept of Tamils:</b> 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.					
<b>Contribution of Tamils to Indian National Movement and Indian Culture:</b> 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.					
<b>References:</b> <ol style="list-style-type: none"> <li>1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).</li> <li>2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).</li> <li>3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)</li> <li>4. பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)</li> <li>5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB &amp; ESC and RMRL – (in print)</li> <li>6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).</li> <li>7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).</li> <li>8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)</li> <li>9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology &amp; Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</li> <li>10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)</li> <li>11. Porunai Civilization (Jointly Published by: Department of Archaeology &amp; Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</li> </ol>					

<b>EE25C04</b>	<b>Basic Electronics and Electrical Engineering</b>	L 2	T 1	P 0	C 3
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>Students will understand the fundamentals and evolution of electronics, electrical systems</li> </ul>					
<b>Basic Electronics:</b> 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. <b>Activities:</b> VI characteristics of PN junction and Zener diode.					
<b>Electrical Machines:</b> 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. <b>Activities:</b> Demonstration of Electrical Machines.					
<b>Measurements and Instrumentation:</b> 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. <b>Activities:</b> Demonstration of measuring equipment's					
<b>Basics of Power Systems:</b> 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 <b>Activities:</b> Demonstration of Earthing and safety precautions in electrical circuits					
<b>Sensors and Transducers</b> 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					
<b>Weightage:</b> Continuous Assessment: 40%, End Semester Examinations: 60%					
<b>Assessment Methodology:</b> Quiz (10%), Assignments (40%), Internal Examinations (50%)					
<b>References:</b> <ol style="list-style-type: none"> <li>Bell, D. (2008). <i>Electronic devices and circuits</i> (5th ed.). Oxford University Press.</li> </ol>					

2. Tooley, M. A. (2006). *Electronic circuits: Fundamentals and applications* (3rd ed.). Elsevier Limited.
3. Malvino, A., & Bates, D. J. (2012). *Basic electronics: Problems and solutions* (8th ed.). Tata McGraw-Hill Publishing Company Pvt. Ltd.
4. Hughes, E. (2016). *Electrical and electronic technology* (12th ed.). Pearson.
5. Theraja, B. L. (2014). *A textbook of electrical technology* (Reprint ed.). 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	PS01	PS02	PS03
CO1	Understand and explain basic electrical and electronic concepts.	---			
CO2	Apply and analyse electrical circuits in real-time applications.	PO1 (3) PO2 (1)			
CO3	Identify and utilise key electrical and electronic devices used in engineering applications	PO2 (3)			



PH25C01	Applied Physics – I	L	T	P	C
		2	0	2	3
<b>Course Objective(s):</b> <ul style="list-style-type: none"><li>To impart knowledge and expose the essentials of physics in various engineering applications.</li></ul>					
<b>Properties of Matter:</b> 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 <b>Practical:</b> Non-Uniform bending, Young’s modulus of the material, Torsional pendulum, Rigidity modulus of the wire and moment of inertia of the disc. <b>Activities:</b> Virtual demonstration of thermal stress.					
<b>Oscillations:</b> Simple Harmonic motion, Torsional pendulum, Couple per unit twist, Damped and Forced Oscillation <b>Waves:</b> 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 <b>Practical:</b> Melde’s string experiment, Frequency of an electrically vibrating metal tip. <b>Activities:</b> Virtual demonstration of propagation of EM waves					
<b>Quantum Mechanics:</b> 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. <b>Practical:</b> Photo-electric effect – Determination of Planck’s constant. <b>Activities:</b> Virtual demonstration of Scanning Transmission Electron Microscope					
<b>Applied Optics:</b> 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 <sub>2</sub> laser (construction, functioning and applications), dye laser <b>Practical:</b> Ruling width of Compact disc using Laser, Thickness of a thin sheet/wire using Air wedge Method. <b>Activities:</b> Demonstration of sensors and applications of Lasers					
<b>Weightage:</b> Continuous Assessment: 50%, End Semester Examinations: 50%					
<b>Assessment Methodology:</b> 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](https://onlinecourses.nptel.ac.in/noc24_ee31/preview)
3. CO2 Laser : [https://onlinecourses.nptel.ac.in/noc25\\_ph03/preview](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](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	PSO1	PSO2	PSO3
CO1	Explain the physics concepts in various applications.	---			
CO2	Apply the principles of wave optics and laser physics in practical systems.	PO1(3)			
CO3	Analyse the behaviour of materials under different conditions.	PO2(2)			
CO4	Conduct experiments in groups and interpret the data.	PO4(3) PO8(1)			

