EXCEL ENGINEERING COLLEGE

(AUTONOMOUS)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

Accredited by NBA (AERO, CSE, MECH, ECE),

NAAC with "A+" and Recognised by UGC (2f &12B)

Komarapalayam, Namakkal (Dt) – 637303.

B.Tech Petrochemical Technology

CURRICULUM AND SYLLABI

REGULATION - 2023

I^{st} – IVth Semesters

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KOMARAPALAYAM - 637303

DEPARTMENT OF PETROCHEMICAL TECHNOLOGY

REGULATION 2023

B. Tech - Petrochemical Technology

Curriculum for Semesters – I to VIII

I – SEMESTER									
Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
23MA102	Matrices and Calculus	BS	3	1	0	4	40	60	100
23PC101	Introduction to Petrochemical Technology	PC	3	0	0	3	40	60	100
23LET07	Heritage of Tamils (தமிழர் மரபு)	HSS	1	0	0	1	100	0	100
Theory with Practical Courses									
23LEZXX	Language Elective – I	HSS	2	0	2	3	50	50	100
23CH102	Chemistry for Material Sciences	BS	3	0	2	4	50	50	100
23PC102	Organic Chemistry	BS	3	0	2	4	50	50	100
23ME101	Engineering Graphics	ES	1	0	4	3	50	50	100
Mandatory Course									
23MC101	Induction Programme	MC	2 Weeks			0	100	0	100
TOTAL			16	1	10	22	480	320	800

Language Electives – I

Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
23LEE01	Communicative English	HSS	2	0	2	3	50	50	100
23LEE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100

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II – SEMESTER

Code No.	Course	Category	Periods/Week L	T	P	C	Maximum Marks CA	FE	Total
Theory Courses									
23MA202	Mathematical Foundations for Engineering	BS	3	1	0	4	40	60	100
23EE203	Basics of Electrical, Electronics and Instrumentation Engineering	ES	3	0	0	3	40	60	100
23LET08	Tamils & Technology (தமிழரும் தொழில்நுட்பமும்)	HSS	1	0	0	1	100	0	100
Theory with Practical Courses									
23LEZXX	Language Elective – II	HSS	2	0	2	3	50	50	100
23PH202	Materials Physics	BS	3	0	2	4	50	50	100
23CS203	Problem Solving using Python Programming	ES	3	0	2	4	50	50	100
Practical Courses									
23PC202	Chemical Analysis Laboratory	PC	0	0	4	2	60	40	100
Mandatory Course									
23MC202	Environmental Sciences	MC	2	0	0	0	100	0	100
Total			16	2	10	21	490	310	800

Language Electives – II

Code No.	Course	Category	Periods/Week L	T	P	C	Maximum Marks CA	FE	Total
23LEE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100
23LEH03	Hindi	HSS	2	0	2	3	50	50	100
23LEF04	French	HSS	2	0	2	3	50	50	100
23LEG05	German	HSS	2	0	2	3	50	50	100
23LEJ06	Japanese	HSS	2	0	2	3	50	50	100

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III – SEMESTER

Code No.	Course	Category	Periods/Week L	Periods/Week T	Periods/Week P	C	Maximum Marks CA	Maximum Marks FE	Maximum Marks Total
Theory Courses									
23PC301	Fluid Mechanics for Chemical Engineers	PC	3	1	0	4	40	60	100
23PC302	Material Technology for Chemical Engineers	ES	3	0	0	3	40	60	100
23PC303	Chemical Process Calculations	PC	3	1	0	4	40	60	100
23PC304	Petroleum Exploration and Exploitation Techniques	PC	3	0	0	3	40	60	100
23UH001	Universal Human Values	HSS	3	0	0	3	100	0	100
Theory with Practical Courses									
23MA301	Transforms and Boundary Value Problems	BS	3	0	2	4	50	50	100
Practical Courses									
23PC305	Fluid Mechanics Laboratory	PC	0	0	2	1	60	40	100
23PC306	Petroleum Testing Laboratory	PC	0	0	2	1	60	40	100
Mandatory Course									
23MC203	Interpersonal Skills	MC	0	0	2	0	100	0	100
Total			17	3	8	23	530	370	900

IV – SEMESTER

Code No.	Course	Category	Periods/Week L	Periods/Week T	Periods/Week P	C	Maximum Marks CA	Maximum Marks FE	Maximum Marks Total
Theory Courses									
23PC401	Mechanical Operations	PC	3	0	0	3	40	60	100
23PC402	Mass Transfer I	PC	3	0	0	3	40	60	100
23PC403	Heat Transfer	PC	3	0	0	3	40	60	100
23PC404	Natural Gas Engineering	PC	3	0	0	3	40	60	100
23PC405	Professional Ethics In Engineering	HSS	3	0	0	3	40	60	100
Theory with Practical Courses									
23MA402	Statistical and Numerical Methods	BS	3	0	2	4	50	50	100
Practical Courses									
23PC406	Heat Transfer Laboratory	PC	0	0	2	1	60	40	100
23PC407	Mechanical Operations Laboratory	PC	0	0	2	1	60	40	100

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Mandatory Course

23MCXXX	Mandatory Course – IV	MC	2	0	0	0	100	0	100
Total			20	1	4	21	470	430	900

V – SEMESTER

Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Courses									
23PC501	Petroleum Processing I	PC	3	0	0	3	40	60	100
23PC502	Chemical Reaction Engineering	PC	3	0	0	3	40	60	100
23PC503	Mass Transfer II	PC	3	0	0	3	40	60	100
23PC504	Chemical Engineering Thermodynamics	PC	3	1	0	4	40	60	100
23PCEXX	Professional Elective-I	PE	3	0	0	3	40	60	100
23PCOXX	Open Elective – I	OE	3	0	0	3	40	60	100
Practical Courses									
23PC505	Mass Transfer Laboratory	PC	0	0	2	1	60	40	100
23PC506	Chemical Reaction Engineering Laboratory	PC	0	0	2	1	60	40	100
Mandatory Course									
23MCXXX	Mandatory Course – V	MC	2	0	0	0	100	0	100
Total			20	1	4	21	460	440	900

VI – SEMESTER

Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Courses									
23PC601	Petrochemical Derivatives	PC	3	0	0	3	40	60	100
23PC602	Petroleum Processing II	PC	3	0	0	3	40	60	100
23PC603	Process Instrumentation Dynamic and Control	PC	3	0	0	3	40	60	100
23PC604	Process Safety in Petrochemical Industries	PC	3	0	0	3	40	60	100
23PCEXX	Professional Elective-II	PE	3	0	0	3	40	60	100

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MANDATORY COURSES (MC)

Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
23MC101	Induction Programme	MC	2 Weeks			0	100	-	100
23MC202	Environmental Sciences	MC	2	0	0	0	100	-	100
23MC203	Interpersonal Skills	MC	0	0	2	0	100	-	100
23MC004	Indian Constitution	MC	2	0	0	0	100	-	100
23MC005	Yoga and Values for Holistic Development	MC	0	0	2	0	100	-	100
23MC006	Soft Skills	MC	0	0	2	0	100	-	100

OPEN ELECTIVE COURSES (For Other Branches)

Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
23PCO01	Solid Waste Management	OE	3	0	0	3	40	60	100
23PCO02	Corrosion Engineering	OE	3	0	0	3	40	60	100
23PCO03	Green Energy	OE	3	0	0	3	40	60	100
23PCO04	Air Pollution and Control Engineering	OE	3	0	0	3	40	60	100
23PCO05	Composite Material	OE	3	0	0	3	40	60	100
23PCO06	Environmental Impact Assessment and Clean Technology	OE	3	0	0	3	40	60	100

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Code No.	Course	Category	L	T	P	C	CA	FE	Total
23PCOXX	Open Elective – II	OE	3	0	0	3	40	60	100
Practical Courses									
23PC605	Process Control Laboratory	PC	0	0	2	1	60	40	100
23PC606	Design Thinking & Mini Project	EEC	0	0	4	2	60	40	100
23PC607	Internship	EEC	2 Weeks			1	60	40	100
Total			18	0	6	22	520	380	900

VII- SEMESTER									
Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Courses									
23PC701	Transport Phenomena	PC	3	0	0	3	40	60	100
23PC702	Catalytic Reaction Engineering	PC	3	0	0	3	40	60	100
23PC703	Modern Separation Techniques	PC	3	0	0	3	40	60	100
23PCEXX	Professional Elective-III	PE	3	0	0	3	40	60	100
23PCEXX	Professional Elective –IV	PE	3	0	0	3	40	60	100
23PCOXX	Open Elective – III	OE	3	0	0	3	40	60	100
Practical Courses									
23PC704	Process Equipment Design and Drawing	PC	0	0	2	1	60	40	100
23PC705	Design Project	EEC	0	0	4	2	60	40	100
Total			15	0	6	21	360	440	800

1

VIII- SEMESTER									
Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Courses									
23PCEXX	Professional Elective-V	PE	3	0	0	3	40	60	100
23PCOXX	Professional Elective-VI	PE	3	0	0	3	40	60	100
23PC801	Major Project	EEC	0	0	16	8	40	60	100
Total			6	0	16	14	120	180	300

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VERTICAL III : CHEMICAL PROCESS ENGINEERING

Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
23PCE16	Industrial Waste Water Treatment	PE	3	0	0	3	40	60	100
23PCE16	Pharmaceutical Technology	PE	3	0	0	3	40	60	100
23PCE17	Fundamentals of Nano science	PE	3	0	0	3	40	60	100
23PCE18	Surface Coating Technology	PE	3	0	0	3	40	60	100
23PCE19	Drugs and Pharmaceutical Technology	PE	3	0	0	3	40	60	100
23PCE20	Biochemical Engineering	PE	3	0	0	3	40	60	100
23PCE21	Chemical Process Design	PE	3	0	0	3	40	60	100

ONE CREDIT COURSES

Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
23PCA01	Energy conservation Technology	EEC	1	0	0	1	100	0	100
23PCA02	Membrane Technology	EEC	1	0	0	1	100	0	100
23PCA03	MATLAB	EEC	1	0	0	1	100	0	100
23PCA04	Logistics of Chemicals	EEC	1	0	0	1	100	0	100
23PCA05	Sugar Technology	EEC	1	0	0	1	100	0	100
23PCA06	Safe handling of chemicals	EEC	1	0	0	1	100	0	100

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Professional Electives

VERTICAL I : HYDROCARBON & EXPLORATION

Code No.	Course	Category	Periods / Week				Maximum Marks		
			L	T	P	C	CA	FE	Total
23PCE01	Petroleum corrosion Technology	PE	3	0	0	3	40	60	100
23PCE02	Safety in Petroleum Industry	PE	3	0	0	3	40	60	100
23PCE03	Drilling Engineering	PE	3	0	0	3	40	60	100
23PCE04	Unconventional Hydrocarbon Sources	PE	3	0	0	3	40	60	100
23PCE05	Reservoir Characterization and Modeling	PE	3	0	0	3	40	60	100
23PCE06	Petroleum Production Engineering	PE	3	0	0	3	40	60	100
23PCE07	Oil and Natural Gas Engineering	PE	3	0	0	3	40	60	100

VERTICAL II: CHEMICAL TECHNOLOGY

Code No.	Course	Category	Periods / Week				Maximum Marks		
			L	T	P	C	CA	FE	Total
23PCE08	Polymer Technology	PE	3	0	0	3	40	60	100
23PCE09	Electrochemical Engineering	PE	3	0	0	3	40	60	100
23PCE10	Storage and Transportation of Crude oil and Natural gas	PE	3	0	0	3	40	60	100
23PCE11	Fertilizer Technology	PE	3	0	0	3	40	60	100
23PCE12	Unit operations in Chemical Industries	PE	3	0	0	3	40	60	100
23PCE13	Pulp and Paper Technology	PE	3	0	0	3	40	60	100
23PCE14	Process Plant Utilities	PE	3	0	0	3	40	60	100

