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ANNA UNIVERSITY, CHENNAI

UNDERGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: B. Tech. Petroleum Engineering Regulations**:** 2025

Abbreviations:

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

BS – Basic Science (Mathematics, Physics, Chemistry)

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

SD – Skill Development

SL – Self Learning

CDP – Capstone Design Project

OE – Open Elective

L – Laboratory Course

T – Theory

LIT – Laboratory Integrated Theory

PW – Project Work

IPW – Internship cum Project Work

DIC – Department Introductory Course

TCP – Total Contact Period(s)

Program Outcomes

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

Program Specific Outcomes:

PSO1: Design and Develop efficient and sustainable oil and gas reservoir production systems.

PSO 2: Acquire the skills using modern tools for development of innovative processes with safety, sustainability, and economic viability.

PSO3: Demonstrate professional skills in-line with rapid technological development in petroleum engineering and also exhibit research aptitude

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.	PE25101	Introduction to Petroleum Engineering	T	2-1-0	3	3	PC (DIC)
3.	UC25H01	தமிழர் மரபு / Heritage of Tamils	T	1-0-0	1	1	HUM
4.	EN25C01	English Essentials – I	T	2-0-0	2	2	HUM
5.	PH25C01	Applied Physics – I	LIT	2-0-2	4	3	BS
6.	CY25C01	Applied Chemistry – I	LIT	2-0-2	4	3	BS
7.	CS25C02	Computer Programming: Python	LIT	2-0-2	4	3	ES (PC)
8.	ME25C04	Makerspace	L	0-0-4	4	2	SD
9.	UC25A01	Life Skills for Engineers – I	---	1-0-2	3	1	HUM
10.	UC25A02	Physical Education – I	---	0-0-4	4	1	HUM
11.		NCC / NSS / NSO / YRC	---	---	---	---	---
Total Credits					**33**	**23**	

Semester – II							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1.	MA25C02	Linear Algebra	T	3-1-0	4	4	BS
2.	PE25201	Solid Mechanics and Offshore Structures	T	3-0-0	3	3	ES (PC)
3.	CY25C04	Applied Chemistry (Tech) - II	T	2-0-0	2	2	BS
4.	EE25C01	Basic Electrical and Electronics Engineering	T	3-0-0	3	3	ES (G)
5.	UC25H02	தமிழர்களும் தொழில்நுட்பமும் / Tamils and Technology	T	1-0-0	1	1	HUM
6.	ME25C01	Engineering Drawing	LIT	2-0-4	6	4	ES (G)
7.	PH25C06	Applied Physics (Tech) – II	T	2-1-0	3	3	BS
8.	ME25C05	Re-Engineering for Innovation	L	0-0-4	4	2	SD
9.	EN25C02	English Essentials – II	LIT	1-0-2	3	2	HUM
10.	UC25A03	Life Skills for Engineers – II	---	1-0-2	3	1	HUM
11.	UC25A04	Physical Education – II	---	0-0-4	4	1	HUM
12.		Foreign Language^	LIT	1-0-2	3	1	HUM
				Total Credits	**39**	**27**	

^ Deutsch / Japanese / Korean

Semester – III							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1.	MA25C03	Computational Differential Equations	T	3-1-0	4	4	ES (PC)
2.	CH25201	Chemical Process Calculations	T	3-1-0	4	4	ES (PC)
3.	PE25301	Thermodynamics for Petroleum Engineers	T	3-0-0	3	3	ES (PC)
4.	PE25302	Reservoir Engineering	T	3-0-0	3	3	ES (PC)
5.	PE25303	Fluid Mechanics and Solid Operations	LIT	3-0-2	5	4	ES (PC)
6.	PE25304	Petroleum Geology	LIT	3-0-2	5	4	ES (PC)
7.	EN25C03	English Communication Skills Laboratory – I	L	0-0-2	2	1	HUM
8.	-	Skill Development Course – I	LIT	1-0-2	3	2	SD
				Total Credits	**29**	**25**	

Semester – IV							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	PE25401	Drilling Fluids and Cementing Techniques	T	3-0-0	3	3	ES (PC)
2.	PE25402	Well Drilling Equipment and Operations	T	3-0-0	3	3	ES (PC)
3.	PE25403	Well logging and Formation Evaluation	T	3-0-0	3	3	ES (PE)
4.	PE25C01	Water Flooding and Enhanced oil Recovery	T	3-0-0	3	3	ES (PC)
5.	CH25C06	Heat Transfer	LIT	3-0-2	5	4	ES (PC)
6.	PE25404	Petroleum Refining and Petrochemicals	LIT	2-0-2	4	3	ES (PC)
7.	EN25C04	English Communication Skills Laboratory – II	L	0-0-2	2	1	HUM
8.	-	Skill Development Course – II	LIT	1-0-2	3	2	SD
				Total Credits	**26**	**22**	

Semester – V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.		Well Completion Techniques	T	3-0-0	3	3	ES (PC)
2.		Programme Elective – I	T	3-0-0	3	3	ES (PC)
3.		Petroleum Production Engineering	T	3-0-0	3	3	ES (PC)
4.		Onshore Engineering	T	3-0-0	3	3	ES (PC)
5.		Programme Elective – II	T	3-0-0	3	3	ES (PE)
6.		Mass Transfer	LIT	3-0-0	3	3	ES (PC)
7.		Natural Gas Engineering	T	3-0-0	3	3	ES (PC)
8.		Skill Development Course – III	LIT	1-0-2	3	2	SD
9.		Industry Oriented Course - I	LIT	1-0-2	3	1	SD
				Total Credits	**27**	**24**	
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.		Petroleum Equipment Design	T	3-0-0	3	3	ES (PC)
2.		Offshore Engineering	T	3-0-0	3	3	ES (PC)
3.		Programme Elective – III	T	3-0-0	3	3	ES (PE)
4.		Open Elective	T	3-0-0	3	3	-
5.		Process Control and Instrumentation	LIT	3-0-2	5	4	ES (PC)
6.		City Gas Distribution	T	3-0-0	3	3	ES (PC)
7.		Self-Learning Course	---	---	0	1	-
8.		Industry Oriented Course - II	LIT	1-0-2	3	1	SD
9.		Computational Petroleum Engineering Laboratory	L	0-0-4	4	2	ES (PC)
Total Credits					**27**	**23**	
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.		Petroleum Process Economics	T	3-0-0	3	3	---
2.		Climate Change and Sustainability	T	2-0-0	2	2	HUM
3.		Process Safety in Oil and Gas Industries	T	3-0-0	3	3	ES (PC)
4.		Well Completion Testing and Work Over	T	3-0-0	3	3	ES (PC)
5.		Introduction to Standards in Petroleum Engineering	T	1-0-0	1	1	ES (PC)
6.		Programme Elective – IV	T	3-0-0	3	3	ES (PE)
7.		Programme Elective – V	T	3-0-0	3	3	ES (PE)

Semester – VII							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T-P	TCP		
8.		Project Management	T	2-0-0	2	2	HUM
9.		Engineering Entrepreneurship Development	T	2-0-2	4	3	HUM
10.		Summer Internship*	---	---	---	1	SD
				Total Credits	**24**	**24**	
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	**8**	

Total No of credits: 176

PROGRAMME ELECTIVE COURSES – STREAMS

S. No.	Vertical I Upstream Processing	Vertical II Petrochemical Process Technology	Vertical III Hydrocarbon Transportation and Storage	Vertical IV Energy Engineering	Vertical V Process Intensification
1.	Oil and Gas Well Testing	Petrochemical Unit processes	Piping Engineering	Renewable and Nonrenewable Energy	Multicomponent Distillation
2.	Mud Engineering	Corrosion in the oil and Gas Industry	Storage and Transportation of Crude oil and Natural gas	Energy Conservation and Management	Advanced separation techniques
3.	Integrated Oil and Gas reservoir Management	Process Equipment Auxiliaries and Utilities	Design of Pressure Vessels and storage Vessels	Energy Storage Systems	Fluidization Engineering
4.	Flow Assurance	Polymer Technology	Non-Conventional Hydrocarbon sources	Hydrogen and Fuel Cell Technology	Optimization of chemical Processes
5.	Reservoir Modelling and Simulation	Fertilizer Technology	Pipeline Engineering	Biofuels	Petroleum catalysis
6.	Natural Gas Engineering and Processing	Petrochemical Derivatives	Product Design and Development for Petrochemical Engineers	Optimum Utilization of Heat and Power	Transport Phenomena

Semester I

MA25C01	Applied Calculus	L	T	P	C
		3	1	0	4

Course Objectives:

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

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

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

Functions of Several Variables: Partial derivatives, Chain rule, Total derivative, Maxima and minima of functions of two variables, Method of Lagrange's Multipliers, Application problems in engineering.

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

Integral Calculus: Fundamental theorem of Calculus, Indefinite integrals and the Net Change Theorem, Improper integrals, Arc Length, Area of Region, Area of surface of revolution.

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

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

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

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

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

References:

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

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

E-resources:

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

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

PE25101	Introduction to Petroleum Engineering	L	T	P	C
		2	1	0	3

Course Objective:

To provide an overview of petroleum industry. Petroleum exploration and exploitation techniques, oil and gas reserve identification and evaluation. Drilling, Reservoir and production of oil and gas

Overview of Petroleum Industry: History and global significance of petroleum. Petroleum industry sectors: Upstream, midstream, downstream. World oil reserves and production. Petroleum exploration and development of process. Role of Petroleum Engineers.