CY25C01	Applied Chemistry – I	L	T	P	C
		2	0	2	3
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>• To provide students with a solid understanding of the chemical principles for engineering applications.</li><li>• To introduce the chemical properties of materials and how these properties influence the selection and use of materials in engineering systems.</li><li>• To impart practical applications of chemistry in commonly used engineering devices.</li></ul>					
<b>Water Technology:</b> Water quality parameters and standards. Industrial feed water – Remediation. Municipal water treatment. Desalination. <b>Practical:</b> Analysis of alkalinity, hardness and dissolved oxygen. <b>Activity:</b> Coagulation of water sample using Alum					
<b>Nano-chemistry:</b> Classification, Size-dependent properties. Preparation of nanomaterials, Top-down and Bottom-Up approaches, Applications (Flipped classroom). <b>Practical:</b> Preparation of nanoparticles by Sol-Gel method.					
<b>Electrochemistry:</b> Electrochemical cell, Electrode potential, Redox reaction. Conductivity of electrolytes – Factors. <b>Practical:</b> Conductometric titrations <b>Activity:</b> Electrochemical cell demonstration					
<b>Corrosion &amp; Control:</b> Chemical and electrochemical corrosions, galvanic series, factors influencing corrosion, Electrochemical protection. Organic and Inorganic coating. <b>Practical:</b> <ul style="list-style-type: none"><li>• Corrosion study by weight loss and salt spray method.</li><li>• Potentiometry/UV-visible spectrophotometer.</li></ul> <b>Activities:</b> Case Study on Corrosion in Pipelines and Electronics, Control measures for a corroded metal					
<b>Batteries:</b> Conventional, Contemporary and Emerging battery storage technologies, Primary & Secondary Batteries, Battery Pack, Battery Materials, Performance Parameters, Testing, Safety aspects. <b>Practical:</b> Measurement of EMF, Internal Resistance, Charge and Discharge Characteristics. <b>Activities:</b> Demonstration of battery pack in e-vehicles.					
<b>Weightage:</b> Continuous Assessment: 50%, End Semester Examinations: 50%					
<b>Assessment Methodology:</b> 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	PSO1	PSO2	PSO3
CO1	Understand the importance of chemistry applications with underlying mechanisms.	---			
CO2	Apply the chemistry concepts in widely used devices.	PO1(3)			
CO3	Analyse the effect of various chemical parameters on performance of engineering systems.	PO2(2)			
CO4	Perform experimentations as a group and interpret the results.	PO4(3) PO8(1)			
CO5	Communicate findings through case studies and reports	PO9(1)			

CS25C01	Computer Programming: C	L	T	P	C
		2	0	2	3
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>To equip engineering students with the foundational knowledge and practical skills in ‘C’ programming to analyse and solve computational problems effectively.</li><li>To foster problem-solving, critical thinking, and modular programming skills essential for engineering domains.</li></ul>					
<b>Introduction to C:</b> 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. <b>Practical:</b> Create Problem Analysis Charts, Flowcharts and Pseudocode for simple C programs (Minimum three).					
<b>Control Structures:</b> if, if-else, nested if, switch-case, while, do-while, for, nested loops, Jump statements. <b>Practical:</b> Usage of conditional logics in programs. (Minimum three)					
<b>Functions:</b> 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. <b>Practical:</b> Usage of functions in programs. (Minimum three)					
<b>Strings &amp; Pointers:</b> 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. <b>Practical:</b> Programs using pointers, dynamic memory, pointer arithmetic, string manipulations, array operations. (Minimum three)					
<b>Structures &amp; Unions:</b> Defining and using structures, Array of structures, Pointers to structures, Unions and their uses, Enumerations. <b>Practical:</b> Program to use structures and unions					
<b>File Operations:</b> Open, read, write, close file operations, Binary vs Text files, File pointers, Error handling in file operations. <b>Practical:</b> Programs reading/writing data in text and binary files (Minimum three).					
<b>Standard Libraries &amp; Header Files:</b> Using standard libraries like stdio.h, stdlib.h, string.h, math.h, Creating and using user-defined header files and libraries. <b>Practical:</b> Use of standard and user-defined libraries in solving problems. (Minimum three), Project (Minimum Two)					
<b>Weightage:</b> Continuous Assessment: 50%, End Semester Examinations: 50%					
<b>Assessment Methodology:</b> Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)					
<b>References:</b>  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/](https://onlinecourses.swayam2.ac.in/imb25_mg71/)

	Description of CO	PO	PSO1	PSO2	PSO3
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)			
CO3	To interpret the data and effectively communicate in groups.	PO2 (3) PO8 (1) PO9 (1)			
CO4	Adapt new programming concepts and technologies in the profession.	PO11 (1)			

ME25C04	Makerspace	L	T	P	C
		0	0	4	2

### Course Objectives:

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

### List of Activities

#### (A). Dis-assembly & Assembly Practices

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

#### (B). Welding Practices

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

#### (C). Electrical Wiring Practices

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

#### (D). Electronics Components / Equipment Practices

- Electronic components, equipment & safety measures.
- Dis-assembly and assembly of Computers.
- Hands-on session of Soldering Practices in a Printed Circuit Board.
- Hands-on session of Bridge Rectifier, Op-Amp and Transimpedance amplifier.
- Hands-on session of integration of sensors and actuators with a Microcontroller.
- Demonstration of Programmable Logic Control Circuit.

#### (E). Contemporary Systems

- Demonstration of Solid Modelling of components.
- 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	PSO1	PSO2	PSO3
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)			
CO3	Develop solid innovative models through software.	PO5 (2)			
CO4	Adapt and follow safety protocols in the work environment.	PO11 (2)			



UC25A01	Life Skills for Engineers – I	L	T	P	C
		1	0	2	-
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>• 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.</li><li>• To enhance self-awareness, interpersonal skills, and resilience to prepare students for the professional and personal challenges of engineering careers and life beyond academics.</li></ul>					
<b>Personal and Emotional Development:</b> Self-Awareness & Personality, Emotional Intelligence & Empathy, Positive thinking, Right attitude, Stress & Anger Management, Goal-Setting & Time Management, Growth Mindset & Resilience. <b>Activities:</b> 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.					
<b>Management Skills:</b> Financial Literacy: Budgeting & Saving, Nutrition, Health, and Hygiene, Digital Literacy & Online Safety, Civic Responsibility & Ethics <b>Activities:</b> Create a monthly budget, financial simulation game, Meal planning workshop, physical wellness challenge, Social media audit, privacy and safety scenarios, Community service, values debate.					
<b>Weightage:</b> Continuous Assessment: 100%					
<b>Assessment Methodology:</b> Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)					
<b>References:</b> <ol style="list-style-type: none"><li>1. Khera, S. (2003). <i>You can win</i>. Macmillan.</li><li>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)</li><li>3. Mitra, B. K. (2017). <i>Personality development &amp; soft skills</i> (3rd impression). Oxford University Press.</li><li>4. ICT Academy of Kerala. (2016). <i>Life skills for engineers</i>. McGraw Hill Education (India) Private Ltd.</li></ol>					