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CREDIT SUMMARY

S.No	CATEGORY	CREDITS PER SEMESTER								TOTAL CREDITS (AICTE)	CREDITS in %
		I	II	III	IV	V	VI	VII	VIII		
1.	HSS	4	4	3	3	0	0	0	0	14	8.48
2.	BS	12	8	4	4	0	0	0	0	28	16.97
3.	ES	3	7	3	0	0	0	0	0	13	7.88
4.	PC	3	2	13	14	15	13	10	0	70	42.42
5.	PE	0	0	0	0	3	3	6	6	18	10.91
6.	OE	0	0	0	0	3	3	3	0	9	5.45
7.	EEC	0	0	0	0	0	3	2	8	13	7.88
8.	MC	0	0	0	0	0	0	0	0	0	0
	Total	22	21	23	21	21	22	21	14	165	100%

HSS - Humanities and Social SciencesBS -

Basic Sciences

ES   - Engineering Sciences

PC   - Professional Core

PE   - Professional Elective

OE   - Open Elective

EEC - Employability Enhancement Course

MC   - Mandatory Courses (Non-Credit Courses)CA

   - Continuous Assessment

FE   - Final Examination

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23MA102	MATRICES AND CALCULUS (Common to all B.E/B.Tech Programmes)	L	T	P	C
		3	1	0	4

Nature of Course	Basic Sciences
Pre requisites	Nil

Course Objectives

The course is intended to

1. Introduce the concept of orthogonal transformation to convert the square matrix into diagonal form.
2. Acquaint the student with mathematical tools needed in evaluating derivatives and differentiation of one variable.
3. Familiarize the functions of two variables, Taylor series and Jacobian techniques
4. Impart knowledge of double integral techniques in evaluating volume of the solid.
5. Learn the Green's theorem, Stoke's theorem and the Divergence theorem to compute integrals

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Apply the concept of orthogonal reduction for diagonalization of the given matrix	Apply
CO 2	Execute the rules of differentiation to differentiate the functions.	Apply
CO 3	Demonstrate the maxima and minima for a given function with two variables	Apply
CO 4	Apply integration to compute area and volume using multiple integrals	Apply
CO 5	Interpret the Green's theorem, Stokes' theorem and Divergence theorem to evaluate integrals.	Apply

Course Contents

Module – I   MATRICES   9+3

Eigen values and Eigenvectors of a real matrix – Characteristic Equation- Properties – Cayley Hamilton Theorem – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of Quadratic Forms.

Module – II   DIFFERENTIAL CALCULUS   9+3

Functions of single Variable -Limits and Continuity - Derivatives - Differentiation rules(sum, product, quotient, chain rule) – Implicit differentiation-Logarithmic differentiation-Maxima and Minima of function of one variable –Taylors series.

Module – III   FUNCTIONS OF TWO VARIABLES   9+3

Limits and Continuity –Partial differentiation–Homogeneous functions and Euler's theorem–Jacobians –Partial differentiation of implicit functions–Taylor's series– Maxima and minima – Lagrange's method of multipliers.

Module – IV   MULTIPLE INTEGRALS   9+3

Double integrals – Change of order of Integrations- Double integrals in polar coordinates – Areaenclosed by plane curves – Triple integrals – Volume of solids.

Module – V   VECTOR CALCULUS   9+3

Gradient and directional derivative — Divergence and curl — Green's, Gauss divergence and Stoke's theorems — Verification andapplicationInevaluatingline, surfaceandvolumeIntegrals (cube, rectangular parallelepiped).

Total : 60 Periods

Text Books

1. B.K.Pal and K.Das , "Engineering Mathematics", Volume-1, 10th Edition, U.N.Dhur and Sons private limited,2020
2. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, Delhi, 44th Edition, 2019.

Reference Books

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 1st Edition, 2018
2. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics Semester II", Laxmi Publications, 6th Edition 2015.
3. Veerarajan T," Engineering Mathematics for Semester I and II", Tata McGraw Hill, 3rd Edition 2017.

Additional References

1. NPTEL-https://nptel.ac.in/courses/111105035
2. NPTEL-https://nptel.ac.in/courses/111104144
3. NPTEL- https://nptel.ac.in/courses/111105122

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	2										1	
CO 2	3	3	2										1	
CO 3	3	1	1										1	
CO 4	3	2	1										1	
CO 5	3	2	2										1	
	3-High .			2-Medium			1-Low							

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

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Formative Assessment

Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	
Understand	Tutorial class / Assignment	5	15
Apply			
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (5)	IAE – II (10)	IAE – III (10)	60
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyse				
Evaluate				
Create				

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Passed in Board of Studies Meeting 17.03.23   Passed in Academic Council Meeting 27.04.23

23PC101	INTRODUCTION TO PETROCHEMICAL TECHNOLOGY	L	T	P	C
Nature of course	Professional Core	3	0	0	3
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Study the evolution, impact and role of petrochemical industry in global market.
2. Provide the knowledge on the basic concepts on the occurrence of petroleum and exploration methods.
3. Teach the various test methods available for petroleum products.
4. Enable the students to impart knowledge on the basic concepts and application of drilling.
5. Relate the primary, secondary and enhanced oil recovery in improving the quality of petroleum products.

Course Outcomes

On the completion of the course students are expected to

CO. No	Course Outcome	Bloom's Level
CO 1	Discover the petrochemical industry and its importance in global perspective	Remember
CO 2	Summarize the preliminary petroleum exploration concepts and theories using petroleum geology	Understand
CO 3	Illustrate the various test methods in deriving the petrochemical products	Understand
CO 4	Summarize the importance of drilling in petroleum and petrochemical industry	Understand
CO 5	Relate the oil recovery using primary, secondary and enhanced methods	Understand

Course Contents

Unit – I	Introduction to Petrochemical Technology	
		9

Evolution and overview of petrochemical industry, Role of Petrochemical Engineer. Major companies in India & abroad. Prospects & Future. Composition of crude oil, Physical properties of oil. Petroleum Materials – Native Materials, Manufactured Materials, Derived Materials.

Unit – II	Origin of oil & gas	
		9

Biogenic & Abiogenic theory, Occurrence, Migration & accumulation of oil & gas. Basic Concepts of Petroleum Geology. Rocks and fluid properties: Physical properties of oil bearing rocks, Carbonate reservoirs Fracture, Anticlines etc, Type of reserve fluids.

Unit – III	Petroleum Products and Test Methods	
		9

Crude oil Analysis, Different types of fuels & their test methods (Domestic fuels, Automotive fuels, Aviation fuel, Furnace fuels, Lubricating Oil and Miscellaneous Products)

Unit – IV	Oil & gas exploration methods	
		9

Geological and Geophysical methods. Drilling: Introduction to drilling operations, Basics of drilling, Drilling rig, Drilling equipment & its components. Oil Field development, Well completion fundamentals.

Unit – V	Reservoir drives & Oil Recovery	
		9

Primary oil recovery, Secondary oil recovery. Enhanced oil recovery methods: Chemical, Thermal & Others Recovery of Heavy Oil & Tar Sand Bitumen: Oil Mining & Non Mining Methods. Products and Product Quality.

Total : 45 Periods

Passed in Board of Studies

Approved in Academic Council Meeting

Text Books

1. J. G. Speight and B. Ozum, Petroleum Refining Process, Marcel Dekker, 2002.
2. R. Meyers, Handbook of Petrochemicals Production Processes, Mcgraw Hill, 2005

Reference Books

1. D.S.J. Jones and P. R. Pujadó, Handbook of Petroleum Processing, Springer, 2006.
2. J. H. Gary and G. E. Handwerk, Petroleum Refining: Technology and Economics, 4th Ed., Marcel Dekker, 2001.
3. C.S. Hsu and P. R. Robinson, Practical Advances in Petroleum Processing, Springer, 2006.

Additional / Web References

1. https://www.youtube.com/watch?v=INqhbll8r4Q
2. https://www.youtube.com/watch?v=PdStB9z37eA
3. https://www.youtube.com/watch?v=GRwqkkyHaXI

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	3	2				2			1	1	2	2
CO 2	3	3	2	3	1			2			1	1	2	2
CO 3	2	3	3	3	1			2			1	1	2	2
CO 4	2	3	3	3	1			2			1	1	2	2
CO 5	2	2	3	3	1			2			1	1	2	2
	3	High				2	Medium				1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (5)	IAE – 2 (10)	IAE – 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

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Approved in Academic Council Meeting

23L-ET07   தமிழர் மரபு   **LTPC**
                                             1 0 0 1

அலகு I   மொழி மற்றும் இலக்கியம்:   3
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.

**அலகு II   மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை –
                சிற்பக் கலை:**   3
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 கோயில்களின் பங்கு.

அலகு III   நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:   3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV   தமிழர்களின் திணைக் கோட்பாடுகள்:   3
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.

**அலகு V   இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத்
               தமிழர்களின் பங்களிப்பு:**   3
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

                                         TOTAL : 15 PERIODS

TEXT 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)

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REFERENCE BOOKS

1. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
2. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
3. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
4. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
5. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

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23LET07

HERITAGE OF TAMILS

L T P C
1 0 0 1

UNIT I   LANGUAGE AND LITERATURE   3
Language Families in India - Dravidian Languages – Tamil as aClassical 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.

UNIT II   HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE   3
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, Perai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III   FOLK AND MARTIAL ARTS   3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV   THINAI CONCEPT OF TAMILS   3
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.

UNIT V   CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE   3
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.

TEXT BOOKS   **TOTAL : 15 PERIODS**

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)

REFERENCE BOOKS

1. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
2. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
3. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
4. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
5. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

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23LEE01	COMMUNICATIVE ENGLISH	L	T	P	C
	Common to all B.E./B.Tech Programmes	2	0	2	3
Nature of Course	Humanities and Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Improve lexical, grammatical and semantic competence.
2. Enhance communicative skills in real life situations.
3. Augment thinking in all forms of communication.
4. Equip with oral and written communication skills.
5. Gain employability skills.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Use effectively the lexical, grammatical and semantic knowledge	Understand
CO2.	Communicate with clarity using intentional vocabulary in English	Apply
CO3.	Articulate perfectly and express their opinions confidently	Apply
CO4.	Accomplish listening and reading skills for life long learning	Apply
CO5.	Comprehend, interpret and present data	Understand

Course Contents:

MODULE I   BASIC GRAMMAR AND USAGE   9
Grammar: Parts of Speech – Verb (Primary & Modal Auxiliary) – Prefixes and Suffixes Listening: Listening Skills: Importance and Types of Listening – Barriers of Listening - Listening to short monologues Speaking: Introducing oneself – Role play Reading: Types of Reading – Intensive reading – Extensive Reading – Reading Comprehension Writing: Permission letter (Industrial Visit) – Informal letter – Dialogue writing

MODULE II   APPLICATIONS OF LANGUAGE SKILLS   9.
Grammar: Tenses (Present, Past and Future) – Different Forms of a word – Types of Questions Listening: Listening strategies – Listening to Announcements Speaking: Likes and dislikes- Movie Reviews – Reading: Skimming - Scanning - Reading Newspaper and Articles Writing: Inviting Dignitaries – Accepting Invitation – Declining Invitation.

MODULE III   CONVERSATIONAL SKILLS   9
Grammar: If conditionals – Numerical Adjectives Listening: - Listening to Telephone calls and taking notes – Listening Lectures Speaking: Technical Presentation – Group Discussion Reading: Reading Magazines - Cloze Test Writing: Calling for Quotation – Complaint Letter – Process Description

MODULE IV   GRAMMATICAL ACCURACY COMPETENCE   9
Grammar: Subject verb agreement – Discourse markers - One word substitution Listening: Listening and gap filling – Listening and Match the answers Speaking: Narrating Story - Asking and giving directions Reading: Rearranging Jumbled sentence - Note making Writing: Instructions – Hints Developing – Report Writing (Fire and Accident Report)

Passed in Board of Studies Meeting on 17.03.23   Passed in Academic Council Meeting on 27.04.23

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MODULE V   TECHNICAL WRITING SKILLS

Grammar: Homophones and Homonyms - Abbreviation and Acronyms **Listening:** Listening announcements – Listening and Summing up **Speaking:** Impromptu speech – Presentation at a business meeting **Reading:** Reading and summarizing articles **Writing:** Paragraph Writing – Checklist – Story writing.