Activity: Virtual demonstration of Upstream, midstream, downstream operation.

Origin and Accumulation of Hydrocarbons: Formation of oil and gas –source rocks and kerogen. Migration and accumulation of hydrocarbons. Reservoir rocks: Porosity, permeability. Traps and seals: structural, fault and stratigraphic. Basin analysis.

Activity: Demonstration of porosity, permeability determination.

Drilling Engineering Basics: Rotary drilling process. Rig components and functions. Drilling fluids and their properties. Casing and cementing. Well planning and directional drilling

Activity: Virtual demonstration of various drilling operation.

Reservoir and Production Engineering: Fundamentals of reservoir engineering. Reservoir drive mechanisms. Well completion and simulation. Production systems and surface facilities. Artificial lift methods

Activity: Demonstration of simulation software tool.

Health, Safety, Environment: Importance of HSE in petroleum operations. Risk assessment and mitigation. Environmental impacts and control measures. Emerging technologies: digital oil field, automation, enhanced oil recovery

Activity: Report preparation on enhanced oil recovery.

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

Assessment Methodology: Assignments (20%), Quiz (10%), Review of GATE questions (20%), Internal Examinations (50%).

References:

1. Franchi, J. R. (2016). *Introduction to petroleum engineering*. Wiley.
2. Lyons, W. C. (2009). *Working guide to petroleum and natural gas production engineering*. Gulf Professional Publishing.
3. Lake, L. W. (Ed.). (n.d.). *Petroleum engineering handbook* (Vols. I–VII). Society of Petroleum Engineers.

4. Blackwell, A. H. (2006). *Petroleum engineering: Principles and practice*. Facts on File.
5. Economides, M. J., & Nolte, K. G. (2000). *Reservoir simulation* (3rd ed.). Wiley.
6. Ahmed, T. (2010). *Reservoir engineering handbook* (4th ed.). Gulf Professional Publishing.
7. Guo, B., & Lyons, W. C. (2011). *Drilling engineering*. Gulf Professional Publishing.

	Description of CO	**PO**	**PSO**
CO1	Explain the structure and functions of the petroleum industry,	-	-
CO2	Explain the origin, generation, migration, and accumulation of hydrocarbons	PO1(3) PO2(2)	PSO1(2)
CO3	Describe drilling operations and equipment	PO1(2) PO2(1)	PSO1(1)
CO4	Illustrate reservoir engineering and production fundamentals	PO3(2)	PSO2(1)
CO5	Demonstrate the importance of HSE and identify emerging technologies in the petroleum industry	PO11(1)	PSO3(2)

UC25H01	தமிழர் மரபு	L	T	P	C
		1	0	0	1

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

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

நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

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

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

References:

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

UC25H01	Heritage of Tamils	L	T	P	C
		1	0	0	1

Language and Literature: Language Families in India, Dravidian Languages, Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature, Distributive Justice in Sangam Literature, Management Principles in Thirukural, Tamil Epics and Impact of Buddhism & Jainism in Tamil Land, Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil, Contribution of Bharathiyar and Bharathidhasan.

Heritage - Rock art Paintings to Modern Art – Sculpture: Hero stone to modern sculpture, Bronze icons, Tribes and their handicrafts,- Art of temple car making, Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments, Mridhangam, Parai, Veenai, Yazh and Nadhaswaram, Role of Temples in Social and Economic Life of Tamils.

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

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

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

References:

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

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

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

Course Objectives:

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

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

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

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

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

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

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

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

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

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

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

References:

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

E-resources:

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

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

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

Course Objective(s):

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

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

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

Activities: Virtual demonstration of thermal stress.

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

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

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

Activities: Virtual demonstration of propagation of EM waves

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

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

Activities: Virtual demonstration of Scanning Transmission Electron Microscope

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

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

Activities: Demonstration of sensors and applications of Lasers

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

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

References:

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

E-Resources:

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

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

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

Course Objectives:

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

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

Practical: Analysis of alkalinity, hardness and dissolved oxygen.

Activity: Coagulation of water sample using Alum

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

Practical: Preparation of nanoparticles by Sol-Gel method.

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

Practical: Conductometric titrations

Activity: Electrochemical cell demonstration

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

Practical:

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

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

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

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

Activities: Demonstration of battery pack in e-vehicles.

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

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

References:

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

E-Resources:

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

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

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

Course Objectives:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

References:

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

E-resources:

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

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

ME25C04	Makerspace	L	T	P	C
		0	0	4	2

Course Objectives:

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

List of Activities

(A). Dis-assembly & Assembly Practices

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

(B). Welding Practices

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

(C). Electrical Wiring Practices

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

(D). Electronics Components / Equipment Practices

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

(E). Contemporary Systems

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

References:

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

Course Outcomes:

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

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

Course Objectives

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

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

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

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

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

Weightage: Continuous Assessment: 100%

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

References:

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

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

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

Course Objectives:

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

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

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

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

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

Weightage: Continuous Assessment: 100%

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

References:

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

E-resources:

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

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

Semester II

MA25C02	Linear Algebra	L	T	P	C
		3	1	0	4

Course Objectives:

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

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

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

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

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

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

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

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

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

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

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

References:

1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). *Linear algebra*. Pearson.
2. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). *Linear algebra and its applications with MATLAB*. Pearson.
3. Bronson, R. (2011). *Schaum's outline of matrix operations*. McGraw-Hill Education.
4. Strang, G., & Thomson, R. (2005). *Linear algebra and its applications*. Brooks/Cole.
5. Lipschutz, S., & Lipson, M. (2009). *Schaum's outline of linear algebra*. McGraw-Hill.
6. Kreyszig, E. (2018). *Advanced engineering mathematics*. Wiley India.

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

PE25201	Solid Mechanics and Offshore Structures	L	T	P	C
		3	0	0	3

Objective:

This course will help students expand their knowledge on the basic principles established in solid mechanics and offshore structures.

Stresses and strains: kinds of – stress-strains, elasticity and plasticity, Hooks law, stress –strain diagrams, modules of elasticity, Poisson's ratio, linear and volumetric strain, relation between E, N, and K, bars of uniform strength, compound bars and temperature stresses.

Activity: Demonstration of various stress strain diagram.

Types of supports, loads, Shear force and bending moment for cantilever and simply supported beams without overhanging for all types of loads.

Theory of simple bending, simple bending formula, Distribution of Flexural and Shear stress in Beam section, Shear stress formula, Shear stress distribution for some standard sections

Activity: Demonstration of Shear stress distribution for some standard sections

Thin cylindrical shells: stress in cylindrical shells due to internal pressures, circumferential stress, longitudinal stress, design of thin cylindrical shells, spherical shells, change in dimension of the shell due to internal pressure, change in volume of the shell due to internal pressure.

Thick Cylinders: Lame's equation- cylinders subjected to inside and outside pressures columns and Struts.

Activity: case studies on stress calculation in different structure.

Floating structures, basic hydrostatics, centre of gravity, center of buoyancy, displacement, law of floatation, draft, keel, Simpson's rule for areas and centroids, second moments of area, moments of inertia, mass moment of inertia, calculation of metacentric height, Stability of floating structures, Definition of neutrally and positively buoyant structures.

Activity: virtual demonstration of floating structures used in the industry.

Functions of offshore structures, Fixed offshore structures, Types of fixed structures, fabrication, transportation, installation and operation of offshore structures, construction of offshore concrete structures, Definition of compliant structures, Types of complaint structures.

Activity: Report preparation on

1. Junarkar, S. B. (1995). *Mechanics of structure* (Vol. 1, 21st ed.). Character Publishing House.
2. Nash, W. A. (1994). *Theory and problems of strength of materials* (3rd ed.). McGraw Hill International Editions.

3. Bansal, R. K. (2010). *Strength of materials* (4th ed.). Laxmi Publications.
4. Beer, F. P., & Johnson Jr., E. R. (2013). *Vector mechanics for engineers* (10th ed.). McGraw-Hill Education (India) Pvt. Ltd.
5. Bansal, R. K. (n.d.). *A textbook of fluid mechanics and hydraulic machines*. Laxmi Publications.
6. Hibbeler, R. C. (2013). *Engineering mechanics: Statics&Engineering mechanics: Dynamics* (13th ed.). Prentice Hall.
7. Meriam, J. L., &Kraige, L. G. (2013). *Engineering mechanics: Statics* (Vol. 1) &*Engineering mechanics: Dynamics* (7th ed.). Wiley.
8. Vela Murali. (2010). *Engineering mechanics*. Oxford University Press.
9. White, F. M. (1999). *Fluid mechanics* (4th ed.). McGraw-Hill Inc.

	Description of CO	**PO**	**PSO**
CO1	Explain the fundamental principles of stresses and strains.	--	-
CO2	Assess different types of supports and loads.	PO1(2) PO2(1)	PSO2(1)
CO3	Evaluate the cylindrical stability the shells and floating structures.	PO2(3) PO3(1)	PSO1(2)
CO4	Design the fixed and floating offshore structures.	PO3(3)	PSO1(2)
CO5	Demonstrate the function of offshore structures and fixed offshore structures.	PO11(1)	PSO3(2)

CY25C04	Applied Chemistry (TECH) – II	L	T	P	C
		2	0	0	2

Course Objectives

- To impart knowledge on chemical principles used in various fields of textile technology.
- To build a foundation in applied chemistry relevant to materials, interfaces, and surface technologies.