	<b>Description of CO</b>	<b>PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
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)			
CO3	Develop and implement best practices in day-to-day life, in terms of planning and execution.	PO11 (3)			

UC25A02	Physical Education - I	L	T	P	C
		0	0	4	1
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>To impart the fundamentals of physical education for development of students' physical, mental, and social well-being.</li><li>To instill a lifelong appreciation for physical activity towards the development of positive attitude and fostering values of team work and sportsmanship.</li></ul>					
<b>Introduction to physical education:</b> Exercise for Good Posture – Conditioning and Calisthenics for Before start, Jogging, Bending, Twisting, Standing, Sitting and Relaxation, Training on First Aid practices.					
<b>Participation of athletic events:</b> Rules and regulations of important athletic events, Sprint, Jumps, Throws and Hurdles.					
<b>Skill development in any one of the following outdoor games:</b> Basket Ball, Volley Ball, Ball Badminton, Football, Hockey, Kho-Kho, Kabaddi, Cricket, Hand ball and Tennis.					
<b>Skill development in any one of the following indoor games:</b> Shuttle Badminton, Chess and Table Tennis.					
<b>Weightage:</b> Continuous Assessment: 100%					
<b>Assessment Methodology:</b> Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)					
<b>References:</b> <ol style="list-style-type: none"><li>Singh, A. (2008). Essentials of physical education. Kalyani Publishers.</li><li>Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.</li><li>Mangal, S. K. (2009). <i>Psychology of sports performance</i>. Sports Publication.</li></ol>					
<b>E-resources:</b> <ol style="list-style-type: none"><li><a href="https://www.who.int/health-topics/physical-activity">https://www.who.int/health-topics/physical-activity</a></li></ol>					

	CO Description	PO	PSO1	PSO2	PSO3
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)			
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8(3)			
CO4	Demonstrate independent learning in health, nutrition, and fitness-related topics.	PO11(2)			

# Semester II

MA25C02	Linear Algebra	L	T	P	C
		3	1	0	4
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>To impart foundational knowledge in linear algebra essential for analysing and solving problems in engineering applications.</li><li>To provide the knowledge on computation using software and interpret key linear algebra concepts using software.</li></ul>					
<b>Vector Spaces</b> Introduction to Vector Spaces, Examples, Subspaces, Linear Combinations, Span, Generating Sets, Linear Dependence and Independence, Basis and Dimension, Dimension of Subspaces. <b>Activities:</b> 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 $\mathbf{R}^2/\mathbf{R}^3$ with visualization.					
<b>Linear Transformations and Diagonalization:</b> Null space, Range, Dimension Theorem (statement only), Matrix representation of a linear transformation, Eigenvalues & Eigenvectors, Diagonalizability. <b>Activities:</b> 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.					
<b>Inner Product Spaces:</b> Inner product, Norms, Cauchy, Schwarz inequality, Gram, Schmidt orthogonalization, Simple problems (up to $\mathbf{R}^3$ ). <b>Activities:</b> Open-Source software, exercises to compute inner products and vector norms.					
<b>Matrix Decomposition:</b> Orthogonal transformation of a symmetric matrix to diagonal form - Positive definite matrices, QR decomposition, Singular Value Decomposition (SVD), Least squares solutions- simple problems (up to $3 \times 3$ matrices). <b>Activities:</b> Open-Source software, exercises to check if a matrix is positive definite, perform QR decomposition and SVD using built-in functions.					
<b>Weightage:</b> Continuous Assessment: 40%, End Semester Examinations: 60%.					
<b>Assessment Methodology:</b> Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (50%).					
<b>References:</b> <ol style="list-style-type: none"><li>Friedberg, S. H., Insel, A. J., &amp; Spence, L. E. (2022). <i>Linear algebra</i>. Pearson.</li><li>Lay, D. C., Lay, S. R., &amp; McDonald, J. J. (2020). <i>Linear algebra and its applications with MATLAB</i>. Pearson.</li><li>Bronson, R. (2011). <i>Schaum’s outline of matrix operations</i>. McGraw-Hill Education.</li><li>Strang, G., &amp; Thomson, R. (2005). <i>Linear algebra and its applications</i>. Brooks/Cole.</li></ol>					

5. Lipschutz, S., & Lipson, M. (2009). *Schaum's outline of linear algebra*. McGraw-Hill.
6. Kreyszig, E. (2018). *Advanced engineering mathematics*. Wiley India.

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

UC25H02	தமிழர்களும் தொழில்நுட்பமும் / Tamils and Technology	L	T	P	C
		1	0	0	1

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

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

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

**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:** அணை, ஏரி, குளங்கள், மதகு, சோழர்காலக் குழுமித் தூம்பின் முக்கியத்துவம், கால்நடை பராமரிப்பு, கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள், வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள், கடல்சார் அறிவு, மீன்வளம், முத்து மற்றும் முத்துக்குளித்தல், பெருங்கடல் குறித்த பண்டைய அறிவு, அறிவுசார் சமூகம்.

**அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:** அறிவியல் தமிழின் வளர்ச்சி, கணித்தமிழ் வளர்ச்சி. தமிழ் நூல்களை மின்பதிப்பு செய்தல். தமிழ் மென்பொருட்கள் உருவாக்கம். தமிழ் இணையக் கல்விக்கழகம். தமிழ் மின் நூலகம். இணையத்தில் தமிழ் அகராதிகள். சொற்குவைத் திட்டம்.

## References

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



UC25H02	Tamils and Technology	L	T	P	C
		1	0	0	1
<b>Weaving and Ceramic Technology:</b> Weaving Industry during Sangam Age, Ceramic technology, Black and red Ware Potteries (BRW), Graffiti on Potteries.					
<b>Design and Construction Technology:</b> Designing and Structural construction House & Designs in household materials during Sangam Age, Building materials and Hero stones of Sangam age, Details of Stage Constructions in Silappathikaram, Sculptures and Temples of Mamallapuram, Great Temples of Cholas and other worship places, Temples of Nayaka Period, Type study (Madurai Meenakshi Temple), Thirumalai Nayaka rMahal, Chetti Nadu Houses, Indo-Saracenic architecture at Madras during British Period.					
<b>Manufacturing Technology:</b> Art of Ship Building, Metallurgical studies, Iron industry, Iron smelting, steel -Copper and gold- Coins as source of history, Minting of Coins, Beads making-industries Stonebeads, Glass beads, Terracotta beads, Shell beads/ bone beats, Archeological evidences, Gem stone types described in Silappathikaram.					
<b>Agriculture and Irrigation Technology:</b> 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.					
<b>Scientific Tamil &amp; Tamil Computing:</b> 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.					
<b>References</b> <ol style="list-style-type: none"><li>1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).</li><li>2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).</li><li>3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)</li><li>4. பொருளை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)</li><li>5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB &amp; ESC and RMRL – (in print)</li><li>6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.</li><li>7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).</li><li>8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)</li><li>9. Keeladi – ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology &amp; Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</li><li>10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)</li><li>11. Porunai Civilization (Jointly Published by: Department of Archaeology &amp; Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)</li></ol>					

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**ME25C02**

**Engineering Mechanics**

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**Course Objectives:**

- To introduce the fundamental concepts and principles of statics related to forces acting on particles and rigid bodies.
- To develop the ability to formulate and apply equilibrium equations for particles and rigid bodies in two and three dimensions.
- To enable students to analyse force systems through vector resolution and calculation of moments and couples.

**Statics of Particles:** Resultant of forces in a plane, Equilibrium of a particle in a plane, Addition of concurrent forces in space, Equilibrium of a particle in space.

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

**Statics of Rigid Bodies:** Concept of Free Body Diagram, Equivalent systems of forces, Transmissibility, Moment of a force about a point and an axis, Couples and force-couple systems, Equilibrium of rigid bodies in two and three dimensions, Principle of virtual work.

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

**Moments of Inertia:** First moments of areas and lines, Centroids of composite areas and lines, Theorems of Pappus-Guldinus, Second moment of area, Parallel axis theorem, Rectangular and Polar Moments of inertia of composite areas, Radius of Gyration, Product of Inertia, Principal Axes and Principal Moments of Inertia, Mass moments of inertia of thin plates.

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

**Friction:** Laws of friction, Coefficients of Friction, Angles of Friction, Types of Friction Problems, Wedges and Ladder friction, Belt friction.

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

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

**Assessment Methodology:**

Quiz - 10%, Assignments - 20%, Solving of GATE questions (20%) and Internal Examinations - 50%

**References:**

1. Beer, F. P., Johnston Jr., E. R., DeWolf, J. T., & Mazurek, D. F. (2015). Mechanics of Materials. McGraw-Hill Education.
2. Meriam, J. L., & Kraige, L. G. (2018). *Engineering Mechanics: Statics and Dynamics*. Wiley.

3. Pytel, A., & Kiusalaas, J. (2014). Engineering Mechanics (Indian Edition). Cengage Learning India.

**E-resources:**

1. **Moment of Inertia Calculator** – <https://skyciv.com/free-moment-of-inertia-calculator/>
2. OpenStax – University Physics Volume 1 – <https://openstax.org/books/university-physics-volume-1/pages/10-4-moment-of-inertia-and-rotational-kinetic-energy>
3. Engineering Mechanics, Dr. Dwarkish. G. S. – [https://onlinecourses.swayam2.ac.in/ntr24\\_ed75/preview](https://onlinecourses.swayam2.ac.in/ntr24_ed75/preview)

	CO Description	PO	PSO1	PSO2	PSO3
CO1	Explain the principles of statics in determination of forces acting on particles and rigid bodies.	---			
CO2	Apply equilibrium conditions to predict the behaviour of particles and rigid bodies under various force configurations.	PO1(3)			
CO3	Analyse various systems through resolution of forces and moments.	PO2(2)			
CO4	Demonstrate the ability to engage in adapting new techniques in the analysis of force and moments in a system.	PO11(1)			