Total: 45 Periods

Laboratory Components

S.No.	List of Exercises	CO Mapping	RBT
1	Self Introduction	1	Understand
2	Movie Review	2	Apply
3	Group Discussion	3	Apply
4	Asking and Giving Directions	4	Apply
5	Impromptu Speech	5	Apply
6	Listening to short monologues	1	Understand
7	Listening to Announcement	2	Understand
8	Listening Telephone calls	3	Understand
9	Listening and Gap Filling	4	Apply
10	Listening and Match the answers	4	Apply

Text Books

1. Rizvi, Ashraf.M, "Effective Technical Communication",Tata McGraw Hill Publishing company Limited,New Delhi, 2nd Edition, 2018.
2. Hewings. M, "Advanced English Grammar", 3rd Edition, Cambridge University Press, Chennai, 9th Edition, 2019.
3. Board of Editors, "Using English – A Course book for Undergraduate Engineers and Technologists", Orient Black Swan Private Limited, Hyderabad, 3rd Edition, 2019.

Reference Books:

1. Raman M & Sangeetha Sharma, "Technical Communication", Oxford University Press,USA,13thEdition,2018.
2. Norman Whitby, Business Benchmark – "Pre-Intermediate to Intermediate, Students Book", Cambridge University Press, 1st Edition, 2006.
3. Dhanavel S. P., "English and Soft Skills", 1stEdition, Orient Black Swan Private Limited, Hyderabad, 1st Edition, 2010.

Web References:

1. https://www.englishclub.com/grammar/
2. https://learnenglish.britishcouncil.org
3. https://www.indiabix.com/verbal-ability/questions-and-answers/
4. https://www.ello.org
5. https://englishforeveryone.org/Topics/Reading-Comprehension.html

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Passed in Board of Studies Meeting on 17.03.23   *Passed in Academic Council Meeting on 27.04.23*

Mapping of Course Outcomes (CO) with Programming Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3	1	2	2		
CO2										3	1	2	2		
CO3										3	1	2	2		
CO4										3	1	2	2		
CO5										3	1	2	2		
	3		High		2		Medium			1		Low			

Bloom's Level	Summative assessment					Final Examination (Theory) [50 marks]
	Continuous Assessment				Practical	
	Theory Marks				Rubric based CIA [20 Marks]	
	IAE-I [5]	IAE-II [10]	IAE -III [10]	Attendance [5]		
Remember	-	-	-		-	-
Understand	40	40	40		40	40
Apply	60	60	60		60	60
Analyse	-	-	-		-	-
Evaluate	-	-	-		-	-
Create	-	-	-		-	-

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23CH102	CHEMISTRY FOR MATERIALS SCIENCE (Common to AERO, AGRI, CIVIL, MECH, PCT and SF)	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Impart knowledge and understanding about the constituents present in water and the need for purification of water.
2. Provide knowledge about the basic principles, preparatory methods and applications of nanomaterials.
3. Understand the causes and control measures of corrosion.
4. Learn about the nature, types of the soil and suitable fertilizers for different types of soil.
5. Gain knowledge about fuels and calorific value of solid fuel, liquid fuel and gaseous fuel.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Develop innovative and eco-friendly method for water purification to meet the growing industrial demand.	Apply
CO 2	Discuss the basic principles, synthesis and applications of nanomaterials	Understand
CO 3	Demonstrate the importance of protection of metals from corrosion.	Understand
CO 4	Identify the nature of the soil and to decide fertilizer for a particular soil depending on its nature	Understand
CO 5	Classify fuels based on their efficiency of combustion.	Apply

Course Contents

Module – I   WATER ANALYSIS AND WATER TREATMENT   9

Water analysis: Sources of water, hard water and soft water, Hardness of water, acidity, alkalinity, pH value. Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD). Water treatment: Definition, Zeolite process, Conditioning methods: internal conditioning (Phosphate, Calgon) and external conditioning (Demineralization), Desalination, Reverse-osmosis (RO).

Module – II   NANOCHEMISTRY   9

Basics: Distinction between molecules, nanomaterials and bulk materials, Size-dependent properties, Types of nanomaterials: Definition, properties, and uses of nanoparticle, nanocluster, nanorod, nanowire and nanotube. Synthesis: Sol-Gel and laser ablation methods. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

Module – III   CORROSION AND ITS CONTROL   9

Corrosion: Classification, Types: Chemical corrosion and Electrochemical corrosion. Corrosion control: Corrosion inhibitors, cathodic protection (sacrificial anodic protection, impressed current cathodic protection), Protective coating, Paint and Electroplating.

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Module – IV   SOIL CHEMISTRY& FERTILIZER

9

Types of soil: saline soil, acidic soil and alkaline soil, submerged soil, salt affected and calcareous soil. Characteristics and Reclamation. Effect of N, P, K, Secondary nutrients and micronutrients on plant growth and development. Importance of nitrogenous fertilizers. Green manuring: definition and examples.

Module – V   FUELS AND COMBUSTION

9

Solid fuel: Coaland its varieties, analysis of coal: proximate and ultimate with their significance. Manufacture of metallurgical coke (Otto-Hoffmann method).Liquid fuel: petroleum oil. Knocking: octane number. Diesel: cetane number. Gaseous fuels - Water gas and Liquefied Petroleum Gas. Combustion: Introduction, Calorific value: Gross and net calorific value, Dulong's formula and problems..

Total : 45 Periods

Laboratory Component

S.No.	Name of the Experiment	CO Mapping	RBT
1	Determination of hardness of water.	3	Apply
2	Determination of chloride content in water sample.	3	Apply
3	Conductometric titration of strong acid versus strong base.	3	Apply
4	Determination of strength of HCl by pH metry.	3	Apply
5	Estimation of copper in brass by EDTA method.	3	Apply
6	Determination of rate of corrosion by weight loss method	3	Apply
7	Estimation of strength of iron by potentiometric titration	3	Apply
8	Determination of strength of acids in a mixture of acids using conductivity meter	3	Apply

Total Periods: 30

Text Books

1. Dr. A. Ravikrishnan, "Engineering Chemistry" Sri Krishna Hitech Publishing Company, Chemistry, 2021.
2. N. Krishnamurthy, "Engineering Chemistry" PHI Learning, 4th Edition, 2020.
3. Dr.Sunita Rattan. Publisher, S.K. Kataria& Sons. Edition, Reprint, 2020

Reference Books

1. S. S. Dara, "A Text Book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018
2. B.S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
3. Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2017

Additional References

1. https://nptel.ac.in/downloads/122101001
2. https://nptel.ac.in/courses/103103033/module9/lecture1.pdf
3. https://nptel.ac.in/courses/102103044/3
4. https://www.youtube.com/watch?v=jFQeDef6bug

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Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2									1			
CO 2	3	2									1			
CO 3	3	1									1			
CO 4	3	2									1			
CO 5	3	2									1			
	3-High			2-Medium				1-Low						

Summative Assessment

Bloom's Level	Continuous Assessment					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [20]	
Remember	20	20	20		-	30
Understand	25	25	25		40	60
Apply	5	5	5		60	10
Analyze	-	-	-		-	
Evaluate	-	-	-		-	
Create	-	-	-		-	

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23PC102	ORGANIC CHEMISTRY	L	T	P	C
		3	0	2	4

Nature of Course	Basic Science
Pre requisites	Nil

Course Objectives

The course is intended to

1. Learn basic principles involved in analysis and synthesis of different organic derivatives.
2. Provide an advanced understanding of the core principles and topics of Organic chemistry.
3. Learn the basic principles of analytical techniques.
4. Acquire a specialized knowledge and understanding in Polynuclear Aromatics.
5. Understand the concept of mechanism of Organic Reactions.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Implement the Organic Reaction Mechanism	Understand
CO 2	Interpret the properties of Carbohydrates	Analyze
CO 3	Summarize the chemistry Polynuclear Aromatics And Heterocycles	Understand
CO 4	Identify the nature of Amino Acids And Proteins	Understand
CO 5	Decide the Characterization and properties of Drugs & Dyes	Apply

Course Contents

Module – I	ORGANIC REACTION MECHANISM	9

Electrophilic reactions- Friedel crafts reaction- RiemerTiemenn reaction- Beckmann rearrangements; nucleophilic reactions- aldol condensation, perkin reaction, benzoin condensation; free radical reaction- halogenation of alkane

Module – II	CARBOHYDRATES	9

Introduction - mono and disaccharides - Important reactions – oxidation, reduction, reaction with HCN, hydroylamine - polysaccarides - cellulose - derivatives of cellulose - carboxy methyl cellulose and gun cotton - structural aspects of cellulose

Module – III	POLYNUCLEAR AROMATICS AND HETEROCYCLES	9

Classification of polynuclear aromatics- naphthalene- preparation, properties and uses. Classification of heterocyclic compounds ;Furan –thiophene – pyrrole – pyridine- quinoline, isoquinoline - preparation, properties and uses.

Module – IV	AMINO ACIDS AND PROTEINS	9

Classification- preparation of Strecker, Gabriel phthalimide- properties of Amino acidsComposition and classification of proteins- Structure of proteins - tests for proteins.

Module – V	DRUGS & DYES	9

Classification and properties of drugs.Penicillin sulpha drugs- mode of action- synthesis of sulphanilamide - Colour and constitution- chromogen and chromophore- Classification of dyes based on mode of dyeing- Synthesis of dyesMalachite green- methyl orange- congo red-phenolphthalein.

Total : 45 Periods

LIST OF EXPERIMENTS

S.NO	Name of the Experiment	CO Mapping	RBT
1.	Quantitativeanalysisoforganiccompounds– Identificationofaliphatic/aromatic,saturated/unsaturated compounds	2	Evaluate
2.	Identification and characterization of various functional groups by their characteristic reactions: a)alcohol, b)aldehyde, c)ketone, d)carboxylicacid, e)phenol	2	Evaluate
3.	Analysis of an unknown organic compound and preparation of suitable solid derivatives (Benzoic acid from Benzaldhehyde, hydrolysis of ester)	3	Analyze
4.	Analysis of an unknown organic compound and preparation of suitable solid derivatives (meta- dinitrobenzene from nitrobenzene)	3	Analyze
5.	Identification and characterization of various functional groups by their characteristic reactions: a) ester, b) primary, secondary and tertiary amines and c) nitrocompounds	2	Analyze
6.	Introduction to organic synthetic procedures: i. Acetylation – Preparation of acetanilide from aniline. ii. Hydrolysis–Preparation of salycilic acid from methyl salyciliate. iii. Nitration–Preparation of m-dinitro benzene from nitrobenzene. iv. Oxidation–Preparation of benzoic acid from Benzaldehyde / benzylalcohol	2	Evaluate
7.	Analysis of carbohydrates	2	Analyze
8.	Analysis of proteins	3	Analyze
9.	Methodology of filtration	2	Evaluate
10.	Methodology of recrystallization	2	Evaluate
		Total:30Periods	

Text Books

1. B.S.Bhal and ArunBhal, "A Text Book of Organic Chemistry", 17th Ed., S Chand & Co. NewDelhi, 2005Satyanarayana U. and Chakerapani U., "Biochemistry", Books & Allied (P) Ltd, 3rdRev.Edition2006.
2. R.T.MorrisonandR.N.Boyd"OrganicChemistry",7thEd.,PrenticeHallInc.USA,2010.
3. Jonathan Clayden, Nick Greeves, Staurt Warren and Peter Wothers, "Organic Chemistry",OxfordUniversityPress,2ndEd.,NewDelhi,2013.