Interface and Colloids: Interface region, Interface control, Emulsion and Foams, Surfactant action.

Activities: Demonstration of oil-water interfaces, Formation of micelles.

Oils, Fats and Soaps: Types of oils, Properties of oils, Fats – classification, Soaps and detergents.

Activities: Seminar on the saponification of edible, non-edible and essential oils.

Lubricants: Mechanism of lubrication, Preparation of Petro lubes, Characteristics, Semisolid lubricant, Solid lubricants.

Activities: Virtual demonstration of lubrication, Assignment on the lubricants used in automotive engines.

Adhesives: Adhesive action, Classification of adhesives, Factors influencing adhesive action, Synthetic adhesives.

Activities: Adherence of liquids on surfaces (Flipped Class sessions).

Colourants: Theory of colour and constitution, Classification of dyes based on application, Chemistry and synthesis of dyes.

Activities: Study of bonding of dyes with fabric (Flipped Class sessions).

Chemical Auxiliaries: Functions, Classification, Preparation, Estimation using Iodometry, Permanganometry.

Activities: Estimation of available chlorine, Determination of strength of hydrogen peroxide, potential hazards of auxiliaries.

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

Assessment Methodology: Quiz (5%), Assignments (20%), Flipped Class (15%), Virtual Practice (10%), Internal Examinations (50%)

References

1. Jain, J., & Jain, S. (2015). Engineering Chemistry. Dhanpat Rai Publishing Company.
2. Dara, S. S., & Umare, S. S. (2024). A textbook of Engineering Chemistry. S. Chand & Company Ltd.
3. Sharma, B. K. (2014). Industrial Chemistry. Goel Publishing House, Krishna Prakashan Media (P) Ltd.
4. Puri, B. R., Sharma, L. R., & Pathania, S. (2020). Principles of Physical Chemistry. Vishal Publishing Co.

	Description of CO	PO	PSO
CO1	Explain the applications of chemistry in civil engineering stream.	---	
CO2	Apply chemistry concepts to select appropriate materials.	PO1(3)	PSO1(2)
CO3	Analyse the systems and interpret data from the virtual studies in the field of civil engineering.	PO2(2)	PSO2(2) PSO3(1)

EE25C01	Basic Electrical and Electronics Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart foundational knowledge in principles and applications of electrical and electronics engineering.

DC Fundamentals: Current and Voltage sources, Resistance, Inductance and Capacitance; Ohm's law, Kirchhoff's law, Series parallel combination of R, L and C components, Voltage Divider and Current Divider Rules.

Activities: Virtual Demonstration of electrical laws & circuits, Hands-on Breadboarding, Solving GATE questions.

AC Fundamentals: Faraday's Laws of Electro-magnetic Induction, Definition of Self and Mutual Inductances, Generation of sinusoidal voltage, Instantaneous & RMS values of sinusoidal signals, Introduction to 3-phase systems, Electrical Safety, Fuses and Earthing.

Activities: Virtual Demonstration of electromagnetic induction, Measurement of instantaneous and RMS values of AC signals, Solving GATE questions.

Electric Machines: DC Machines, Transformers, Star and delta Connections, Three phase Induction motors, Synchronous Generators, Single Phase Induction Motors, Stepper Motor, Universal Motor and BLDC motor.

Activities: Virtual demonstration of step-up and step-down transformers, Virtual working models of Universal and BLDC motors, Solving GATE questions.

Semiconductor Devices: PN junction diodes, Zener Diode, Voltage regulator, BJT & FET Transistors, Timers, Operational Amplifiers.

Activities: Virtual demonstration of V-I characteristics of PN junction and Zener diodes using simulation, inverting/non-inverting amplifiers, Solving GATE questions.

Digital Electronics: Boolean algebra, Basic and Universal Gates, adders, multiplexers, demultiplexers and flip-flops.

Activity: Online logic gate simulators, Solving GATE questions.

Microcontrollers: Introduction, Architecture, Potential Applications.

Activities: Physical demonstration of a microcontroller and online simulation of microcontroller.

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

Assessment Methodology: Quiz (5%), Assignments (25%), GATE Questions (20%), Internal Examinations (50%)

References:

1. Del Toro, V. (2022). Electrical engineering fundamentals. Pearson Education.
2. Hambley, A. R. (Year). Electrical engineering: Principles and applications (Edition if known). Publisher.(Note: Please provide the year and edition for complete citation)
3. Mehta, V. K., & Mehta, R. (2006). Principles of electrical engineering and electronics. S. Chand Publishing.

E-resources:

1. https://archive.nptel.ac.in/courses/108/106/108106172/
2. Circuit Simulator – https://www.falstad.com/circuit/

	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(2)
CO3	Identify and utilise key electronic devices used in engineering applications	PO2 (2)	PSO1(2)

UC25H02	தமிழர்களும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

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

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

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

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

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

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

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

References

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

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

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

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

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

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

Scientific Tamil & Tamil Computing: Development of Scientific Tamil, Tamil computing, Digitalization of Tamil Books, Development of Tamil Software, Tamil Virtual Academy, Tamil Digital Library, Online Tamil Dictionaries, Sorkuvai Project.

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

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

Text-Cum-Reference Books

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

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

ME25C01	Engineering Drawing	L	T	P	C
		2	0	4	4

Course Objectives:

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

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

Activities: Virtual Demonstration of Conics and Cycloids.

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

Projection of Solids: Simple Solids, Section of Solids, Development of Surfaces

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

Isometric Projection: Isometric Scale, Projection of Simple solids.

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

Perspective Projection: Simple solids projection

Activities: Virtual demonstration of perspective views.

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

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

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

References:

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

E-resources:

1. CAD Software – https://www.freecadweb.org/
2. Engineering Drawing and Computer Graphics, Prof. Rajaram Lakkaraju (IIT Kharagpur) – https://onlinecourses.nptel.ac.in/noc22_me105/preview
3. MIT Design Handbook: Engineering Drawing and Sketching – https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/

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

PH25C06	Applied Physics (Tech) – II	L	T	P	C
		2	1	0	3

Course Objectives:

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

Thermal Physics: Thermal Expansion- Thermal stress- Thermal resistance - Heat transfer- Thermal conductivity (Virtual demo) - Lee's disc method - Forbe's method - conduction through compound media –thermo-electric power.

Activities: Measurement of thermal conductivity of bad conductors.

Dielectric Properties: Dielectric- ferroelectric materials - Internal field – Clausius Mosotti equation – dielectric loss – Piezo, Pyro electric materials – Applications

Activities: Virtual demonstration of Piezoelectric sensor.

Optical Properties: Classification of optical materials – Luminescence-Phosphors -Polarization – Optical anisotropy - Optical processes in semiconductors – LED characteristics (Virtual demo)

Activities: Virtual demonstration of LED Characteristics

New Engineering Materials: Ceramics –Composites - fibre reinforced plastics - fibre reinforced metals – Shape memory alloys (Virtual Demo) – Biomaterials – hydroxyapatite – Bio-sensors – Polymer semiconductors – CNT (Carbon Nano Tubes)

Activities: Virtual demonstration of 3D structure of CNTs.-

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

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

References:

1. Raghavan, V. (2007). *Materials science and engineering*. Prentice Hall of India.
2. Brijlal, & Subramaniyan, N. (2018). *Heat, thermodynamics and statistical physics*. S. Chand.
3. Askeland, D. R. (2010). *Materials science and engineering*. Brooks/Cole.
4. Kasap, S. O. (2007). *Principles of electronic materials and devices*. McGraw-Hill Education.

E-resources:

1. Thermal conductivity - Understanding Thermal Conductivity in Solids - https://youtu.be/VcFqqdGcwrw-
2. Applications of Piezo and pyro electric materials -NDLI: Lecture 40- Applications of Piezoelectric and Pyroelectric Materials
3. White LED_ https://archive.nptel.ac.in/courses/108/108/108108122/

4. Shape memory alloys:
https://nescacademy.nasa.gov/video/00a31561480547248033a1c2df6f87831d

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

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

Course Objectives:

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

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

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

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

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

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

References:

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

E-resources:

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

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

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

Course Objectives

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

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

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

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

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

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

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

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

Suggested Activities: SWOT Analysis, Brainstorming and Group discussions.

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

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

References:

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

E-resources:

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

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

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

Course Objectives:

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

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

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

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

Activities: Case study analysis, Escape Room challenge.

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

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

Weightage: Continuous Assessment: 100%

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

References:

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

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

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

Course Objectives:

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

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

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

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

Weightage: Continuous Assessment: 100%

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

References:

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

E-resources:

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

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

Foreign Language^

UC25F01	Deutsch – I	L	T	P	C
		1	0	2	1

Course Objectives:

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

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

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

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

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

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

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

Weightage: Continuous Assessment: 100%

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

References:

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

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

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

Course Objectives:

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

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

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

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

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

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

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

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

Weightage: Continuous Assessment: 100%
Assessment Methodology: Assignments (30%), Quiz (10%) and Internal Examinations 60%
References: 1. Banno, E., Ikeda, Y., Ohno, Y., Shinagawa, C., & Tokashiki, K. (2011). Genki I: An integrated course in elementary Japanese. The Japan Times. 2. The Japan Foundation. (2017). Marugoto Japanese language and culture starter (A1) course book for communicative language activities. Goyal Publishers.