PH25C07	Medical Physics	L	T	P	C
		2	1	0	3
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>To impart knowledge about the use of physics radiation principles and techniques in medical science.to highlight the fundamentals, consequences, and medical uses of electromagnetic, ionizing, and non-ionizing radiation.</li></ul>					
<b>Low Energy Electromagnetic Spectrum and its Medical Application:</b> Physics of light, Intensity of light, limits of vision and color vision an overview, Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Tissue as a leaky dielectric-Low Frequency Effects- Higher frequency effects., Thermography– Application.					
<b>Activities:</b> Virtual demonstration of Thermography					
<b>Principles of Radioactive Nuclides:</b> Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, radionuclide Generator-Milking process (Technetium generator).					
<b>Activities:</b> Radiology lab visit					
<b>Interaction of Radiation with Matter Lipids:</b> Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering, Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance.					
<b>Activities:</b> Case study in applications of radiation					
<b>Radiation Dose and its Effects:</b> Dose and Exposure measurements – Units (SI), Inverse square law, Maximum permissible exposure, relationship between the dosimetric quantities, Radiation biology – effects of radiation, concept of LD 50, Stochastic and Non-stochastic effects, Radiation Syndrome.					
<b>Activities:</b> Case study in radiation effects.					
<b>Principles and Applications of Sound in Medicine:</b> Physics of sound, Normal sound levels, ultrasound fundamentals, Generation of ultrasound (Ultrasound Transducer), Interaction of Ultrasound with matter- Cavitations, Reflection, Transmission, Scanning methods, Artifacts, Ultrasound- Doppler effect, Clinical Applications.					
<b>Activities:</b> Seminar on Clinical Applications of Ultrasound					
<b>Weightage:</b> Continuous Assessment: 40%, End Semester Examinations: 60%					
<b>Assessment Methodology:</b> Quiz (10%), Assignments (30%), Flipped Class (10%),					

Internal Examinations (50%)

**References:**

1. aha, G. B. (2013). *Physics and radiobiology of nuclear medicine*. Springer.
2. Samei, E., & Peck, D. J. (2019). *Hendee's physics of medical imaging*. John Wiley & Sons Inc.
3. Hendee, R., & Ritenour, R. (2002). *Medical imaging physics*. Wiley-Liss Inc.
4. Maqbool, M. (2017). *An introduction to medical physics*. Springer.
5. Podgoršak, E. B. (2016). *Radiation physics for medical physicists*. Springer.

**E-resources:**

1. <http://www.nptel.ac.in/courses/115102017/> , "Nuclear science and Engineering," Dr. Santanu Gosh, Department of Physics, IIT, Delhi.
2. <http://www.uthgsbmedphys.org/GS02-003/> , "Introduction to Medical Physics," Dr George Starkschall, The University of Texas at Houston.
3. <https://humanhealth.iaea.org/HHW/MedicalPhysics/e-learning/index.html>
4. <http://www.sprawls.org/PhysicsWindows/>

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain the properties of electromagnetic radiations and its effect on human.	-			
CO2	Apply the of radioactive nuclides and properties of sound and its application in medicine	PO1(3), PO2(3),			
CO3	Analyse the radiation dose and its effects	PO1(3), PO6(1), PO7(1), PO9(2)			

BM25C01	Anatomy And Physiology	L 3	T 0	P 2	C 4
<b>Course Objective:</b> <ul style="list-style-type: none"> <li>To impart fundamental and practical knowledge in structural and functional of human system.</li> </ul>					
<b>Anatomy and organization of cell:</b> Anatomical positions and planes, anatomical movements. Cell structure and organelles, functions of cellular organelles. Origin of membrane potential, resting and action potential. Tissue, Types, Classification, Location. Membrane, Glands, Classification and Functions. Body cavities. <b>Practical:</b> Visualization of different types of tissues. <b>Activities:</b> Making anatomical models					
<b>Digestive and urinary systems:</b> Organs of Digestive system, Digestion and Absorption. Cartilage structure and functions. <b>Activities:</b> Virtual demonstration of animal digestion.					
<b>Sensory system:</b> Eye, Layers of Eye, Mechanism of Vision, Errors of Refraction. Ear: Ear Divisions, Mechanism of Hearing, Skin, Layers of Skin, Functions of Skin. <b>Practical:</b> Ear and Eye function study. <b>Activities:</b> Virtual demonstration of functioning of Ear, Eye and Skin.					
<b>Cardiovascular system:</b> Blood cells and their functions. Blood groups, importance, identification and structure of blood vessels. Structure of heart, function of valves, conducting system of heart, cardiac cycle, circulatory system-coronary, systemic and pulmonary. <b>Practical:</b> WBC and RBC differential Count, Identification of Blood Groups. <b>Activities:</b> Virtual demonstration of functioning of Heart.					
<b>Lymphatic system:</b> Spleen and thymus gland, lymphatic vessels. <b>Respiratory system:</b> Organs involved in respiration and its mechanism. Types of respiration - respiratory volumes and recording of respiratory volume. <b>Nervous system:</b> Structure of neuron, Cross Sections of brain, Cortical localizations and functions, Spinal nerve, Tracts of spinal cord and reflex mechanism. <b>Urinary system:</b> Structure of kidney and nephron. Mechanism of urine formation, urinary reflex. <b>Practical:</b> Clinical urinary analysis: urea, creatinine and glucose. <b>Activities:</b> Clinical visits.					
<b>Weightage:</b> Continuous Assessment: 40%, End Semester Examinations: 60%					

**Assessment Methodology:** Quiz (10%), Report submission (10%), Models (10%), Review of GATE & IES questions (20%) Assignments (10%) and Internal Examinations (40%)