Reference Books

1. Organic Chemistry Lab Manual, Chemistry Division, Chemical Engineering Department, A.C.Tech,AnnaUniversity,2007.
2. Vogels's Text Book of Practical Organic Chemistry, Fifth Edition, Longman SingaporePublishersPte.Ltd.,Singapore,1989

Additional References

1. http://unaab.edu.ng/funaab-ocw/index.php/biochemistry-80342/lecture-notes-32095
2. http://egyankosh.ac.in/handle/123456789/32934
3. https://microbenotes.com/amino-acids-properties-structure-classification-and-functions/
4. https://www.coursehero.com/file/17782635/Nutritional-Organicchemistry/
5. https://www.pinterest.com/lianashep/Organicchemistry-notes/

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2										1	2	
CO 2	3	2										1	2	
CO 3	3	2										1	2	
CO 4	3	3										1	2	
CO 5	3	2										1	2	

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

3-High 2-Medium 1-Low

Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (5)	IAE – II (10)	IAE – III (10)	60
Remember	20	20	20	40
Understand	20	20	20	40
Apply	10	10	10	20
Analyse				
Evaluate				
Create				

Summative Assessment

CHAIRMAN-BOARD OF STUDIES

Passed in Board of Studies Meeting   Passed in Academic Council Meeting

23ME101	Engineering Graphics (Common to All Branches)	L	T	P	C
		1	0	4	3
Nature of Course	Engineering Sciences				
Prerequisites	Nil				

Course Objectives:

The course is intended to

1. Understand visualization concepts, layouts and pictorial views in various fields of engineering
2. Imagine and visualize the principal planes of engineering objects.
3. Translate the geometric information of engineering objects into projections of solids.
4. Develop the graphical skills for communication of concepts, ideas and design of engineering products through sectional technical drawings.
5. Visualize and draw isometric views

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Develop the conic sections, special curves, and draw orthographic views from pictorial views.	Apply
CO 2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in first quadrant.	Apply
CO 3	Construct the projections of simple solids like prisms, pyramids, cylinder and cone.	Apply
CO 4	Build the sectional views of solids like cube, prisms, pyramids, cylinders & cones and development of its lateral surfaces.	Apply
CO 5	Organize and draw isometric view of simple solids.	Apply

Course Contents

Concepts and Conventions (Not for Examination)   1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

Module -I   Plane Curves and Free Hand Sketching   (3+12)
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three- Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

Module –II   Projection of Lines and Plane Surface   (3+12)
Orthographic projection- principles-Principal Planes-First angle projection- Projection of points - Projection of straight lines (only First angle projections) inclined to both the principal planes -

Passed in Board of studies Meeting 28.02.2023 Approved in Academic Council Meeting 27.04.2023

CHAIRMAN - BOARD OF STUDIES

Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Module –III   Projection of Solids   (3+12)
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

Module - IV   Projection of Sectioned Solids and Development of Surface   (3+12)
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section, Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

Module -V   Isometric Projections   (3+12)
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems.

TOTAL: (15+60) Periods

TEXT BOOKS
1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2011
2. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012.

REFERENCE BOOKS
1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Parthasarathy N S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.

Web References
1. http://nptel.ac.in/courses/112103019/Engineering drawing
2. http://pioneer.netserv.chula.ac.th/~kjirapon/self-practice.html

Publication of Bureau of Indian Standards
1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable only to Final Examinations of Engineering Graphics:
1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

Passed in Board of studies Meeting 28.03.2023   **CHAIRMAN -BOARD OF STUDIES**   *Approved in Academic Council Meeting 27.04.2023*

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2										1	2		
CO 2	3	2										1	2		
CO 3	3	2										1	2		
CO 4	3	3										1	2		
CO 5	3	2										1	2		
	3			High		2		Medium			1			Low	

	Summative assessment					
	Continuous Assessment					Final Examination (Theory) [50 marks]
	Theory				Practical	
Bloom's Level	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	10	10	10		20	20
Understand	20	20	20		40	40
Apply	20	20	20		40	40
Analyse						
Evaluate						
Create						

23MC101	INDUCTION PROGRAMME	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory, Non Credit				
Pre requisites	Completion of Schooling at Higher Secondary Level				

Course Objectives

The course is intended to

1. To nurture the character and behavior as a student.
2. To have broad understanding of society andrelationships.
3. To impart interpersonal and softskills.
4. To inspire the students in the field ofengineering.
5. To provide exposure toindustries.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Perform curricular and co-curricular activities excellently.	Knowledge
CO 2	Do the skill based training with excellence.	Understand
CO 3	Work as team for the given task	Apply
CO 4	Gain character and behaviour	Knowledge
CO 5	Demonstrate the acquired skills effectively	Apply

Course Contents
PHYSICAL ACTIVITY
Yoga, Sports

CREATIVE ARTS (students can select any one of their choice)
Painting, sculpture, pottery, music, craft making and so on

UNIVERSAL HUMAN VALUES
Enhancing soft skills

LITERARY AND PROFICIENCY MODULES
Reading, Writing, Speaking- Debate, Role play etc., Communication and computer skills

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Passed in Board of Studies Meeting 17.03.23   Passed in Academic Council Meeting27.04.23

LECTURES BY EMINENT PEOPLE
Guest lecture by subject experts

VISIT TO LOCAL CITIES
Meditation centers / Industry

FAMILARIZATION TO DEPARTMENT / BRANCH INNOVATION
Lectures by Departments Head and senior faculty members

Total Hours: 45

Mapping of COs with POs and PSOs

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						2	1	2				3	2		
CO2						2	1	2				3	2		
CO3						2	1	2				3	2		
CO4						2	1	2				3	2		
CO5						2	1	2				3	2		
	3		High			2			Medium			1	Low		

Bloom's Level	Continuous Assessment (Non-Credit, Mandatory)				
	Test -I [20]	Test -II [20]	Test - III [20]	Assignment/ Activity [20]	Attendance [20]
Remember	10	10	10		
Understand	20	20	20	10	
Apply	20	20	20	10	
Analyse					
Evaluate					
Create					

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Passed in Board of Studies Meeting 17.03.23   Passed in Academic Council Meeting 27.04.23

23MA202	MATHEMATICAL FOUNDATIONS FOR ENGINEERING	L	T	P	C
	(Common to all B.E. / B.Tech Programme)	3	1	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

Course Objectives

The course is intended to

1. Understand the curvature and calculate the radius of curvature, centre, evolutes, involutes.
2. Acquire the mathematical skills required to solve ordinary differential equations.
3. Familiarizethe concepts of Laplace transform and its inverse.
4. Gain knowledge of analytic approach to analyse the conformal mapping.
5. Obtainthe knowledge of evaluating contour integrals using residue theorem.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Identify the circle of curvature, evolutes and involutes of the curves.	Apply
CO2	Demonstrate various techniques to solve ordinary differential equations.	Apply
CO3	Select Laplace transform to standard functions and solve initial value problems / differential equations .	Apply
CO4	Find an analytic function ,when its real or imaginary part is known	Apply
CO5	Classify the Singularities and its corresponding Residues for the given function	Apply

Course Contents:

Module – I	APPLICATION OF DIFFERENTIAL CALCULUS	12

Curvature – Curvature in Cartesian co-ordinates - Centre and Radius of curvature- Circle of curvature- Evolutes and Involutes.

Module – II	ORDINARY DIFFERENTIAL EQUATION	12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – non-Homogenous equation - Euler and Legendre Equations.

Module – III	LAPLACE TRANSFORMS	12

Laplace transform –Transform of elementary functions –Properties –Transforms of derivatives and integrals -Transform of periodic functions. Inverse Laplace transform –Statement and applications of Convolution theorem - Method of solving second order ordinary differential equations with constant coefficients by using Laplace transform technique.

Module – IV	ANALYTIC FUNCTIONS	12

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping : w = a+z, az, 1/z – Bilinear transformation.

Module – V	COMPLEX INTEGRATION	12

Line integral - Cauchy's integral theorem –Cauchy's integral formula – Taylor's and Laurent's series — Singularities — Residues — Residue theorem — Application of residue theorem for evaluation of real integrals.

Total: 60 Periods

Text Books:
1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2019.
2. Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Limited, 10th Edition, 2016.

Reference Books:
1. Bali.N.P and ManishGoyal N.P, "A text book of Engineering Mathematics", Laxmi Publications, 6th Edition, 2015.
2. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, 1st Edition, 2018.
3. Veerarajan T," Engineering Mathematics for Semester I and II", Tata McGraw Hill, 3rd Edition 2017.

Additional References:
1. https://onlinecourses.nptel.ac.in/noc24_ma12/preview
2. https://onlinecourses.swayam2.ac.in/cec24_ma10/preview
3. https://onlinecourses.nptel.ac.in/noc24_ma37/preview

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3												
CO2	3	3	2												
CO3	3	2	2												
CO4	3	3	3												
CO5	3	3	3												

3	High			2	Medium			1	Low	

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class /Assignment	5	15
	Attendance	5	

Passed In Board of Studies Meeting on 28.12.2023   Passed In Academic Council Meeting on 11.01.2024

CHAIRMAN - BOARD OF STUDIES

Summative Assessment				
Bloom's Category	Internal Assessment Exam			Final Examination (60)
	IAE I (5)	IAE II (10)	IAE III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

23EE203	BASICS OF ELECTRICAL , ELECTRONICS AND INSTRUMENTATION ENGINEERING (Common to PCT & M.TECH- CSE)	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Engineering Science				

Course Objectives

The course is intended to

1. Introduce the basic concepts of electrical elements and measuring instruments.

2. Familiarize the basics of electric circuits and analysis

3. Impart knowledge in the basics of working principles and application of electrical machines.

4. Predict the analog devices and their characteristics

5. Educate on the fundamental concepts of digital electronics.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Express the operating principles of electrical elements and measuring instruments	Understand
CO 2	Compute the electric circuit parameters for simple problems.	Apply
CO 3	Examine the working principle and applications of electrical machines	Understand
CO 4	Explain the characteristics of analog electronic devices	Understand
CO 5	Discuss the basic concepts of digital electronics	Understand

Course Contents

Module – I	INTRODUCTION AND MEASURING INSTRUMENTS	9
Resistance, Inductance, Capacitance, Wires and Cables Ammeter, Voltmeter, Wattmeter, Energy meter, Thermistor and Anemometer		
Module – II	ELECTRICAL CIRCUITS	9
Ohm's Law, Kirchhoff's Laws, Mesh and Nodal analysis (D.C Circuits), Introduction to AC Circuits, Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor.		
Module-III	ANALOG ELECTRONICS	9
Semiconductor Materials: Silicon &Germanium ,Construction and operating characteristics of PN Junction Diodes, Zener Diode , Half wave and Full wave Rectifiers , Bipolar Junction Transistor ,CB, CE, CC Configurations and Characteristics.		
Module – IV	DIGITAL ELECTRONICS	9
Number System ,Logic Gates ,Boolean algebra ,Adders, Subtractors, SOP and POS forms, K-map representations, minimization using K maps (Simple Problems only)		

Passed in Board of Studies Meeting (13.12.2023)   Approved in Academic Council Meeting (11.01.2024)

CHAIRMAN - BOARD OF STUDIES   CHAIRMAN - ACADEMIC COUNCIL

Module – V	ELECTRICAL MACHINES	9
	Construction and working: DC Motor, DC Generator, Single Phase Transformer.	
		Total : 45 Periods

Text Books

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2. S.K. Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

Reference Books

1. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
3. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
4. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

Additional References

1. NPTEL - https://nptel.ac.in/courses/108105017
2. NPTEL -https://onlinecourses.nptel.ac.in/noc21_ee55/preview
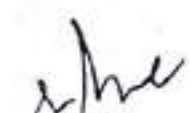
Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	1	1										1	1
CO 2	3	2	1										1	1
CO 3	2	1	1										2	1
CO 4	2	1	1										2	1
CO 5	2	1	1										2	1
	3-High			2-Medium				1-Low						

Passed in Board of Studies Meeting (13.12.2023)

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting (11.01.2024)

CHAIRMAN - ACADEMIC COUNCIL

Formative Assessment			
Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	
Understand	Tutorial class / Assignment	5	15
Apply			
	Attendance	5	

	Summative Assessment			
Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (5)	IAE – II (10)	IAE – III (10)	60
Remember	10	10	10	20
Understand	40	20	30	60
Apply		20	10	20
Analyse				
Evaluate				
Create				

Passed in Board of Studies Meeting (13.12.2023)
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting (11.01.2024)
CHAIRMAN - ACADEMIC COUNCIL

23LET08	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY (Common to all B.E. / B.Tech Programme)	L	T	P	C
		1	0	0	1
Nature of Course	Humanities and Sciences				
Pre requisites	Tamil				

Course Objectives

The course is intended to

1. Introduce students to the great technology of ancient Tamil society.
2. Realize the contribution of various technologies for the development of governing area.
3. Highlighting the different manufacturing technology to make the coins, jewels, stones, art etc.
4. Know the role of agriculture, water management system and food processing.
5. Learn about the Scientific Tamil and Tamil computing of the past and how it has evolved over the generations.