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

UC25F03	Korean – I	L	T	P	C
		1	0	2	1

Course Objectives:

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

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

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

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

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

Everyday Korean Communication: Polite speech levels and honorifics introduction, Talking about time, dates, and schedules, Ordering food, shopping phrases, counting objects, Simple directions and transportation vocabulary, Listening practice with short dialogues, Cultural notes on etiquette and communication.

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

Weightage: Continuous Assessment: 100%

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

References:

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

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

SEMESTER - III

MA25C03	Computational Differential Equations	L	T	P	C
		3	1	0	4

Course Objectives: The Objectives of the course are to equip students with the ability to formulate and solve various types of Ordinary and Partial Differential Equations (ODEs & PDEs) and to develop proficiency in applying numerical methods and computational tools for solving differential equations encountered in engineering problems.

First Order Ordinary Differential Equations: Basic concepts of ordinary differential equations–Formation of first order differential equations from physical problems–First order and first-degree ODE: Variables separable–Exact equations–Leibnitz's equation – Bernoulli's equation – Numerical Methods: Solving first order ODE by Euler's formula, Taylor series and Runge Kutta method of 4th order.

Activities: Application and Visualization of the first order ODE using open-source software and solving Competitive Examination questions

Higher Order Ordinary Differential Equations: Formation of second order differential equations from physical problems–Linear equations of second and higher order with constant coefficients – Euler's linear equations – Method of variation of parameters– Numerical Methods: Solving second order ODE by Runge-Kutta method of 4th order and finite difference method.

Activities: solving ordinary differential equations using open-source software and solving of Competitive Examination questions

First Order Partial Differential Equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of standard types of first order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Numerical Methods for first order PDE by Method of lines with Runge-Kutta method of order fourth.

Activities: Application and Visualization of the Partial Differential Equations using open-source software and solving Competitive Examination questions

Higher Order Partial Differential Equations: Linear homogeneous partial differential equations of second and higher order with constant coefficients. Numerical Methods: Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain—Solution of one-dimensional heat equation using Bender Schmidt and Crank Nicholson difference schemes—Solution of one-dimensional wave equation by explicit scheme.

Activities: Application of the second order PDE using open-source software of 1-D wave, 1-D heat equations, Laplace and Poisson equations and Solving Competitive Examination questions

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

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

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, (11th ed.), John Wiley & Sons, USA,2025.
2. Joe D. Hoffman, Numerical *Methods for Engineers and Scientists* (3rd ed.). CRC Press (Taylor & Francis Group), 2001.
3. Steven C. Chapra and Raymond P. Canale. *Numerical Methods for Engineers* (8th ed.). McGraw-Hill Education, 2021.
4. William E. Boyce and Richard C. DiPrima. *Elementary Differential Equations and Boundary Value Problems,* (11thed.). John Wiley & Sons, USA,2017.
5. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2026.
6. Randall J. LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations, SIAM,2007.

E-resources:

1. https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/
2. https://archive.nptel.ac.in/content/syllabus_pdf/111107063.pdf
3. https://github.com/patrickwalls/mathematicalpython

	Description of CO	PO	PSO
CO1	Explain first and higher-order ODEs using appropriate analytical and numerical techniques.	-	-
CO2	Solve higher-order PDEs using classical and finite difference methods.	PO1(3) PO5(3)	PSO1(2)
CO3	Apply various solution methods to differential equations arising in engineering contexts.	PO1 (3) PO5(3)	PSO2(1)
CO4	Interpretation of numerical solutions for partial differential equations and using open-source software.	PO2(3) PO5(3) PO11(2)	PSO2(1)

CH25201	Chemical Process Calculations	L	T	P	C
		3	1	0	4

Course Objectives:

- To introduce the fundamental principles of material and energy balances in chemical processes. To develop problem-solving skills using basic laws, property data, and flow diagrams.
- To equip students with tools including psychrometric charts and process simulators for practical process analysis.

Measurement Systems and Units: Fundamental and derived units; unit conversions; dimensional consistency.

Basic Chemical Calculations: Density, viscosity & volume – relationship with temperature, concentration, flow rate, pressure, force, work, and power.

Chemical Properties: Molecular weight, atomic weight, empirical and molecular formulas, equivalent weight, average molecular weight. Physical Properties: Specific volume, specific gravity.

Activity: Evaluation of various properties of commonly used materials.

Ideal Gases and Gas Laws: Boyle's Law, Charles' Law, Dalton's Law, Amagat's Law.

Real Gases: Equations of state, Compressibility charts and their applications, Van der Waals equation, Real gas mixtures. Raoult's Law and Henry's Law. Vapour pressure and its significance. Concepts of absolute and relative humidity, dew point, humid volume, and humid heat, Use and interpretation of psychrometric charts.

Activity: Virtual Demonstration of Ideal and real gas behavior, and Determination of air properties from psychrometric charts.

Material Balances: Material balance calculations for single-unit systems With and Without chemical reactions, Material balances for multi-unit systems.

Activity: Material balances in distillation, crystallization, and absorption processes, followed by class discussion.

Energy Balances: Systems involving, Sensible heat, Latent heat and Chemical reactions (heat of combustion, heat of formation, and heat of reaction), Fuels and combustion.

Activity: Virtual Demonstration of Combustion process.

Combined Material and Energy Balances: Steady-state systems, Methodology, Introduction to Process Simulation Tools.

Activity: Usage of Simulation tools for material and energy balance.

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

Assessment Methodology: Quiz (10%), Assignments (20%), Review of GATE Questions (20%), Internal Examinations (50%)

References

1. Himmelblau, D. M., & Riggs, J. B. (2014). Basic principles and calculations in chemical engineering. Prentice Hall Inc.
2. Felder, R. M., & Rousseau, R. W. (2005). Elementary principles of chemical processes. John Wiley & Sons.
3. Narayanan, K. V., & Lakshmikutty, B. (2016). Stoichiometry and process calculations. Prentice Hall Inc.
4. Hougen, O. A., Watson, K. M., & Ragatz, R. A. (1973). Chemical process principles (Part I). CBS Publishers.

E-Resources

Simulation videos for activity: https://learncheme.com/simulations/mass-energy-balances/

	Description of CO	PO	PSO
CO1	Understand and explain the core concepts of process calculation in Chemical Engineering.	---	---
CO2	Apply and analyse the material and energy balance in chemical processes.	PO1 (3) PO2 (1)	PSO1(2)
CO3	Apply the appropriate gas equation and interpret data in engineering applications	PO1 (2) PO2 (2)	PSO1(1)
CO4	Demonstrate the ability to engage in adapting new techniques in the analysis of chemical process.	PO11 (1)	PSO3(3)

PE25301	Thermodynamics for Petroleum Engineers	L	T	P	C
		3	0	0	3

Course Objectives: The primary objectives of Thermodynamics for Petroleum Engineers are to apply fundamental thermodynamic laws to analyze, predict, and optimize behavior in fluid mixtures, phase equilibria, and chemical reaction equilibria.

Zeroth and First Laws, Properties of Pure Substances: Definitions and Concepts. Property, Thermodynamic State. Equilibrium, Energy, Work. Zeroth Law of Thermodynamics, Temperature Scale. Pure substance, Phase, Simple compressible substance, Ideal gas Equation of State, Law of corresponding states, Compressibility chart, Pressure –Volume and Temperature volume Phase diagrams. Mollier diagram. First Law of Thermodynamics and its consequences.

Activities: Solve basic thermodynamics problems. Application of thermodynamic principles to solve heat & work requirements for various processes.

Application of First Law to Steady- State Processes, Second Law: Application of First Law of Thermodynamics for Flow Steady-state processes. Second Law of Thermodynamics and its Applications: Limitations of the First Law of Thermodynamics, Heat Engine, Heat Pump/ Refrigerator. Second Law of Thermodynamics – Kelvin Planck and Clausius statements. Reversible and irreversible processes, Criterion of reversibility, Carnot cycle and Carnot principles, Thermodynamic Temperature scale, Clausius inequality, Entropy.

Activities: Solve Carnot engine / Carnot Pump problems. Application of thermodynamic principles to solve heat, work, and entropy requirements for various processes.

Power Cycles, Thermodynamic Potentials, Equilibria and Stability: Power and Refrigeration Cycles. Thermodynamic Potentials. Maxwell relations. Thermodynamic relations. Equilibria and stability. Maxwell construction, Gibbs Phase Rule. Clapeyron equation and vapor pressure correlations.

Activities: Solve Ideal gas / real gas EOS problems. Application of thermodynamic potentials / maxwell's relations to solve U, Q, W, S, H and G values for various processes.

Properties of Pure Components and Mixtures: Pure component properties: Equation of state. Ideal gas heat capacities, fundamental equations from experimental data, fugacity and corresponding states. Mixture Properties: Mixing function. Gibbs-Duhem relation for mixtures, partial molar quantities. Ideal gas mixtures and fugacities, ideal mixtures and activities, excess functions. Gibbs free energy models, infinite dilution properties. Henry's Law.