**References:**

1. Vaz, M., & Raj, T. (2020). Guyton & Hall textbook of medical physiology. Elsevier Health Sciences.
2. Makari, H. K., Gurumurthy, H., & Sowmya, S. V. (2009). A textbook of human physiology. I.K. International Publishing House Pvt. Ltd.
3. Singh, I. (2005). Anatomy & physiology for nurses. Jaypee Brothers Medical Publishers.
4. Tortora, G. J., & Derrickson, B. (2003). Principles of anatomy and physiology. John Wiley & Sons.
5. Thibodeau, G. A., & Patton, K. T. (2007). Anthony's textbook of anatomy and physiology. Elsevier.
6. Marieb, E. N. (2007). Essentials of human anatomy and physiology. Pearson Education.
7. Pocock, G., & Richards, C. D. (2009). The human body: An introduction for biomedical and health sciences. Oxford University Press.
8. Ganong, W. F. (2015). Review of medical physiology. McGraw-Hill Education.
9. Guyton, A. C., & Hall, J. E. (2006). Textbook of medical physiology. Elsevier Saunders.

	CO Description	PO	PSO1	PSO2	PSO3
CO1	Describe anatomical positions, body planes, and major cell structures and their functions.	---			
CO2	Illustrate the structure and function of organ systems.	PO1(3)			
CO3	Analyze the physiological processes.	PO1 (2) PO2 (3)			
CO4	Perform the basic lab tests and interpret the results.	PO1 (1) PO2 (2) PO5 (1) PO11 (1)			

BM25C02	Biosciences for Medical Engineering	L	T	P	C
		3	0	2	4
<b>Course Objective:</b> To impart knowledge in biosciences by dealing with various aspects of biochemical reactions of biomolecules, importance of immunological defence system in human well-being and influence of microbes in universal system.					
<b>Introduction to Biochemistry:</b> structure of water and its significance, importance of covalent and noncovalent bonds. Acid- base maintenance and the role of biological buffers in p H maintenance. Henderson- Hasselbalch equation. Disorders associated with acid- base imbalance. Principles of viscosity, surface tension, adsorption, diffusion, osmosis and their contribution in biological systems.					
<b>Practical:</b>  1. Preparation of solutions- normality and molar solutions. 2. Preparation of buffer solution. 3. Standardisation of p H meter.					
<b>Activities:</b> Case studies on acid-base imbalance.					
<b>Complex Organic Molecule:</b> Carbohydrates-General classification, structure and functions. Carbohydrate metabolism -glycolysis and hormonal regulation. Lipid-structure and functions. Lipid metabolism- triglyceride formation and degradation. Lipoproteins-chemistry and types. Protein- structure and functions. Abnormalities- Diabetes mellitus, hypercholesterolemia and phenylketonuria.					
<b>Practical:</b>  1. Estimation of glucose by Orthotoluidine method. 2. Estimation of protein by Biuret method. 3. Estimation of cholesterol by Zak's method.					
<b>Activities:</b> Visit to clinical laboratory for automation in clinical analysis.					
<b>Immunology:</b> Cells and organs of Immune system, innate and adaptive Immunity. Antigenicity, epitopes, antigen presenting cells. Antibody- structure, function and its isotypes. Recombinant antibodies, monoclonal antibodies in cancer treatment and autoimmune disorders. Cell and humoral mediated immunity. Hypersensitivity and its types. Immunotherapeutics and its applications.					
<b>Practical:</b>  1. Separation of serum from whole blood. 2. Separation of plasma from whole blood. 3. Agglutination test.					
<b>Activities:</b> Poster presentation on immunological diseases.					
<b>Microbiology:</b> Microscopy- Principles and working of fluorescence microscope, confocal microscope, Electron Microscopes -TEM and SEM. Microbial culturing, inoculation and culture media, growth curve of microbes, identification of microbes.					



Staining methods- simple staining, differential staining, acid fast staining, negative staining and hematoxylin and eosin staining.

**Practical:** Simple and differential staining.

**Activities:** Case study presentation on differential staining

**Pathology:** Cell injury-reversible and irreversible, necrosis, apoptosis, intracellular accumulations, cellular adaptations of growth and differentiation-atrophy, hypertrophy, hyperplasia, dysplasia, metaplasia. Edema, thrombosis, embolism, Hematological disorders-bleeding disorders, leukemias, lymphomas.

**Practical:** Hematoxylin and eosin staining.

**Activities:** Review of research papers on leukemias, lymphomas and its impact on human well-being

**Mandated Activities with marks:**

Report Submission on Lab Visit (30), Case Studies (50), Review of GATE & IES questions (20).

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

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

**References:**

1. Rafi MD, Text book of Biochemistry for Medical student, 4<sup>th</sup> edition, University of Press, 2021.
2. David W Martin, Peter A, Mayes, Victor. W, Rodwell, Harpers review of biochemistry, Lange Medical Publications, 2021.
3. Prescott, Harley and Klein, Microbiology, 9<sup>th</sup> edition, McGraw Hill, 2017.
4. Jenni Punt, Sharon Stranford, Patricia Jones, Judith A Owen, Kuby Immunology, 8<sup>th</sup> edition, WH Freeman, 2018.
5. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of diseases," WB Saunders Co. 7th Edition, 2005.