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Remember the life style and technology of the Sangam people.	Remember
CO 2	Get an updated knowledge of ancient designing and construction of House, Temple, hero stones etc.	Understand
CO 3	Learnt the speciality of manufacturing technology types and usages.	Understand
CO 4	Gain the knowledge on production of agricultural products based on the ancient technologies.	Understand
CO 5	Understand the evaluation of Tamil language through the digital system.	Understand

Course Contents (in Tamil)

அலகு - I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	2
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில் நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.		

அலகு - II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	2
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் 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 கட்டிடக் கலை - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.		

Passed in Board of Studies Meeting on 28.12.2023   Passed in Academic Council Meeting on 11.01.2024

CHAIRMAN - BOARD OF STUDIES

அலகு - III	உற்பத்தித் தொழில் நுட்பம்	2

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சன்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் -நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு - IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்	2

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழிகள் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார்.

அலகு - V	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்	2

அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

Total : 10 Periods

Course Contents (in English)

Module – I	WEAVING AND CERAMIC TECHNOLOGY	2

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

Module – II	DESIGN AND CONSTRUCTION TECHNOLOGY	2

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

Module – III	MANUFACTURING TECHNOLOGY	2

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 Stone beads –Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

Module – IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	2

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of 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.

Module – V	SCIENTIFIC TAMIL & TAMIL COMPUTING	2

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total : 10 Periods

பார்வை நூல்கள் (TEXT-CUM-REFERENCE BOOKS)

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

Passed in Board of Studies Meeting on 28.12.2023   Passed in Academic Council Meeting on 11.01.2024

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23LEE02	ADVANCED COMMUNICATIVE ENGLISH	L	T	P	C
	(Common to all B.E. / B.Tech Programme)	2	0	2	3
Nature of Course	Humanities and Sciences				
Pre requisites	Communicative English				

Course Objectives

The course is intended to

1. Hone professional communication skills, including email etiquette and formal presentation.
2. Develop advanced vocabulary and collocation for official communication.
3. Communicate effectively and actively in social interactions.
4. Improve writing skills such as project and report writing for various purposes.
5. Foster collaborative communication abilities through group discussion in diverse contexts.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Communicate professionally in various contexts.	Understand
CO 2	Make use of common English phrases and vocabulary.	Understand
CO 3	Integrate basic English communication skills at a personal and a professional level in day-to- day interaction.	Apply
CO 4	Implement listening, reading and writing skills in real - life situations	Apply
CO 5	Decipher collaborative communication skills through diversified contexts.	Understand

Course Contents

Module – I	TECHNICAL VOCABULARY AND USAGE	9

Grammar: Technical Vocabulary (Synonyms and antonyms) - Articles - Reported Speech - **Listening:** Listening to video lectures (TED / INK Talks) **Speaking:** Describing pictures, places – Speaking practice to improve pronunciation **Reading:** Critical reading from the given text **Writing:** Job Application with Resume - E mail writing.

Module – II	EFFECTIVE OFFICIAL COMMUNICATION	9

Grammar: Collocation – Question tags – Prepositions **Listening:** Listening to telephonic conversation **Speaking:** Role plays – Telephonic Etiquette and telephonic phrases **Reading:** Company profile - Advertisement (job / product) **Writing:** – Preparing Memo – Prepare Circular, Agenda and Minutes – Placing Order – Prepare Advertisement.

Module – III	TECHNICAL LANGUAGE SKILLS FOR CONVERSATION	9

Grammar: Degrees of Comparison – Conjunctions **Listening:** Sports commentaries – Animated short stories **Speaking:** Asking for and giving directions – Describing simple process **Reading:** Reading and understand technical vocabulary **Writing:** Letter to the Editor – Review of Favourite Movie / Book – Recommendations.

Passed in Board of Studies Meeting on 28.12.2023   Passed in Academic Council Meeting on 31.01.2024

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Module – IV	LANGUAGE FOR BUSINESS CORRESPONDENCE	9

Grammar: Idioms and Phrases – Single line definitions Phrasal verbs Listening: Listening to informal communication Speaking: Narrating personal experience Reading: Speed reading – reading passage within the time limit Writing: Project writing – Report writing (Accident and Survey) – Preparing welcome address and vote of thanks.

Module – V	VERBAL ABILITY FOR WRITING	9

Grammar: Verbal Analogy – Cause and effect expressions Listening: Listening to Iconic Speeches - debate and reviewing the performance Speaking: Group communication skills – Discussing social issues and current affairs Reading: Short story – critical reading Writing: Itinerary –Interpretation of charts (Flow chart and Pie chart) - Essay Writing and Paragraph.

Total : 45 Periods

Laboratory Components:

S.No	List of Experiments	CO Mapping	RBT
1	Describing Picture / Place	1	Understand
2	Listening	1	Understand
3	Role Play	2	Understand
4	Prepare Circular, Agenda & Minutes	2	Understand
5	Asking and Giving Directions	3	Apply
6	Narrate a Favourite Movie / Book	3	Apply
7	Welcome Address	4	Apply
8	Vote of Thanks	4	Apply
9	Discussing Social Issues	5	Understand
10	Interpretation of Charts	5	Understand
		Total	15 Periods

Text Books
1. Rizvi, Ashraf.M, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 8th Edition, 2020.
2. Hewings. M, "Advanced English Grammar", 3rd Edition, Cambridge University Press, Chennai, 9th Edition, 2019.
3. Board of Editors, "Using English – A Course book for Undergraduate Engineers and Technologists", Orient Black Swan Private Limited, Hyderabad, 3rd Edition, 2019.

Reference Books
1. Dr. Krishnakumar TP, "Rudiments of Communication Skills", Buddha Publication, 1st Edition, 2023.
2. Raman M & Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 13th Edition, 2018.
3. Dhanavel S. P., "English and Soft Skills", 1st Edition, Orient Black Swan Private Limited, Hyderabad, 2010.

Passed in Board of Studies Meeting on 28.12.2023   Passed in Academic Council Meeting on 11.01.2024

CHAIRMAN - BOARD OF STUDIES

Web References:
1. https://nptel.ac.in/courses/111104031
2. https://nptel.ac.in/courses/111106139
3. https://nptel.ac.in/courses/111105134

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1									1	3	1		2	
CO 2									1	3	1		2	
CO 3									1	3	1		2	
CO 4									1	3	1		2	
CO 5									1	3	1		2	
	3-High			2-Medium			1-Low							

Summative assessment

Bloom's Level	Continuous Assessment (IAE)				Practical	Final Examination (FE) [50marks]
	Theory Marks				Rubric based CIA [20 Marks]	
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]		
Remember	25				4	10
Understand	25	25	25		8	20
Apply		25	25		8	20
Analyse						
Evaluate						
Create						

23PH202	MATERIALS PHYSICS	L	T	P	C
	(Common to Aero, Agri, Civil, FT, Mech, PCT & SF)	3	0	2	4

Nature of Course	Basic Sciences
Pre requisites	Fundamentals of Basic Physics

Course Objectives

The course is intended to

1. Impart knowledge in production of laser and their applications in engineering and medical field.
2. Understand on the concept and properties of matter like elasticity and its applications.
3. Provide a valuable theoretical introduction and an overview of the fundamental structures of the crystal physics.
4. Apply the concepts of thermal conductivity to solve the thermal coefficients.
5. Give an idea on new engineering materials like shape memory alloys, metallic glasses and nanomaterials.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Compare the types of lasers for various industrial applications.	Understand
CO 2	Study the elastic behavior and working of torsional pendulum.	Understand
CO 3	Account for how crystalline materials are studied using miller indices, including concepts like coordination number and packing factor.	Understand
CO 4	Demonstrate the thermal conductivity of good and bad conductors.	Apply
CO 5	Explain a conceptual understanding about the properties of new engineering materials like shape memory alloys, metallic glasses and nanomaterials.	Apply

Course Contents

Module – I	LASER PHYSICS	9

Lasers: Introduction- characteristics of laser - population of energy levels, Einstein's A and B coefficients derivation - resonant cavity - semiconductor lasers: homojunction and heterojunction - Applications of lasers - particle size determination and holography.

Module – II	PROPERTIES OF MATTER	9

Elasticity - stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever - uniform and non-uniform bending - I-shaped girders.

Module – III	CRYSTAL PHYSICS	9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures.

Passed in Board of Studies Meeting on 28.12.2023   Passed in Academic Council Meeting on 11.01.2024

CHAIRMAN - BOARD OF STUDIES

Module – IV	THERMAL PHYSICS	9

Transfer of heat energy - thermal expansion of solids and liquids - expansion joints - bimetallic strips - thermal conductivity - Forbe's and Lee's disc method: theory and experiment – thermal insulation - applications: heat exchangers in refrigerators, ovens and solar water heaters.

Module – V	MODERN ENGINEERING MATERIALS	9

Metallic glasses – preparation, properties and applications – Shape memory alloys – Types, characteristics and applications – Nanomaterials – preparation– Physical Vapour Deposition (PVD) - sol gel method, properties and applications. Carbon Nano Tube (CNT) –properties and applications.

Total : 45 Periods

Laboratory Components (Any Five)

S.No	List of Experiments	CO Mapping	RBT
1	Determination of wavelength and particle size of the given Laser beam.	CO1	Apply
2	Determination of numerical aperture and acceptance angle of an optical fiber.	CO1	Apply
3	Determination of the rigidity modulus of a given wire by using Torsion pendulum.	CO2	Apply
4	Determination of Young's modulus of a material by non-uniform bending method.	CO2	Apply
5	Determination of Young's modulus of a material by uniform bending method.	CO2	Apply
6	Determination of thermal conductivity of a bad conductor by Lee's Disc method.	CO4	Apply
		Total	15 Periods

Text Books

1. Bhattacharya, D.K and Poonarn, T, "Engineering Physics", Oxford University Press, 2nd edition, 2015.
2. M.N. Avadhanulu, M.N. &Kshirsagar PG. "A Text book of Engineering Physics", S.Chand and company, Ltd., New Delhi, 10th edition, 2014.
3. Singh Dheeraj Kumar, "Nanomaterials", Springer International Publishing, 1st Edition, 2023.

Reference Books

1. David Halliday. Robert Resnick and Jearl Walker., "Principles of Physics", Wiley, 10th Edition, 2014.
2. Raymond A Serway and John W Jewett., "Physics for Scientists and Engineers", Cengage Learning, 9th Edition, 2019.

Web References:

1. https://nptel.ac.in/courses/115/107/115107095/
2. https://spaceplace.nasa.gov/laser/en/
3. https://www.coursera.org/lecture/fe-exam/stresses-in-beams-strains-in-pure-and-nonuniform-bending-6aMRx

4. https://nptel.ac.in/courses/113106093

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	1												
CO 2	3	1												
CO 3	3	2	2											
CO 4	3	2	2											
CO 5	3													

3-High	2-Medium	1-Low	

Summative Assessment

Bloom's Level	Continuous Assessment (IAE)					Final Examination (FE) [50marks]
	Theory Marks				Practical	
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	10	10	10			20
Understand	35	35	35		40	60
Apply	5	5	5		60	10
Analyse						10
Evaluate						
Create						

23CS203	PROBLEM SOLVING USING PYTHON PROGRAMMING (Common to Aero,Agri,Civil,Mech,SF,PCT,FT)	L	T	P	C
		3	0	2	4

Nature of Course	Engineering Sciences
Prerequisites	Mathematical and Logical Knowledge

Course Objectives

The course is intended

1. Understand the basics of algorithmic problem solving.
2. Discuss the basics of simple python programs.
3. Develop python programs with conditionals and loops.
4. Explain python functions and call them.
5. Test the Python data structures—lists, tuples, dictionaries and files.