Activities: Solve for fugacity, activity, fugacity coefficient and activity coefficient of pure and multicomponent systems using Lewis fugacity and other laws. Application of Gibbs-Duhem equation for calculation of properties of mixtures.

Phase Equilibria and Chemical Reaction Equilibria: Phase Equilibria of Mixtures. Osmotic pressure and Osmotic coefficients. Boiling point elevation and freezing point depression. Chemical Reaction Equilibria. Reaction extent and Independent reactions.

Equilibrium criteria and equilibrium constant. Standard enthalpies and Gibbs free energy, temperature and pressure effects on reactions, heterogeneous reaction, multiple chemical reactions. **Activities:** Stability test of x-y data, Apply reaction equilibrium principles to find equilibrium composition, conversion, equilibrium constant, and Gibb's free energy change.
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.
Assessment Methodology: Assignments (20%), Problem-solving using thermodynamic models and software tools (20%), Quiz / MCQs (20%), Internal Examinations (40%).
References 1. Narayanan, K.V. A Textbook of Chemical Engineering Thermodynamics Prentice Hall India, 2004 2. Gopinath Halder," Introduction to Chemical Engineering Thermodynamics", PHI Learning Ltd (2009). 3. S. Sundaram, "Chemical Engineering Thermodynamics", R. N. Ahuja *Book* Company, New Delh, 1998. 4. Pradeep ahuja," Chemical Engineering Thermodynamics", PHI Learning Ltd (2009)

CO mapping with PO and PSO

CO	Description of CO	PO	PSO
CO1	Understand the fundamental principles of petroleum engineering thermodynamics and perform basic thermodynamic calculations.	-	-
CO2	Apply thermodynamic principles and relevant property data to solve energy transformation and engineering problems.	PO2(3), PO5(2)	PSO1(2), PSO2(2)
CO3	Analyze the application of thermodynamic laws in petroleum and chemical engineering processes and interpret their impact on system performance.	PO2(3), PO4(2)	PSO1(2), PSO2(2), PSO3(2)

PE25302	Reservoir Engineering	L	T	P	C
		3	0	0	3

Course Objectives: To impart knowledge in the basic concepts like PVT analysis for oil, Material balance applied to oil reservoir, Darcy's law and applications, well inflow estimation for stabilized flow conditions.

Basic Concepts in Reservoir Engineering: Calculation of hydrocarbon volumes- Fluid pressure regimes- Oil recovery and recovery factor-Volumetric gas reservoir engineering– Application of the real gas equation of state - Gas material balance and recovery factor-Hydrocarbon phase behavior.

Activities: Classify given reservoir samples into oil, gas, or water systems.

PVT analysis for oil: Definition of the basic PVT parameters – Collection of fluid samples - Determination of the basic parameters in the laboratory and conversion for field operating conditions.

Activities: Referring Oil and Gas properties data book and evaluate PVT relationship

Material Balance and Darcy's Law and Applications: General equation - the material balance expressed as a linear equation, Reservoir drive mechanism, types of gas drives, Compaction drive under related pore compressibility phenomena, Darcy's law and field potential- Sign convention- Units and units' conversion- Real gas potential – Datum pressures- Radial steady state flow and well stimulation- Two phase flow- Effective and relative permeabilities.

Activities: Solve a basic steady-state flow problem and present the impact of reservoir geometry on flow.

Methods For Residual Oil and Well Inflow Equation: Recommended methods for assessing residual oil – Existing wells, new wells, Chemical Flooding, Gas injection, Thermal recovery – Well Testing, Well inflow equations for stabilized flow conditions. Constant terminal rate solution of the radial diffusivity equation and its application to oil well testing.

Activities: Apply the material balance equation to a sample oil reservoir dataset and predict performance.

Fluid Flow Reservoirs: Fluid flow in reservoirs, Fluid movement in water flooded Reservoirs – Recovery efficiency – Areal or pattern. Sweep efficiency, - Vertical or invasion sweep efficiency, - Permeability variation – Cross flow – Estimates of volumetric sweep efficiency – Estimation of water flood recovery by material balance – prediction methods – Monitoring injectivity. Darcy Law and application.

Activities: Plot a decline curve (exponential/hyperbolic) from given production data and interpret reservoir behaviour.

Reservoir Management: Reservoir management process, reservoir management team, downhole monitoring and acquisition, management of continuous data stream, integration of data to subsurface model, immersive visualization systems, intelligent completions, rig less intervention, improved performance through field life. Benefits of reservoir management – case examples. **Activities:** Case studies on reservoir management, 3D model for integration of subsurface data
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%
Assessment Methodology: Assignments (20%), Problem-solving using thermodynamic models and software tools (20%), Quiz / MCQs (20%), Internal Examinations (40%).
References 1. Fundamentals of Reservoir Engineering, L.P. Dake, Elsevier Science, 1978 (17th Impression 1998). 2. B. C. Craft – M. Hawkins Applied Petroleum Reservoir Engineering, Third Edition, Revised by Ronald E. Terry & J. Brandon Rogers, Prentice Hall, New York, 2014. 3. William C.Lyons, Gary J.Plisga “Standard Hand Book of Petroleum &Natural Gas Engineering” Second Edition – (Elsevier), Gulf Publishing, Burlington U.S.A (2005).

CO mapping with PO and PSO

CO	Description of CO	PO	PSO
CO1	Understand the fundamental principles of reservoir engineering, hydrocarbon behavior, and PVT analysis.	-	-
CO2	Apply Darcy's law and reservoir engineering principles to solve fluid flow and pressure distribution problems.	PO2(3), PO5(2)	PSO1(2), PSO2(2)
CO3	Analyze well testing data and residual oil recovery methods to evaluate reservoir performance.	PO2(3), PO4(3)	PSO1(2), PSO2(2), PSO3(2)
CO4	Evaluate reservoir fluid flow behavior and engineering parameters for effective reservoir management and production optimization.	PO3(3), PO5(3)	PSO1(3), PSO2(2), PSO3(2)
CO5	Develop reservoir management strategies by integrating reservoir data, production performance, and recovery techniques.	PO3(3), PO10(2), PO11(2)	PSO1(3), PSO2(3), PSO3(2)

PE25303	Fluid Mechanics and Solid Operations	L	T	P	C
		3	0	2	4

Course Objectives: To impart to the student knowledge on fluid properties, fluid static and dynamic characteristics flow metering and transport, particle mechanics, techniques of solid – fluid separation.

Properties Of Fluid: Newtonian fluids Classification of fluid motion Fluid statics – equilibrium of fluid element – pressure variation in a static fluid – Differential analysis of fluid motion – continuity, Euler's and Bernoulli equation.

Activities: Numerical problems on fluid statics and Bernoulli equation; derivations and applications in engineering systems

Flow Through Pipes & Boundary Layer Concepts: Reynolds number regimes, Flow through pipes – pressure drop under laminar and turbulent flow conditions; boundary layer concepts; different types of flowmeters; Valves, pumps, compressors – characteristics and sizing; Agitation and Mixing.

Practicals: Centrifugal pump characteristics, Venturimeter, rotameters

Activities: Problem-solving on pressure drop and Reynolds number; analysis of pump and flow meter performance. Numerical problems on size reduction laws; case studies on industrial size reduction equipment

Size Analysis: General characteristics of solids, techniques of size analysis; Laws of size reduction, equipment for size reduction.

Practicals: Sieve analysis, Reduction ratio in Jaw Crusher / Pulverizer / Hammer Mill, Reduction ratio in Ball mill, Reduction ratio of Roll Crusher

Activities: Virtual demonstration of industrial screening and particle size analysis

Flow Through Fluidized Beds: Flow over a sphere – friction and pressure drag - flow through fixed and fluidized beds. Filtration – batch and continuous, filtration equipment - selection, operation.

Practicals: Pressure drop studies in packed column, Hydrodynamics of fluidized bed

Activities: Calculations on fluidization and pressure drop; analysis of filtration systems. Case studies on industrial separation techniques; numerical problems on sedimentation and centrifugation

Classifiers: Screening, gravity separation - sedimentation, thickening, elutriation, classifiers – Centrifugal separation - continuous centrifuges, cyclones and hydro cyclones, electrostatic and magnetic separators.

Practicals: Separation characteristics of Cyclone separator, Characteristics of batch Sedimentations

Activities: Virtual demonstration of industrial air pollution control systems and the separation of particulate matter from gas streams.
Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.
Assessment Methodology: Assignments (20%), Experimental data analysis and design calculations (20%), Quiz/MCQs (20%), Internal Examinations (40%).
References 1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers ", Third Edition, McGraw-Hill, (2005). 2. Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", Fifth Edition, Tata McGraw Hill, 2001. 3. McCabe W.L, Smith, J C and Harriot. P “Unit operations in Chemical Engineering McGraw Hill, V Edition, 2001 4. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I, 4th Edn., Asian Book, Pvt. Ltd., India, 1998.