	CO Description	PO Mapping	PSO1	PSO2	PSO3
CO1	Explain the fundamental concepts of biochemistry in various engineering applications.	---			
CO2	Apply various methods for analyzing complex organic molecules in human body	PO1(3), PO2 (3), PO3 (3)			
CO3	Analyze the immune system and physiological condition using various techniques	PO1(3), PO2 (3), PO3 (3),			

EN25C02	English Essentials – II	L	T	P	C
		1	0	2	2
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>• Enable learners to improve fluency and accuracy in spoken and written communication.</li><li>• Develop learners' ability to articulate ideas clearly and effectively in formal and informal spoken interactions.</li><li>• Help learners construct well-organised written documents relevant to academic and workplace contexts.</li></ul>					
<b>Oral Communication:</b> Types (Verbal and Nonverbal), Interpersonal and group communication, Telephonic conversation. <b>Suggested Activities:</b> Short presentations, Debates, Formal Speeches (Welcome, Vote of Thanks and introducing guests), Listen and respond to short podcasts.					
<b>Business Correspondence:</b> Email Communication, Formal Letters (Types), Business Meeting. <b>Suggested Activities:</b> Email and letter writing (Complaint, request, permission), Agenda, minutes of the meeting.					
<b>Academic Writing:</b> Paraphrasing, Summarizing, Essay Writing, Instructions and Recommendations. <b>Suggested Activities:</b> Essay writing (Cause and effect, argumentative, persuasive), User guides/ manuals, policy document.					
<b>Team Work:</b> Leadership Skills (Team building, Team Leader, Team player), Negotiation and Problem solving skills <b>Suggested Activities:</b> SWOT Analysis, Brainstorming and Group discussions.					
<b>Weightage:</b> Continuous Assessment: 50%, End Semester Examinations: 50%					
<b>Assessment Methodology:</b> Worksheets (10%), Group Activity (20%), Report Writing (20%), Internal Examinations (50%)					
<b>References:</b> <ol style="list-style-type: none"><li>1. Koneru Aruna. (2020). <i>English Language Skills for Engineers</i>. McGraw Hill Education.</li><li>2. Taylor, Shirley &amp; Chandra .V. (2010). <i>Communication for Business A Practical Approach</i>. India: Pearson Longman.</li><li>3. Ian Badger, et al., (2014). <i>Listening: B2 (Collins English for Life: Skills)</i>, Collins.</li><li>4. Raymond Murphy (2019), <i>Grammar in Use</i>, Cambridge University Press.</li></ol>					
<b>E-Resources:</b> <ol style="list-style-type: none"><li>1. CommunicationforBusinessSuccess- <a href="https://open.umn.edu/opentextbooks/textbooks/8">https://open.umn.edu/opentextbooks/textbooks/8</a></li><li>2. TED Talks – <a href="https://www.ted.com/">https://www.ted.com/</a></li></ol>					

	<b>Description of CO</b>	<b>PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
CO10	Demonstrate effective communication skills both in academic and professional contexts.	---			
CO20	Develop engaging and meaningful business correspondence.	PO1(3)			
CO30	Participate actively in group discussions by analysing critically from different views.	PO2(2) PO8(1)			
CO40	Create coherent written texts and documents for various purposes.	PO9(2)			
CO50	Adapt communication styles to global environments.	PO11(1)			

UC25A03	Life Skills for Engineers – II	L	T	P	C
		1	0	2	-
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>To impart and cultivate analytical reasoning, innovative thinking, effective collaboration, and ethical leadership to prepare students for complex challenges in professional and personal environments.</li></ul>					
<b>Critical Thinking:</b> Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.					
<b>Activities:</b> Two-Brainstorm Method, “30 Circles” Challenge, “Desert Survival” Simulation, Lateral thinking riddles and puzzles, "What If?" Scenario Writing, Fast vs. Slow Thinking Game, Creativity Myth Busters					
<b>Problem Solving:</b> Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.					
<b>Activities:</b> Case study analysis, Escape Room challenge.					
<b>Leadership:</b> Leadership Styles & Self-Assessment, Communication & Active Listening, Decision-Making & Responsibility, Teamwork & Delegation, Empathy, Integrity & Conflict Management, Vision, Motivation & Goal-Setting.					
<b>Activities:</b> Crisis Leadership Simulation, Tower Challenge, Leadership Dilemmas Role-Play, Team Vision Board					
<b>Weightage:</b> Continuous Assessment: 100%					
<b>Assessment Methodology:</b> Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)					
<b>References:</b> <ol style="list-style-type: none"><li>De Bono, E. (2017). <i>Six thinking hats</i>, Little, Brown Book Group.</li><li>Facione, P. A. (2015). <i>Critical thinking: What it is and why it counts</i>. Insight Assessment.</li><li>Kahneman, D. (2011). <i>Thinking, fast and slow</i>. Farrar, Straus and Giroux.</li><li>Whetten, D. A., &amp; Cameron, K. S. (2016). <i>Developing management skills</i>. Pearson.</li></ol>					

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



UC25A04	Physical Education - II	L 0	T 0	P 4	C 1
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>To impart knowledge on gymnastic exercises and pressing needs for upskilling in a particular game.</li> </ul>					
<p><b>Basic gymnastics exercises:</b> 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.</p> <p><b>Upskilling in any one of the athletics:</b> Broad Jump, High Jump, Triple Jump, Relay Sprints, Javelin Throw, Discuss Throw, Shot Put, Short and Long-distance Running.</p> <p><b>Advance skills in any one of the indoor/outdoor games, which has been opted by the student in the I semester.</b></p>					
<b>Weightage:</b> Continuous Assessment: 100%					
<b>Assessment Methodology:</b> Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)					
<b>References:</b> <ol style="list-style-type: none"> <li>Singh, A. (2008). Essentials of physical education. Kalyani Publishers.</li> <li>Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.</li> <li>Mangal, S. K. (2009). <i>Psychology of sports performance</i>. Sports Publication.</li> <li>Kandappan, K. (2004). <i>Foundations of physical education</i>. Friends Publications.</li> </ol>					
<b>E-resources:</b> <ol style="list-style-type: none"> <li><a href="https://www.who.int/health-topics/physical-activity">https://www.who.int/health-topics/physical-activity</a></li> </ol>					