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO1	Develop algorithmic solutions to simple computational problems and read, write, execute by simple python programs	Understand
CO2	Read, Write, Execute by hand simple python programs.	Understand
CO3	Write simple Python programs using conditionals and loops for Solving problems	Apply
CO4	Develop python string functions and lists	Apply
CO5	Illustrate the compound data using python Tuples, Dictionaries, Files and Packages.	Apply

Course Contents

Module–I	Basics of Computers & Problem solving	9
Computer Basics – Components-Computer organization – Computer Software- Types of software-Software Development steps –Need for logical analysis and thinking-Algorithms – Flowchart - Number system.		
Module– II	Introduction of Python Programming	9
Introduction-PythonIDLEInstallation-PythonInterpreter-Interactiveandscriptmode-Valuesand types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, Input and Output Statements.		
Module– III	Control statements and Functions	9

Conditional(if), alternative(if-else), chainedconditional(if-elif-else)-Iteration-while,for,break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Illustrative Programs: Students Mark Statement.

Module–IV	Strings, Lists	
		9

Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability,aliasing,cloninglists,listand strings, list and functions-list processing-list comprehension, Sorting: Merge Sort, Insertion Sort. Illustrative Programs: Reverse String, Adding Elements to a List, Adding List to a List.

Module–V	Tuples , Dictionaries ,Files and Packages	
		9

Tuples- Tuple assignment, lists and tuples, Tuple as return value- Dictionaries-operations and methods,FilesandException-Textfiles,readingandwritingfiles,Exception handling, Modules and Packages.

Total:45 Periods

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Write a algorithm & draw flowchart for simple Computational problems.	CO1	Apply
2	Write a program to perform different arithmetic operations on numbers in python.	CO1	Apply
3	Write a python program to implement the various control structures.	CO2	Apply
4	Write a python program for computational problems using recursive function.	CO2	Apply
5	Demonstrate use of list for data validation.	CO3	Apply
6	Develop a python program to explore string functions.	CO3	Apply
7	Implement linear search and binary search.	CO4	Apply
8	Develop a python program to implement sorting methods.	CO4	Apply
9	Develop python programs to perform operations ondictionaries.	CO5	Apply
10	Write a python program to read and write into a file.	CO5	Apply
11	Create a game activity using Pygame like bouncing ball, car race etc.	CO5	Create

Passed in Board of Studies Meeting 29.03.2023

CHAIRMAN-BOARD OF STUDIES

Approved in Academic Council Meeting 27.04.2023

Text Books

1. Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 1st Edition 2021.
2. Dr. R. Nageswara Rao, "Core Python Programming", Dream tech Press, 1st Edition 2019.

Reference Books

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2nd Edition 2021.
2. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 1st Edition 2020.
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2nd Edition 2019.
4. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 1st Edition 2015.

Additional References

1. Python Research Association of India - https://www.araiindia.com/services/technology-and-products
2. NPTEL - https://nptel.ac.in/courses/107/106/107106088/
3. MOOC Courses - https://www.mooc-list.com/tags/automotive-engineering

Mapping of Course Outcomes(COs) with Programme Outcomes(POs) Programme Specific Outcomes(PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		1							2	3	1	
CO2	3	2	1		1							2	3	1.	
CO3	3	2	2		1							2	3	1	
CO4	3	2	2		1							2	3	1	
CO5	3	2	2		1							2	3	1	
	3	High			2				Medium			1	Low		

Formative Assessment			
Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	
Understand	Tutorial class/Assignment	5	15
Apply			
	Attendance	5	

Passed in Board of Studies Meeting 29.03.2023   Approved in Academic Council Meeting 27.04.2023

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Bloom's Category	Summative Assessment			
	Internal Assessment Examinations(IAE)			Final Examinations(FE)
	IAE–I(5)	IAE–II(10)	IAE–III(10)	60
Remember				
Understand	20	20	20	20
Apply	30	30	30	30
Analyze				30
Evaluate				20
Create				

Passed in Board of Studies Meeting 29.03.2023   Approved in Academic Council Meeting 27.04.2023

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23PC202	CHEMICAL ANALYSIS LABORATORY	L	T	P	C
		0	0	4	2

Nature of course	Professional Core (PC)
Pre requisites	Nil

Course Objectives

The course is intended to
1. To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of nitrite in water.
2. Identify the flash and fire point, cloud and pour point & acid value and iodine value of oils.
3. Know the quantitative estimation of coal.
4. Study application of quantitative estimation of Phenol/aniline.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Familiarization with equipment like viscometers, viscosity index of Lubricating oils	Analyze
CO 2	Learn the flash and fire point, cloud and pour point & acid value and iodine value of oils	Understand
CO 3	Illustrate the synthetic techniques for soap, cement and coal	Analyze
CO 4	Familiarization of methods for determining COD and nitrite in water.	Analyze
CO 5	Analysis of phenol and/or aniline by Winklers methods/ separation efficiency of binary mixtures	Analyze

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Determination of Redwood / Saybolt numbers, kinematic viscosity and viscosity index of Lubricating oils	CO1	Analyze
2.	Determination of flash point, fire point of oils	CO2	Understand
3.	Determination of cloud and pour point of oils	CO2	Understand
4.	Estimation of acid value and iodine value of the given oil sample	CO2	Analyze
5.	Soap Analysis a. Estimation of total fatty acid	CO4	Analyze

Passed in Board of Studies   Approved in Academic Council Meeting

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3										1	3	2
CO 2	3	3										1	3	2
CO 3	3	3										1	3	2
CO 4	3	2										1	3	2
CO 5	3	2										1	3	2
	3	High				2	Medium				1	Low		

Assessment based on Continuous Assessment and Final Examination

Bloom's Level	Continuous Assessment (50 marks) (Attendance - 5marks)		Final Examination (50 marks)
	Rubric based Continuous Assessment (25 marks)	Model examination (20 marks)	
Remember			
Understand	20	20	20
Apply	40	40	40
Analyze	40	40	40
Evaluate			
Create			

CHAIRMAN-BOARD OF STUDIES

Passed in Board of Studies

Approved in Academic Council Meeting

	b. Estimation of percentage alkali content			
6.	Cement Analysis a. Estimation of silica content b. Estimation of mixed oxide content c. Estimation of calcium oxide content d. Estimation of calcium oxide by rapid method	CO4	Analyze	
7.	Coal Analysis a. Estimation of sulphur present in coal b. Ultimate analysis of coal c.Proximate analysis of coal	CO4	Analyze	
8.	Determination of COD of water samples	CO4	Understand	
9.	Determination of nitrite in water.	CO4	Analyze	
10.	Estimation of phenol and/or aniline by Winklers methods/ separation efficiency of binary mixtures	CO5	Analyze	
11.	Determination of calorific value using bomb calorimeter	CO5	Analyze	
12.	Flue gas analysis by Orsat's apparatus	CO5	Analyze	

Total : 30 Periods

LIST OF EQUIPMENTS FOR BATCH OF 30 STUDENTS

S.No	Description of Equipment	Quantity
1.	Silica Crucible	20
2.	Heating Mantle	3
3.	Muffle Furnace	1
4.	Hot air oven	1
5.	Desiccator	5
6.	Vacuum Pump	1
7.	Condenser	10
8.	Reflux Condenser	10
9.	Pensky martens closed cup apparatus	1
10.	Cleveland Open cup apparatus	1
11.	Cloud point apparatus	1
12.	Saybolt Viscometer	1
13.	Redwood Viscometer	1
14.	Bomb Calorimeter	1
15.	COD reflux	1

Reference Books
1. Environmental pollution analysis, S.M.Khopkar, New age international. 2011
2. Manual of environmental analysis, N.C Aery, Ane books. 2010
3. Text book of quantitative chemical analysis, J.Mendham, Pearson education 2008

Passed in Board of Studies   Approved in Academic Council Meeting

23MC202	ENVIRONMENTAL SCIENCES	L	T	P	C
	(Common for all branches)	2	0	0	0
Nature of Course	Mandatory, Non Credit				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the concept of eco system and environment.
2. Become conversant with ecological balance and values of biodiversity.
3. Know the role of human in prevention of pollution and making a clean environment.
4. Get knowledge about conservation of non-conventional energy resources.
5. Study about the nature and management of e-waste and solid waste.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Explain the knowledge about ecosystem and environment	Understand
CO 2	Interpret the ecological balance and preservation of bio diversity	Understand
CO 3	Demonstrate various types of pollution in order to control pollution	Apply
CO 4	Classify the energy sources for the conservation of non conventional energy sources	Understand
CO 5	Identify the nature and management of e-waste and solid waste	Apply

Course Contents

Module – I	**ECOSYSTEM**	6

Eco system - Food chains, Food webs and Ecological pyramids. Ecosystem (a) Forest eco system, (b) Aquatic eco system (pond ecosystem and marine ecosystem).

Module – II	**BIODIVERSITY**	6

Introduction to Bio diversity, Values of Bio diversity, Threads to Bio diversity, Endangered and Endemic species of India, Hotspots of biodiversity. Conservation of Biodiversity: In-Situ and Ex-Situ conservation of biodiversity.

Module – III	**ENVIRONMENTAL POLLUTION**	6

Definition, Causes, Effects and Control of (a) Air pollution (b) Water pollution (c) Soil pollution. Electrostatic Precipitator for controlling air pollution.

Module – IV	**NON-CONVENTIONAL ENERGY RESOURCES**	6

Introduction, Types, Working and Applications of: Solar Energy- Photovoltaic (PV) solar energy, Wind Energy-Onshore wind power- and Geo Thermal Energy-Geo thermal power plant.

Module – V	ENVIRONMENTAL MANAGEMENT	6
Sustainable Development, Waste Management: Types, sources and disposal of municipal, industrial solid Waste, Role of Information technology in Environment and Human. COVID-19 and JN-1 Virus.		

Total : 30 Periods

Activity Components

S.No	List of Experiments	CO Mapping	RBT
1	Field study of simple eco system: pond, river and hill slopes	CO1	Understand
2	Case study regarding environmental management	CO5	Apply

Text Books

1. AnubhaKaushik and C.P. Kaushik, "Environmental Science and Engineering, New Age International Publishers, New Delhi, 2nd Edition, 2019.
2. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. Reprint Edition, 2020.

Reference Books

1. Santosh Kumar Garg and Rajeshwari Garg "Ecological and Environmental Studies", Khanna Publishers, Nai Sarak, Delhi, 2nd Edition, 2019.
2. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2nd Edition, 2020.

Web References:

1. https://nptel.ac.in/courses/122103039/38
2. https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909
3. https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm
4. www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
5. nptel.ac.in/courses/120108004/module7/lecture8.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1		3					1					3		
CO 2		3					3					1		
CO 3		3					2					3		
CO 4		2					3					2		
CO 5		3					3					2		
	3-High			2-Medium				1-Low						

Bloom's Level	Summative Assessment				
	Continuous Assessment				
	IAE-I [20]	IAE-II [20]	IAE-III [20]	Attendance [20]	Activity [20]
Remember	20	20	15		
Understand	30	25	25		
Apply		5	10		
Analyze					
Evaluate					
Create					

23PC301	FLUID MECHANICS FOR CHEMICAL ENGINEERS	L	T	P	C
		3	1	0	4
Nature of Course	Professional Core (PC)				
Pre requisites	NIL				

Course Objectives

The course is intended
1. Depict the students to the fundamentals of fluids and its classification.
2. Facilitate the students to understand and the various equations related to fluid mechanics
3. Enable the students to understand the concepts of laminar, turbulent flows.
4. Formulate the students to understand the incompressible fluid flow.
5. Make the students understand the concepts related to flow and pumps.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Remember the basic concepts and of fluid mechanics	Remember
CO 2	Solve problems related to mass, momentum and energy balances in fluid flow.	Apply
CO 3	Demonstrate the applications of flow statics, fluid flow phenomena.	Apply
CO 4	Understand the concepts of Flow through packed beds and fluidization.	Understand
CO 5	Estimate the pump efficiency, head developed and pressure drop	Understand
CO 6	Estimate the constant and variable head flow meter	Understand

Course Contents:

MODULE- I BASIC CONCEPTS OF FLUID MECHANICS   12

Definition of a fluid - Shear stress in a moving fluid - difference between liquids and gases - compressible and incompressible fluids - Newtonian and Non- Newtonian fluids - continuum concept of a fluid - properties of fluids - viscosity -compressibility. Dimensional analysis and its applications in fluid flow. Statics of fluid systems - Pressure - General equation for the variation of pressure due to gravity in a static fluid - manometers: U-tube, differential and inclined manometers.