CO mapping with PO and PSO

CO	Description of CO	PO	PSO
CO1	Understand the fundamental properties and behavior of fluids and their significance in petroleum engineering applications.	-	-
CO2	Apply fluid flow principles and engineering equations to solve flow-through-pipe and fluid transport problems.	PO2(3), PO5(2)	PSO1(2), PSO2(2)
CO3	Analyze particle size distribution and sieve analysis techniques used in petroleum and process industries.	PO2(3), PO4(2)	PSO1(2), PSO2(2), PSO3(1)
CO4	Evaluate the performance of fluidized beds and related solid–fluid systems in petroleum production and processing operations.	PO3(3), PO5(3)	PSO1(2), PSO2(3), PSO3(2)
CO5	Develop suitable classification and separation strategies for industrial applications involving particulate materials.	PO3(3), PO5(3), PO10(2)	PSO1(3), PSO2(3), PSO3(2)

PE25304	Petroleum Geology	L	T	P	C
		3	0	2	4

Course Objectives: This is a basic course in petroleum geology. The students will be exposed to different source, reservoir and cap-rocks, characterization of reservoir rocks, classification of reservoir pore space, permeability, migration and entrapment, temperature-pressure conditions for the generation of oil and gas from sediments.

Source Rocks: Definition of source rock, Organic rich sediments as source rocks, Nature and type of source rocks - Claystone / shale, The process of diagenesis, catagenesis and metagenesis in the formation of source rocks, Evaluation of petroleum source rock potential, Limestone as source rocks, Subsurface pressure temperature conditions for the generation of oil and gas from the source sediments, Oil window.

Practicals: Calculation of True and Apparent Dip, Estimation of Thickness, Distance and Depth of the ore body. Activities: Identification of rock types

Reservoir Rocks and Reservoir Properties: Characteristics of Reservoir rocks, Classification and nomenclature: Clastic Reservoir Rocks, Carbonate Reservoir Rocks, Unconventional, Fractured and Miscellaneous reservoir rocks, Marine and non-marine reservoir rocks, Concept of Shale oil Reservoir pore space, porosity- primary and secondary porosity, effective porosity, fracture porosity - permeability – effective and relative permeability relationship between porosity, permeability and texture.

Practicals: Identification of important sedimentary rocks in hand specimen. 8) Identification of important sedimentary rocks in microscopic level

Activities: Numerical estimation of porosity and permeability

Cap Rocks and Hydrocarbon Migration: Definition and characteristics of cap rocks, The concept of hydrocarbon migration from source beds to the carrier beds, Carrier beds to the reservoir, Free path ways for migration, short distance and long-distance migration, Evidence for migration, Oil and gas seepages.

Entrapment of Hydrocarbons: Entrapment and accumulation of hydrocarbons, Classification and types of traps: Structural, stratigraphic and combination type of traps, Traps associated with salt domes.

Practicals: Estimation of Throw and Nature of the fault

Sedimentary Basins: Introduction to plate tectonics, Sedimentary basins -origin and classification, Types of basins and their relationship to hydrocarbon prospects, Tectonic classification.

Practicals: Interpretation of surface Geology using contour maps.

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

Assessment Methodology: Assignments (20%), Experimental data analysis and design calculations (20%), Quiz/MCQs (20%), Internal Examinations (40%).

References

1. Geology of Petroleum, A.I. Levorsen,2ndEdition. CBS, Publishers, 2006
2. Cox, P.A., “The Elements on Earth”, Oxford University Press, Oxford 1995.
3. Wilson, M., Igneous Petrogenesis”, Unwin Hyman, London 1989

CO mapping with PO and PSO

CO	Description of CO	PO	PSO
CO1	Understand the origin, classification, characteristics, pore structure, and porosity of source and reservoir rocks relevant to petroleum systems.	-	-
CO2	Identify and classify different source rocks and evaluate their potential for hydrocarbon generation.	PO1(3), PO2(2)	PSO1(2), PSO2(1)
CO3	Analyze hydrocarbon migration, entrapment, and accumulation processes within petroleum reservoirs.	PO2(3), PO4(2)	PSO1(2), PSO2(2), PSO3(2)

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

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

List of Activities

A. Elements of Effective Speaking and Listening

(i) Sharing life experience/ turning point in their life – SATORI

(ii) Situational Conversation – eg. Talking to a Senior about Internship Tips

(iii) Welcoming a Guest Speaker at a Seminar

(iv) Pictography to represent data using images or symbols

(v) B2-C1 Listening exercises include lectures, interviews, and discussions.

B. Mastering Presentations

(i) Presentation Skills – Non-verbal communication

(ii) Mini-Presentations: Topics like "My Dream Project," "Engineering in 2050," 3-minute technical pitches with logical flow

(iii) Technical Presentations with PPT

C. Group Discussion Strategies:

(i) Introduction to Group Discussions - Key skills for effective participation

(ii) Phases in a GD and Conversational Phrases in GD.

(iii) Group Discussions – Abstract and Factual topics

D. Resume & LinkedIn Optimization

(i) Building LinkedIn Profile – Drafting headlines and summaries

(ii) Social Media Optimisation

(iii) Preparing Video Resume

E. Podcast-Based Language Learning:

(i) Listening to podcast (motivational, career oriented, success stories)

(ii) Podcast Preparation – Purpose – Topic – Structure – Recording Tips - Publication of the Podcast

F. Mock Interviews and Communication Strategies:
(i) Listening – Job interview

(ii) Speaking – Mock interviews

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

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

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

References:

1. Floyd Kory, “Interpersonal Communication”, McGraw Hill Publication, 2023.
2. Bharadwaj Apoorva, “Leadership Communication Skills for Intercultural Management: Strategies for Effective Intercultural Management (Contemporary Themes in Business and Management)”, Routledge India; 1st edition, 2024.
3. Helen Spencer-Oatey and DomnaLazidou, “Making Working Relationships Work: The TRIPS Toolkit for Handling Relationship Challenges and Promoting Rapport”, Castledown Publishers,2023.
4. Presentations - Cambridge
5. Speaking Extra
6. Listening Extra – Miles Craven by Cambridge University Press
7. CVs, Resumes, and LinkedIn: A Guide to Professional English – Springer International Publishing

E-resources:

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

CO Mapping with PO & PSO

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

SEMESTER IV

PE25401	Drilling Fluids and Cementing Techniques	L	T	P	C
		3	0	0	3

Course Objectives: To enable the students to understand the types of drilling fluids and cementing techniques.

Introduction: Introduction to the basic functions and properties of drilling fluids and cement slurries. Compositions and related properties of drilling fluids and cement slurries.

Classification Of Drilling Fluids: Drilling fluids – classification – water base drilling fluids. Testing of drilling fluids. Drilling fluid additives.

Types And Methods: Types of equipment and methods used in cementing operations. Drilling fluid and cement slurry hydraulics.

Anaysis of Cemmenting Techniques: Determination of torque and drag. Calculation of cutting transport efficiency. Placement technique of cements. Gas migration through cement columns.

Properties and Types of Cementing: Will cementing – chemistry of cements. Cementing principles – primary cementing, secondary cementing, linear cementing, plug cementing, and single stage cementing, multistage casing
cementing.

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

Assessment Methodology: Assignments (20%), Quiz / MCQs (20%), Solving of Competitive type exam questions (20%), Internal Examinations (40%).

References

1. Rabia.H. 'Oil Well Drilling Engineering, Principles And Practices' Graham And Trotman Ltd. 1985.
2. Smith.P.K, 'Cementing' SPE Pulications 2nd Edition 1976.
3. Cementing Technology – Powel Schlumberger Publication 1984.
4. Mc.Cray. A.W and Cole.F.W. 'Oil Well Drilling Technology' University of Oklahoma Press, Norman 1959.

CO mapping with PO and PSO

CO	Description of CO	PO	PSO
CO1	Understand the concepts, properties, functions, and applications of drilling fluids used in petroleum drilling operations.	-	-
CO2	Explain and analyze the equipment, materials, and operational procedures involved in well cementing operations.	PO2(3), PO5(2)	PSO1(2), PSO2(2), PSO3(1)

PE25402	Well Drilling Equipment and Operations	L	T	P	C
		3	0	0	3

Course Objectives: To make the students learn about the Drilling Process and Drilling Equipments.

(Introduction to Drilling Operation) Drilling operations – Location to Rig, Rig Types – Land Types – Marine types- Release Well Bore Diagram, Crews – Operator – Drilling, contractor – Third Party Services.

Activities: Virtual demonstration of drilling operation

Components of Drilling Rig Components- Overall Drilling Rig, Drilling Sub systems – Mud circulation system – Power – Hoisting Line – speeds and Loads Power – Loading Components – Drill Pipe, Heavy Weight Drill Pipe (HWDP), Drill String Loads - Bottom hole assembly-Drilling Assembly.

Activities: Visual demonstration of various components of drilling equipments

Directional Drilling, Well Planning, Two Dimensional, Horizontal, Tools, Techniques, MWD, surveying, Muds, Mud Use, Property measurements, Types, - Pneumatic (Air, Gas, Mist, Foam), Water based, Oil based, solids Control, Definitions, Equipment, Problems, Contaminations Effect.

Activities: Virtual demonstration of directional drilling, recent Case studies from literature

Hydraulics Modeling Classifications of Fluids, Rheological Models – Rotary Drilling Hydraulics – Jet Hydraulic Optimizing and Maximizing – Circulations Rate Selection – Drill Bit – Jet Sizing – Equivalent Circulations Density, Hole Cleaning. Theory – Vertical and Deviated Holes, Annular Velocities – Carrying Capacity – Pills and Slugs.