	CO Description	PO	PSO1	PSO2	PSO3
CO1	Understand and explain the importance of physical activity for mental and physical health.	---			
CO2	Apply safety principles and methods during sports activities.	PO1(3)			
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8 (3)			
CO4	Demonstrate the advanced technical skills and strategic understanding in the game of their interest.	PO11(1)			

ME25C05	Re-Engineering for Innovation	L	T	P	C
		0	0	4	2
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>• To cultivate foundational skills in prototyping, and automation for development of prototypes with real-world applications.</li><li>• To provide a comprehensive, hands-on exposure to product development through reverse engineering concepts.</li></ul>					
<b>Bootcamp 1:</b> 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.					
<b>Bootcamp 2:</b> Embedded System Programming (Open-source platforms), Practice of interfacing sensors, reading data, automation in home, healthcare and agriculture.					
<b>Reverse Engineering:</b> Sketch and prototype alternative designs, Group brainstorming sessions, Manufacture prototype parts using 3D printing and / or workshop tools, Assemble prototype product.					
<b>Weightage:</b> Continuous Assessment: 60%, End Semester Examinations: 40%					
<b>Assessment Methodology:</b> Project (30%), Assignment (10%), Practical (30%), Internal Examinations (30%)					
<b>References:</b> <ul style="list-style-type: none"><li>1. Wang, W. (2010). Reverse engineering: Mechanisms, structures, systems &amp; materials. CRC Press.</li><li>2. Margolis, M. (2020). Arduino cookbook: Recipes to begin, expand, and enhance your projects (3rd ed.). O'Reilly Media.</li></ul>					
<b>E-Resources:</b> <ul style="list-style-type: none"><li>1. GrabCAD – <a href="https://grabcad.com/">https://grabcad.com/</a></li><li>2. GitHub – <a href="https://github.com/">https://github.com/</a></li></ul>					

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

	Description of CO	PO	PSO1	PSO2	PSO3
CO4	Engage in independent learning and continuously adapt to emerging technologies in product design	PO11 (2)			

#### FOREIGN LANGUAGE^

UC25F01	Deutsch – I^	L	T	P	C
		1	0	2	-

#### Course Objectives:

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

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

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

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

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

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

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

**Weightage:** Continuous Assessment: 100%

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

#### References:

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

	CO Description	PO	PSO1	PSO2	PSO3
CO1	Understand simple spoken Deutsch in everyday contexts.	---			



	CO Description	PO	PSO1	PSO2	PSO3
CO2	Communicate with widely used Deutsch words effectively.	PO9 (2)			
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Deutsch language.	PO11 (1)			

UC25F02	Japanese – I^	L	T	P	C
		1	0	2	-

### Course Objectives:

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

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

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

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

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

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

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

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

characters, Vocabulary tests and conversational practice on daily topics, Oral presentations and listening comprehension quizzes.

**Weightage:** Continuous Assessment: 100%

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

**References:**

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

	CO Description	PO	PSO1	PSO2	PSO3
CO1	Understand simple spoken Japanese in everyday contexts.	---			
CO2	Communicate with widely used Japanese words effectively.	PO9 (2)			
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Japanese language.	PO11 (1)			

UC25F03	Korean – I^	L	T	P	C
		1	0	2	-
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>To impart fundamentals of the Korean language, including reading, writing systems, pronunciation, and speaking.</li></ul>					
<b>Fundamentals of Korean:</b> Introduction to Hangul: consonants and vowels, Basic pronunciation and syllable formation, Common greetings and self-introductions, Numbers (Sino-Korean and Native Korean basics), Basic sentence structure (Subject-Object-Verb), Simple expressions (e.g., 감사합니다, 안녕하세요).					
<b>Activities:</b> Writing and reading Hangul practice sheets, Pronunciation drills and audio repetition, Dialogue practice for greetings and self-introduction, Counting and number exercises.					
<b>Essential Grammar and Vocabulary:</b> 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).					
<b>Activities:</b> Verb conjugation and sentence formation drills, Role-play conversations for shopping and daily routines, Descriptive writing and speaking exercises, Question and answer practice.					
<b>Everyday Korean Communication:</b> 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.					
<b>Activities:</b> Role-play ordering at a restaurant or buying items, Listening comprehension exercises, Giving and asking for directions practice, Group conversations and presentations.					
<b>Weightage:</b> Continuous Assessment: 100%					
<b>Assessment Methodology:</b> Assignments (30%), Quiz (10%) and Internal Examinations 60%					
<b>References:</b> <ol style="list-style-type: none"><li>King, R., Yeon, J., &amp; Brown, A. (2015). Elementary Korean (2nd ed.). Tuttle Publishing.</li><li>Cho, Y., Lee, H., Schulz, C., Sohn, H.-M., &amp; Sohn, S.-O. (2001). Integrated Korean: Beginning 1. University of Hawai'i Press.</li></ol>					

	CO Description	PO	PSO1	PSO2	PSO3
CO1	Understand simple spoken Korean in everyday contexts.	---			
CO2	Communicate with widely used Korean words effectively.	PO9 (2)			
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Korean language.	PO11 (1)			