MODULE-II DYNAMICS OF FLUID FLOW   12

Fluid flow - basic concepts - Reynolds experiment - laminar and turbulent flows - nature of turbulence Basic concepts of Boundary layer. Equation of continuity and its applications -momentum equations - Euler's equation of motion -Bernoulli's theorem and its applications

MODULE-III INCOMPRESSIBLE FLUID FLOW   12

Flow in conduits -Shear stress distribution in a cylindrical tube -Friction factor-Fanning's equation - Applications -Laminar flow in pipes -Hagen Poiseuille equation -Velocity distribution for laminar and turbulent flows -Losses due to sudden expansion and sudden contraction -Losses in pipe fittings.

MODULE-IV PACKED BEDS AND FLUIDISED BED   12

Flow through packed beds - Ergun equation and Kozeny - Carman equation. Equation for one dimensional motion – Fluidisation Mechanism of fluidisation - Types of fluidisation- Pressure drop in fluidised beds - Minimum fluidisation velocity.

MODULE-V PUMPS AND FLOW METERS

12

Pipes, Fittings and valves - Pumps, Fans, Compressors and Blowers - Positive displacement pumps - Centrifugal pumps - NPSH and cavitation - Pump calculations - Constant and variable head flow meters.

Total: 60 Periods

Text Books:

1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers ", 2nd Edition, McGraw-Hill, (2004).
2. Munson, B. R., Young, D.F., Okiishi, T.H. "Fundamentals of Fluid Mechanics", 5th Edition, John Wiley, (2006).

Reference Books:

1. James O Wilkes [with contributions], "Fluid Mechanics for Chemical Engineers with Microfluidics, CFD, and COMSOL Multiphysics 5" Prentice Hall, PTR (International series in Chemical Engineering) (2018).
2. Douglas.J.F.,Gasiorek, J.M., Swaffielf, J.A., FLUID MECHANICS, Sixth Edition, 2011.
3. R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", 9th Edition (Revised),(2010).
4. McCabe. W.L., Smith. J C., Harriot. P., Unit operations of Chemical Engineering, McGraw Hill, Seventh Edition, 2014.

Additional References:

1. SWAYAM PORTAL: https://www.classcentral.com/course/udemy-fundamentals-of-fluid-mechanics 39057
2. IIT Guwahati: https://freevideolectures.com/course/4163/nptel-fluid-mechanics

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO2	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO4	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO5	3	3	3	1	-	-	-	-	-	-	-	1	3	3
CO6	3	3	3	1	-	-	-	-	-	-	-	1	3	3
	3	High			2		Medium					1	Low	

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Bloom's Category	Summative Assessment			
	Internal Assessment Examinations			Final Examination
	IAE I (5)	IAE II (10)	IAE III (10)	(60)
Remember	20	10	10	20
Understand	20	10	20	40
Apply	10	30	20	40
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

CHAIRMAN-BOARD OF STUDIES

23PC302	MATERIALS TECHNOLOGY FOR CHEMICAL ENGINEERS	L	T	P	C
		3	0	0	3
Nature of Course	Engineering Sciences
Pre requisites	NIL

Course Objectives

The course is intended to
1. Provide students with a strong foundation in materials science
2. Emphasis on the fundamental , scientific and engineering principles of material structures
3. Know the various ferrous , non-ferrous and ceramics materials for structural applications
4. Explain the various characteristics and applications of polymers and compsite materials
5. Enrich the knowledge on advancement in new materials

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Acquaint with properties and selection of materials	Understand
CO 2	Discuss the basics of metallurgical science	Understand
CO 3	Know the various types of metallic and traditional materials	Apply
CO 4	Familiarize with light weight materials for technological applications	Understand
CO 5	Learn the novelty of new materials	Understand
CO 6	Summarize the application functional materials	Apply

Course Contents:

MODULE-I INTRODUCTION TO MATERIALS   9
Classification of Engineering Materials ,Structure of materials, Single crystals – polycrystalline – Non crystalline solids , Imperfection in solids – Vacancies – Interstitials point, line, surface and volume defects .

MODULE-II METALLURGICAL AND PHYSICAL PROPERTIES OF MATERIALS   9
Invariant reactions, Mechanical properties - tension test, Conductivity of materials, Introduction to magnetic materials - Soft and Hard magnetic materials, Anti-ferromagnetic materials, Ferrites-Properties and applications.

MODULE-III FERROUS AND NON FERROUS ALLOYS, CERAMICS   9
Classification of ferrous alloys, Iron-Iron carbide Diagram, Tool steel , Stainless steel, Copper and its alloys, Magnesium and its Alloys , Engineering Ceramics ,Traditional ceramics ,Glass ceramics , Properties and application.

MODULE-IV POLYMERS, AND COMPOSITES   9
Polymers classification, reaction, types, Mechanism, Composites –Need for composites, Classification-PMC, MMC, CMC, Reinforcement – particle reinforced composites, Fibre reinforced composites.

MODULE-V INTRODUCTION TO NEW MATERIALS   9
Biomaterials, Bio-degradable Materials, Nanomaterials-properties and applications, Metallic glasses Shape memory alloys, Photo responsive polymers

Total: 45 Periods

Passed in the Board of Studies   Approved in Academic Council

Text Books:
1. V. Raghavan, "Materials Science and Engineering", Prentice –Hall of India Pvt. Ltd., 2015
2. William D. Callister, Jr., "Materials Science and Engineering an Introduction", 9/e Edition, John Wiley & Sons, Inc., 2014.
3. Smith, W.F., Hashemi, J. & Prakash. R. "Materials Science and Engineering". Tata Mcgraw Hill Education Pvt. Ltd., 2014

Reference Books:
1. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", 7th Edition, Thomson Learning, 2015
2. Vijayamohanan K. Pillai and Meera Parthasarathy, "Functional Materials: A chemist's perpective", Universities Press Hyderabad (2012).
3. Leopoido Javier Rios Gonzalez. "Handbook of Research on Bioenergy and Biomaterials. Consolidated and green process" Apple academic press, 2021.

Additional References:
1. COURSERA LINK: \..\Fundamentals of Materials Science _ Coursera_files
2. MIT COURSE WORK:\..\Materials Science and Engineering _ MIT OpenCourseWare _ Free Online Course Materials.html

Mapping of Course Outcomes (COs) with Programme Outcomes (PO's) Programme Specific Outcomes (PSO's)

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	2	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	2	1
CO6	3	2	1	-	-	-	1	-	-	-	-	1	2	1
	3	High			2			Medium			1		Low	

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE I (5)	IAE II (10)	IAE III (10)	
Remember	20	20	15	20
Understand	20	20	30	60
Apply	10	10	10	20
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

CHAIRMAN-BOARD OF STUDIES

23PC303	CHEMICAL PROCESS CALCULATIONS	L	T	P	C
		3	1	0	4
Nature of course	PROFESSIONAL CORE (PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Learn the concept of units and dimensions
2. Impact knowledge in the mass balances
3. Gain insight on fundamentals of units and stoichiometric equations
4. Know the fundamentals of humidification
5. Get idea on fundamentals of thermophysics and thermochemistry

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Explain the fundamentals of ideal gas behavior and phase equilibria	Understand
CO 2	Describe concepts for expressing compositions and behavior of different gases and solutions	Apply
CO 3	Solve material balance problems and can sketch block diagrams of various chemical process	Apply
CO 4	Comprehend the fundamentals of Humidity, Drying and the equipments used.	Apply
CO 5	Perform energy balance calculations for units with and without chemical reactions.	Apply
CO 6	Calculate conversion and selectivity for various reactions with and without recycle	Apply

Course Contents

Module – I   Basic Chemical Calculations   12

Introduction to process calculations: Units and Dimensions - Conversion of Units; Process and process variables: process flow sheet, process unit, process streams, mass and volumetric flow rates, mole concept, molecular and equivalent weights; Composition of streams: other expressions for concentration; Basic Material Balance Principles, Degrees of Freedom analysis.

Module – II   Material Balance on Non-Reactive systems   12

Stoichiometric principles, Application of material balance to unit operations like distillation, Evaporation, Crystallization, Drying, Absorption, Extraction, etc., Material balance on multi-unit process: Recycle – Bypass and purging, Unsteady state material balances

Module – III   Material Balance on Reactive systems   12

Material balance with chemical reaction: Conversion, Yield, Selectivity, Limiting and excess reactants, extent of reaction method for a single reaction, Multiple reactions, Combustion reactions, Orsat analysis, proximate and ultimate analysis of coal, theoretical and excess air, Determination of

composition by Orsat analysis of products of combustion of solid, liquid and gas fuels.

Module – IV   Humidity & Saturation   12

Gas Calculations: Ideal and real gas laws – Gas constant – Calculations of pressure, volume and temperature using ideal gas law – Use of partial pressure and pure component volume in gas calculations –Applications of real gas relationship in gas calculation.

Properties of atmospheric air , Humidity of air: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity, Use of humidity in condensation and drying. Psychrometric chart, dew point, Wet and dry bulb thermometry.

Module – V   Energy Balance   12

Thermophysics: Heat Capacity, Sensible heat and latent heat, Calculation of enthalpy changes without and with phase change, Heat of solution and mixing; Energy balances without chemical reactions;

Thermochemistry: Energy balances with chemical reactions - Standard heat of reaction, formation and combustion, Hess Law, Effect of temperature; Simultaneous material and energy balances - Adiabatic flame temperature.

Total : 60 Periods

Text Books

1. Himmelblau, D., "Basic Principles and Calculations in Chemical Engineering", 8thEdition, Prentice Hall of India (P) Ltd.,2012
2. Bhatt, B.I. and Vora, S. M., "Stoichiometry", 6th Edition, McGraw Hill Education (India) Private Limited.,2021.

Reference Books

1. Venkataramani, V. and Anantharaman, N., "Process calculations", Prentice HallofIndia (P) Ltd., 2003.
2. K.A.Gavhane ,"Introduction to Process Calculations", Nirali Prakashan, Pune ,2016
3. Nayef Ghasem, Redhouane Henda, Principles of Chemical Engineering Processes: Material and Energy Balances, 2nd Edition, CRC Press, 2015.
4. Narayanan K.V., Lakshmikutty B., Stoichiometry and Process Calculations, PHI Learning Pvt. Ltd., 7th Edition, 2015.