Activities: Numerical estimation and optimizing various drilling measures

Advanced topics Origin of Overpressure, Kick Signs, shut-in Procedures, kill sheets, Kill Procedures, Driller's Methods – Engineer's Method (Wait and Weight).

Activities: Discuss the merits of various advanced methods in drilling operation

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

Assessment Methodology: Assignments (20%), Quiz / MCQs (20%), Solving of Competitive type exam questions (20%), Internal Examinations (40%).

References:

1. Rabia.H. 'Oil Well Drilling Engineering, Principles and Practices' Graham and Trotman Ltd. 1985.
2. D.P Helander 'Fundamentals of Formation Evaluation' , Oil & Gas Consultants Inlernational, Inc. 1983
3. Rabia.H. 'Oil Well Drilling Engineering, Principles and Practices' Graham and Trotman Ltd. 1985.

4. D.P Helander ‘Fundamentals of Formation Evaluation’ , Oil & Gas Consultants International, Inc. 1983
5. Standard Handbook of Petroluem and Natural Gas Engineering, 2nd Edition, William C Lyons, Gary C Pilisga, Gulf Professional Publishing

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Understand the concepts, equipment, and techniques used in well drilling operations.	-	-
CO2	Apply well planning and construction principles to design safe and efficient wells.	PO2(3), PO3(2)	PSO1(2), PSO2(2)
CO3	Evaluate and optimize drilling program design by considering technical, safety, and economic factors.	PO3(3), PO5(2), PO6(2)	PSO1(2), PSO2(2), PSO3(2)

PE25403	Well logging and Formation Evaluation	L	T	P	C
		3	0	0	3

Course Objectives: To enable the students to understand the concept of formation evaluation and well logging and techniques involved in it.

Introduction to Well Logging and Formation Aims and objectives of well logging. Reservoir formations. Borehole conditions. Fundamental concepts in borehole geophysics physical properties of reservoir rocks. Formation parameters and their relationships: formation factor, porosity, permeability, resistivity, water and hydrocarbon saturations, and movable oil. Archie's and Humbles equations

Activities: Discuss formation parameters and relationship. Numerical estimation of factors

Well Logging Instruments Principles, instrumentation, operational procedures and applications of different geophysical logs: S.P., electrical, induction, nuclear, sonic, caliper, temperature, dip and direction. Natural gamma ray spectrometry log, nuclear magnetic log, litho density log, neutron activation technique, thermal neutron decay time log, chlorine and oxygen logs.

Activities: Virtual demonstration and working principles of well logging instruments

Annalysis of Log Data Recording, transmission and processing of log data. Formation evaluation for hydrocarbons. Qualitative and quantitative interpretations of well log data. Overlays and cross-plots. Determination of reservoir parameters – porosity, resistivity, permeability, water and hydrocarbon saturation, movable oil. Lithology determination by neutron, density and sonic cross-plots, dual mineral method, triporosity method, litho porosity cross-plot (M-N plot), clean sand and shaly sand interpretations.

Activities: Use of Open Source softwares for interpretation of log data

Sub-Surface Analysis Sub-surface correlation and mapping from log data. Delineation of fractures from logs. Production logging. Well logging for metallic and non-metallic minerals: radioactive and non-radioactive evaporates, coal, sulphur. Borehole geophysics for groundwater exploration. Effective pay thickness of an aquifer. Saline water-fresh water interface from log data. Determination of groundwater flow direction by logs.

Activities: Literature survey and analysis of well logs

Theoretical computations of normal and lateral log responses. Identification and delineation of sub-surface formations from well log data. Calculation of reservoir parameters: formation factor, porosity, permeability, resistivity, water and hydrocarbon saturations, and movable oil. Sub-surface correlation of formations and interpretation of field data.

Activities: Numerical simulation of reservoir parameters

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

Assessment Methodology: Assignments (20%), Quiz / MCQs (20%), Solving of Competitive type exam questions (20%), Internal Examinations (40%).

References:

1. Standard Handbook of petroleum and Natural Gas Engineering. 2nd Edition. William CLyons, Gary C Plisga. Gulf Professional Publishing.
2. D.P Helander 'Fundamentals Of Formation Evaluation'
3. Dewan.J.T 'Essentials of Modern Open-Hole Log Interpretation' Pen Well Books, 1983, ISBN 0878142339.
4. Serra.O 'Fundamentals of Well log Interpretation' Volume1. Elsevier Science Publisher, New York, 1984, ISBN 04441327

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Explain the principles, objectives, and applications of well logging in subsurface formation evaluation.	PO1(3)	PSO1(2)
CO2	Apply the concepts and operational procedures of various geophysical logging techniques for data acquisition.	PO2(3), PO5(2)	PSO1(2), PSO2(2)
CO3	Analyze qualitative and quantitative well log data to determine formation and reservoir properties.	PO2(3), PO4(2), PO5(2)	PSO1(3), PSO2(2)
CO4	Evaluate well log responses for the exploration and characterization of metallic and non-metallic mineral deposits.	PO3(3), PO4(2)	PSO1(2), PSO2(2), PSO3(1)
CO5	Characterize subsurface formations and reservoir zones through integrated interpretation of well log data.	PO3(3), PO5(3), PO10(2)	PSO1(3), PSO2(2), PSO3(2)

PE25C01	Water Flooding and Enhanced Oil Recovery	L	T	P	C
		3	0	0	3

Course Objectives: To enable the students to understand the basics of oil recovery methods in oil & gas Industry.

Water Flooding: Mobility ratios, displacement efficiency, sweep efficiency, factors to consider in water flooding, optimum time to water flood, performance predictions using fractional flow and frontal advance equations and water sources. Oil displacement by water in a layered reservoir using Dykstra-Parson´s method.

Activities: Discuss the recent trends in water flooding from literature (SPE Communications)

Introduction To Enhanced Oil Recovery (EOR): Introduction and Overview of EOR methods and EOR status worldwide. Basic petro-physical properties; Permeability/porosity, Relative permeability, capillary pressure and residual oil saturation.

Activities: Development of physical models using poly urithin foam (Thermocoal)

Types of Flooding: Chemical recovery methods – Polymer flooding – Surfactant flooding - Alkaline flooding – Hydrocarbon or Gas injection - Carbon dioxide (CO2) flooding – Nitrogen and flue gas flooding - Thermal recovery methods – fire flooding – steam flooding.

Activities: Construct a display chart comparing flooding methods

Mechanism Of Flooding: Mechanism of surfactant/polymer flooding - Mechanism of alkaline flooding - Mechanism of hydrocarbon miscible flooding – Mechanism of CO2 flooding - Mechanism of nitrogen and flue gas flooding – Mechanism of steam flooding.

Activities: Collection of literature by each individual student

Testing And Methods: Criteria for chemical methods - Criteria for gas injection - criteria for thermal methods. Microbial EOR methods (MEOR), Laboratory design for EOR – Preliminary test – Water analysis – Oil analysis – Core testing – Viscosity testing.

Activities: Virtual videos / LabView demos

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

Assessment Methodology: Assignments (20%), Quiz / MCQs (20%), Solving of Competitive type exam questions (20%), Internal Examinations (40%).

References:

1. Von Pollen. H.K. and Associates. Inc., “Fundamentals of Enhanced oil Recovery” – PennWell publishing co., Tulsa (1980)
2. Latil.M. et al., “Enhanced oil recovery” – Gulf publishing co. Houston (1980).
3. Ahmed, Tarek, “Reservoir engineering handbook” Gulf professional publishing, ISBN: 9780080480688, (2018).

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Explain the principles of water flooding, displacement efficiency, sweep efficiency, and factors affecting oil recovery in reservoirs.	-	-
CO2	Apply fractional flow, frontal advance equations, and reservoir engineering concepts to analyze water flooding performance.	PO1(3), PO2(3), PO5(2)	PSO1(3), PSO2(2)
CO3	Analyze the mechanisms and performance of chemical, gas, and thermal enhanced oil recovery methods under different reservoir conditions.	PO2(3), PO3(3), PO4(2)	PSO1(3), PSO2(2), PSO3(2)
CO4	Evaluate the suitability of surfactant, polymer, alkaline, CO_2, hydrocarbon gas, nitrogen, and steam flooding techniques for improved oil recovery.	PO3(3), PO4(3), PO6(2)	PSO1(2), PSO2(3), PSO3(2)
CO5	Design laboratory testing and screening procedures for EOR applications, including fluid analysis, core testing, and microbial EOR evaluation.	PO3(3), PO5(3), PO10(2)	PSO1(2), PSO2(3), PSO3(3)

CH25C06	Heat Transfer	L	T	P	C
		3	0	2	4

Course Objectives: To provide knowledge on conduction, convection, radiation, phase change heat transfer and heat exchanger design for chemical engineering applications.

Conduction: Introduction to heat transfer-General heat conduction equation, One dimensional steady state conduction in rectangular coordinate, One dimensional steady state conduction in cylindrical and spherical coordinate; Critical and optimum insulation; Extended surface heat transfer; Transient heat flow - Analysis of lumped parameter model – applications.

Practicals:
1. Measurement of thermal conductivity
2. Heat transfer studies through composite wall
3. Heat transfer in Bare and Finned Tube Heat Exchanger

Activities: Analyze steady and transient heat conduction problems in different geometries.

Convection: Introduction to Convective Heat Transfer; Dimensional analysis for -forced convection, free convection; Heat transfer co-relations for - laminar and internal flows, turbulent and internal flows, Co-relation for turbulent and external flows, for flow across tube banks, Momentum.Heat transfer analogies; Boundary layer heat transfer- Equations, Approximate analysis in boundary layer, Theoretical concepts of natural / free convention heat transfer; Empirical relations for free convention heat transfer.

Practicals: Heat transfer studies by forced convection

Activities: Analyze convective heat transfer mechanisms under forced and natural convection, apply dimensional analysis and empirical correlations.

Heat Exchanger: Classification of heat exchangers; Co-current, Counter current& Cross-current; log-mean temperature difference; overall heat transfer coefficient; fouling factors. Various types of shell and tube heat exchangers; Effectiveness-NTU; method of heat exchanger analysis; Design of - double pipe heat exchanger, shell and tube heat exchanger & Plate and Spiral Heat exchangers.

Practicals:
1. Heat transfer Studies in Shell and Tube heat exchanger
2. Heat transfer in Double pipe heat exchanger

Activities: Perform preliminary design calculations for industrial heat exchangers.

Heat Transfer with Phase Change: Boiling and Condensation-Types-Condensation heat transfer over vertical plate, Condensation heat transfer for various conditions & geometries, Fundamentals of boiling heat transfer, boiling heat transfer co-relations.

Evaporation: Types of evaporators, boiling point elevation and Duhring's rule, material and energy balances for single and multiple effect evaporators: forward, mixed and backward feeds, capacity and economy of evaporators.

Practicals:
1. Heat transfer in Horizontal and vertical condenser
2. Heat transfer in Helical coil

Activities: Analyze boiling and condensation heat transfer mechanisms, evaluate evaporator performance and economy, solve material and energy balance problems in multiple effect evaporators.

Radiation & Industrial Applications: Introduction to radiation heat transfer, Thermal Radiation laws, Black and Gray bodies, Properties of a Blackbody, Kirchhoff's Law, Radiation intensity and radiation view factor, Radiation heat exchange, Radiation shield and gas radiation, emissivity, radiation between black surfaces and grey surfaces. Solar radiations, combined heat transfer coefficients by convection and radiation. Industrial applications -Heat transfer through packed and fluidized bed.

Practicals:
1. Emissivity measurement
2. Heat transfer in packed column

Activities: Analyze radiative heat transfer between surfaces.

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

Assessment Methodology: Assignments (20%), Experimental data analysis and heat transfer calculations (20%), Quiz/MCQs (20%), Internal Examinations (40%).

References:

1. Incropera, F. P. & Dewitt, D. P., (2011), Fundamental of Heat and Mass Transfer,John Wiley & Sons ISBN-10: 0-471-45728-0
2. Holman, J. P., 'Heat Transfer', 8th Edn., McGraw Hill, 1997. ISBN-10 : 0078447852
3. Ozisik, M. N., Heat Transfer: A Basic Approach, McGraw-Hill, 1984 ISBN-10: 0070479828
4. Kern, D.Q., "Process Heat Transfer ", McGraw-Hill, 1999. ISBN-10 : 0070341907
5. Cengel, Y.A. (2002) Heat Transfer: A Practical Approach. 2nd Edition, McGraw-Hill, New York.
6. Coulson, J.M. and Richardson, J.F., "Chemical Engineering "Vol. I, 4th Edn., Asian Books Pvt. Ltd., India, 1998.
7. McCabe, Warren L., Julian C. Smith, and Peter Harriott. Unit Operations of Chemical Engineering. 5th ed. New York; London: McGraw-Hill, 1993.

E-Resources:

1. NPTEL courses on Heat Transfer and Process Heat Transfer.
2. SWAYAM online modules on conduction, convection and radiation heat transfer.
3. Virtual laboratory simulations for heat exchangers and phase change heat transfer.

CO Mapping with PO & PSO:

CO	CO Description	PO Mapping	PSO Mapping
CO1	Understand the fundamental principles of conduction heat transfer under steady and transient conditions in different geometries.	–	–
CO2	Apply convective heat transfer correlations to determine heat transfer coefficients for internal and external flow systems.	PO1 (3) PO2 (2)	PSO1 (2)
CO3	Analyze heat exchanger performance using LMTD and effectiveness–NTU methods.	PO2 (3) PO4 (2)	PSO1 (2) PSO2 (1)
CO4	Evaluate boiling, condensation, and evaporation processes used in industrial heat transfer applications.	PO3 (3) PO5 (2)	PSO2 (2)
CO5	Design heat transfer systems involving radiation, packed beds, and fluidized beds for efficient industrial operation.	PO3 (3) PO5 (2) PO6 (1) PO11 (1)	PSO1 (2) PSO2 (2) PSO3 (1)

PE25404	Petroleum Refining and Petrochemicals	L	T	P	C
		2	0	2	4

Course Objectives

- To understand the properties and their significance of crude oils and petroleum fractions.
- To understand, design and analyze the various petroleum refinery processes including primary, secondary and supporting processes.
- To understand the process technologies for petrochemical products.

Introduction and Refinery Feed Stocks: Overall refinery operations & Indian scenario. Refinery feed stocks: Crude oil classification-Composition and properties-Composition of petroleum crude suitable for asphalt/coke manufacture – Evaluation of crude oils.

Practicals: ASTM Distillation apparatus, true boiling curve

Activities: Understanding distillation process

Petroleum Products and Their Specifications: LPG - Gasoline- Diesel fuels- Jet and turbine fuels –Lube oils-Heating oils – Residual fuel oils - Wax and Asphalt- Petroleum coke-All Product specifications-Product blending.

Practicals: Develop calibration curve of binary mixture of hydrocarbon with refractometer

Activities: Discuss the application of various fuels and their heat value

Crude Distillation, Catalytic Reforming and Isomerization: Crude distillation: Atmospheric and Vacuum distillation units, Auxiliary equipment such as desalters, pipe-still heaters and heat exchanger trains etc.

Catalytic reforming and isomerization: Catalytic reforming processes (for petroleum and petrochemical feed stocks) – Isomerization Processes -Feed stocks-Feed preparation – Yields.

Practicals: Flash point, Pour point, Doctor’s apparatus for moisture content

Activities: Virtual demonstration of Atmospheric and Vacuum distillation

Petrochemical Process I: Thermal & Catalytic cracking processes: Visbreaking-Delayed Coking – Fluid Catalytic cracking and Hydrocracking - Feed stocks – Catalysts - Process variables – Product Recoveries - Yield estimation.

Hydrotreating & Hydro processing: Naphtha, Kerosene, Diesel, VGO & Resid, Hydrotreating / Hydro processing – Feed stocks – Process description and Process variables.

Activities: Identification of relevant feed stock for synthesis of petroleum products

Petrochemical Process II: Petrochemical Industry - Indian Petrochemical Industry- Feed stocks – Process description and Process Variables-Naphtha cracking-Gas cracking and Gas reforming, Chemicals from gas reforming: Methanol- Acetic acid- Ammonia and urea. Chemicals from ethylene: Ethylene oxide-Monoethylene glycol-Ethyl benzene-Styrene. Polymers: LDPE, HDPE & LLDPE and Polypropylene – PVC – Polystyrene.

Activities: Discuss the recent scenario of petroleum industry
Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.
Assessment Methodology: Assignments (20%), Experimental data analysis and heat transfer calculations (20%), Quiz/MCQs (20%), Internal Examinations (40%).
References 1. Petroleum Refining: Technology and Economics, J.H. Gary and G.E.Handwerk,4th Edition, Marcel Dekkar, Inc., 2001. 2. Elements of Petroleum Processing, D S Jones, Wiley 1995. 3. Petrochemical Process Technology, ID Mall, Macmillan India Ltd., 2007. 4. Modern Petroleum Refining Processes, B.K. Bhaskara Rao, 5th Edition, Oxford & IBH Publishing, 2011.

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Explain crude oil characterization, crude assays, and methods for safe handling and storage of crude oil.	-	-
CO2	Analyze the specifications, properties, and applications of petroleum products used in industrial sectors.	PO1(3), PO2(3)	PSO1(2), PSO2(2)
CO3	Evaluate distillation processes and catalytic refining operations employed in petroleum refineries and petrochemical industries.	PO2(3), PO4(2), PO5(2)	PSO1(3), PSO2(2), PSO3(2)
CO4	Analyze the sources, characteristics, and processing routes of petrochemical feedstocks derived from refining and natural gas operations.	PO1(3), PO2(3), PO10(2)	PSO1(2), PSO2(2), PSO3(1)
CO5	Evaluate petrochemical products and select appropriate technologies for their efficient and sustainable production.	PO3(3), PO5(3), PO10(2)	PSO1(2), PSO2(3), PSO3(2)

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

Course Objectives:

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

List of Activities

Stage Ready – Impactful Public Speaking.

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

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

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

Professional and Application-Oriented Writing

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

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

Receptive Skills in Workplace Communication·

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

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

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

Intercultural Communication

(i) Assertive vs Aggressive communication

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

From Campus to Career: Industry Skills and Global Exam Preparation

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

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

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

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

End Semester Assessment:

1. Interview (50 marks)
2. Verbal Ability test (50 marks)
   (students must bring the resume but evaluation must be done based on the performance in the interview)

References:

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

E-resources:

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

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