Additional References

1. **SWAYAM   PORTAL:**   https://www.classcentral.com/course/swayam-processcalculations-11092
2. **IIT   GUWAHATI:**   https://freevideolectures.com/course/4139/mphit-unit-operations

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	3	2							2	3	3	3
CO 2	3	3	2	3							2	3	3	3

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) and ProgrammeSpecific Outcomes (PSO's)

CO 3	2	3	3	3								2	3	3	3
CO 4	2	3	3	3								2	3	3	3
CO 5	2	2	3	3								2	3	3	3
CO 6	2	2	3	3								2	3	3	3

3-High	2-Medium	1- Low

Formative Assessment

Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	
Understand	Tutorial class / Assignment	5	15
Apply			
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations (IAE) (40)			Final Examinations (FE) (60)
	IAE – I (5)	IAE – II (10)	IAE – III (10)	
Remember	10			10
Understand	30	10	10	30
Apply	10	40	40	60
Analyse				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

Passed in Board of Studies

Approved in Academic Council

23PC304	PETROLEUM EXPLORATION AND EXPLOITATION TECHNIQUES	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core(PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Make the students to learn the origin of petroleum.
2. Understand the petroleum exploration methods.
3. Know about various geological structures.
4. Understand importance of drilling fluids functions during drilling.
5. Gain knowledge about the various drilling techninques.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	The origin and favorable geological conditions for the formation of petroleum	Understand
CO 2	Understand the modern oil finding techniques and its feasibility for oil production	Understand
CO 3	Analyze the various oil recovery and stimulation methods to optimize oil production.	Analyze
CO 4	Formulate drilling fluid for well drilling and well completion methods	Understand
CO 5	Understand the offshore exploration methods and well completion	Understand
CO 6	Acquire knowledge on recent trends in drilling technology and software used	Analyze

Course Contents:

UNIT - I ORIGIN OF PETROLEUM AND SEDIMENTARY ENVIRONMENT   9
Origin of petroleum – Rock cycle – Formation of petroleum – Source, cap and reservoir rocks – Classification of traps and faults - Classification and types of sedimentary rocks – Sedimentary basins – Formation, migration and accumulation of petroleum - Continental environment – Transitional environment – Marine environment.

UNIT - II PETROLEUM EXPLORATION METHODS   9
Geological exploration methods – Geophysical exploration methods – Geochemical methods – Reserve estimation methods - survey methods -Prognostication – Classification of drilling locations – Economic analysis – Well programme – Geo Technical order.

UNIT - III GEOLOGICAL STRUCTURE AND WELLOGGING   9
Core Collection Techniques – Sample logging, Drilling time logging, Mud/Gas/Oil logging – Formation Evaluation Techniques using wire line well logging include – Spontaneous potential logging, Natural Gamma Ray Logging, Density Logging, Neutron Porosity logging, Sonic velocity Logging, Electrical Resistance Logging.

UNIT - IV DRILLING FLUIDS AND FUNCTIONS   9
Function, composition and properties of drilling fluids – Classification of drilling fluids – Casing packs - Cementing – Various well completion methods – Various stimulation methods in oil and gas industries.

UNIT - V OFF – SHORE DRILLING TECHNOLOGY

Seismic technology – Off-shore rigs – Drilling techniques: Primary, Secondary and enhanced oil recovery techniques and methods – Major well complication and remedies.

Total: 45 Periods

Text Books:

1. Bhagwan Sahay "Petroleum Exploration and Exploitation Practices" Allied Publishers Ltd.,Chennai, 1994.
2. Richard Dawe, "Modern Petroleum Technology", Vol.I, Upstream, 6th Edition, John and Wiley Sons Ltd, 2000.

Reference Books:

1. Howard B. Bradley, "Petroleum Engineering Handbook", Society of Petroleum Engineers, 1987.
2. Norman J. Hyne., "Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production", 2nd Edition, Pennwell Books, 2001.
3. Shay B., "Wellsite Geological Techniques for Petroleum Exploration" Allied Publishers Ltd., 1991.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	-	-	3	3	-	-	-	-	3	3
CO2	3	2	2	1	-	-	3	2	-	-	-	-	2	3
CO3	3	2	2	1	-	-	2	2	-	-	-	-	3	3
CO4	3	2	2	1	-	-	3	2	-	-	-	-	2	3
CO5	3	3	2	1	-	-	3	3	-	-	-	-	3	3
CO6	3	3	2	1	-	-	3	3	-	-	-	-	3	3
3	High			2		Medium					1		Low	

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE I (5)	IAE II (10)	IAE III (10)	(60)
Remember	15	10	10	20
Understand	25	30	30	60
Apply	10	10	10	20
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Passed in the Board of Studies   *Approved in Academic Council*

CHAIRMAN-BOARD OF STUDIES

23UH001	UNIVERSAL HUMAN VALUES (Common to all B.E. / B.Tech Programme)	L	T	P	C
		3	0	0	3
Nature of Course	Humanities and Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Encourage respect for the inherent dignity and worth of all individuals, regardless of differences in race, ethnicity, gender, religion, or socioeconomic status.
2. Cultivate empathy and compassion towards others, promoting understanding and solidarity across diverse communities.
3. Promote peaceful coexistence and harmony among individuals and communities.
4. Foster a sense of responsibility towards the environment and future generations, promoting sustainable practices and conservation efforts.
5. Hold and celebrate cultural diversity, recognizing the richness and value of different traditions, languages, and perspectives.
6. Contribute to the realization of universal human values and create a more just, compassionate, and sustainable world.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Embrace values such as empathy, tolerance, and respect can lead to decreased conflict and violence, both at interpersonal and societal levels.	Understand
CO 2	Support values like equality, justice, and human rights can lead to more equitable societies, where everyone has access to opportunities and resources	Understand
CO 3	Emphasize values such as empathy, compassion, and honesty fosters healthier and more meaningful relationships among individuals and groups.	Apply
CO 4	Grasp values of environmental stewardship and responsibility contributes to sustainable development practices that preserve natural resources.	Apply
CO 5	Celebrate cultural diversity and promoting values of inclusivity and acceptance enriches societies by fostering creativity, innovation, and mutual understanding	Understand
CO 6	Create a world that is more just, compassionate, and sustainable for all.	Apply

Course Contents

Module – I	NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION	9

Purpose and motivation for the course, recapitulation from Universal Human Values-I - Self-Exploration – what is it? – Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration – Continuous Happiness and Prosperity-A look at basic Human Aspirations - Right understanding, Relationship and Physical Facility - the basic requirements for fulfilment of aspirations of every human being with their correct priority – Understanding Happiness and Prosperity correctly -

CHAIRMAN-BOARD OF STUDIE

A critical appraisal of the current scenario – Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Module – II	UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!	9

Understanding human being as a co-existence of the sentient 'I' and the material 'Body' – Understanding the needs of Self ('I') and 'Body'- happiness and physical facility – Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) – Understanding the characteristics and activities of 'I' and harmony in 'I' – Understanding the harmony of I with the Body : Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health.

Module – III	UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY-HARMONY IN HUMAN- HUMAN RELATIONSHIP	9

Understanding values in human - human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship – Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship – Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals – Visualizing a universal harmonious order in society-Undivided Society, Universal Order- from family to world family.

Module – IV	UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE-WHOLE EXISTENCE AS COEXISTENCE	9

Understanding the harmony in the Nature – Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature – Understanding Existence as Co-existence of mutually interacting units in all- pervasive space Holistic perception of harmony at all levels of existence.

Module – V	IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS	9

Natural acceptance of human values – Definitiveness of Ethical Human Conduct – Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics – Case studies of typical holistic technologies, management models and production systems – Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

Total : 45 Periods

Text Books

1. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.
2. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.
3. A N Tripathy, Human Values, New Age International Publishers, 2003.

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
3. Human Values, A. N. Tripathi, New Age Intl.Publishers, NewDelhi, 2004.

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Web References

1. https://www.studocu.com/in/document/i-k-gujral-punjab-technical-university/universal-human-values/uhv-complete-notes/46743542.
2. https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1Kyqte ziTbTjN1So
3. https://www.youtube.com/watch?v=Ff0LUTOCuLE&list=PLWDeKF97v9SO8vvjC1Kyqte ziTbTjN1So&index=16

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1									1	2	1		1	
CO 2									1	2	1		1	
CO 3									1	2	1		1	
CO 4									1	2	1		1	
CO 5									1	2	1		1	
	3-High				2-Medium				1-Low					

Formative assessment

Bloom's Level	Continuous Assessment (IAE)		Total marks
	Assessment component	Marks	
Remember	Online Quiz	5	
Understand	Tutorial class/Assignment	5	15
	Attendance	5	

Summative assessment

Bloom's Level	Continuous Assessment (IAE) Theory Marks			Final Examination [60 marks]
	IAE-I [5]	IAE-II [10]	IAE-III [10]	
Remember	20	10	10	10
Understand	30	20	20	20
Apply		20	20	20
Analyse				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

23MA301	TRANSFORMS AND BOUNDARY VALUE PROBLEMS (Common to Aero, Agri, Civil, ECE, EEE, FDT, Mech, PCT, S&F)	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Pre requisites	Foundations of Mathematics				

Course Objectives

The course is intended to

1. Learn about linear and non-linear partial differential equations and obtain their solutions using various techniques.
2. Gain familiarity with Fourier series.
3. Orient Fourier series techniques to solve one dimensional wave and heat equations.
4. Provide the concept of Fourier transforms and its inverse.
5. Introduce the concept of Z-transforms and difference equations.
6. Utilize advanced mathematical techniques to solve complex boundary value problems, reflecting mastery in mathematical transformations.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Identify linear and non-linear partial differential equations.	Apply
CO2	Construct the Fourier series of a given function and apply in the field of Engineering.	Apply
CO3	Interpret solutions of one dimensional wave and heat equations.	Apply
CO4	Implement Fourier transforms in engineering field .	Apply
CO5	Illustrate the Z-transforms and difference equations.	Apply
CO6	Develop mathematical techniques to solve the boundary value problems.	Apply

Course Contents:

Module – I	PARTIAL DIFFERENTIAL EQUATIONS	9

Solution of standard types of first order non-linear partial differential equations (i) $f(p,q)=0$, (ii) Clairaut's type - Lagrange's linear equation - linear partial differential equations of second order with constant coefficients of homogeneous equations.

Module – II	FOURIER ANALYSIS	9

Dirichlet's Conditions - Fourier series for periodic functions - Expansion of periodic functions with period $(0, 2\pi)$ and period $(-\pi, \pi)$ – Half Range Series - Root mean square value - Parseval's identity – Harmonic Analysis.

CHAIRMAN, BOARD OF STUDIES

Module – III	FOURIER TRANSFORMS	9
Statement of Fourier integral theorem – Fourier transforms pair: Fourier transforms and Inverse Fourier transforms – Fourier sine transforms -Fourier cosine transforms – Transforms of simple functions – Convolution Theorem - Parseval's identity.		
Module – IV	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	9
Z-transforms - Properties – Inverse Z-transform: Partial fraction method and Convolution theorem - Formation of difference equations –Solution of difference equations using Z – transform.		
Module – V	APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS	9
Classification of second order Partial differential equations – Method of separation of variables – Solutions of one dimensional wave equation – Solutions of one dimensional heat equation – Application to Boundary value problems.		

Total: 45 Periods

Text Books:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., 3rd edition, 2016.
2. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2021.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 2014.

Reference Books:

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Lakshmi Publications Pvt Ltd, 9th Edition, 2017.
2. Ramana.B.V,"Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, 4th Edition, 2017.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Publications, 10th Edition, 2023.

Additional References:

1. https://archive.nptel.ac.in/courses/111/101/111101153
2. https://www.youtube.com/watch?v=ygOjw0_Kh8k.
3. https://archive.nptel.ac.in/courses/111/106/111106111.

Laboratory Components using MATLAB:

S.No	List of Experiments	CO Mapping	RBT
1	Solutions of Clauirat's form	1	Apply
2	Solution of second order homogeneous differential equations with constant coefficients	1	Apply
3	Fourier Series in $(0, 2\pi)$	2	Apply
4	Harmonic Analysis in Fourier Series	2	Apply

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5	Fourier Transform	3	Apply
6	Inverse Fourier Transform	3	Apply
7	Z - Transform	4	Apply
8	Inverse Z - Transform	4	Apply
9	One dimensional wave equation	5	Apply
10	One dimensional heat equation	5	Apply

Total: 30 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										2		
CO2	3	2	2										2		
CO3	3	2	1										2		
CO4	3	2	1										1		
CO5	3	3	2										2		
CO6	3	2	2										2		
	3	High				2	Medium					1	Low		

Bloom's Level	Summative Assessment						Final Examination (Theory) [50]
	Continuous Assessment						
	Theory			Practical			
	IAE I (5)	IAE II (10)	IAE III (10)	Attendance [5]	Rubric based [10]	Model Exam [10]	
Remember	10	10	10				10
Understand	10	10	10		40	40	30
Apply	30	30	30		60	60	60
Analyze							
Evaluate							
Create							

CHAIRMAN-BOARD OF STUDIES

23PC305	FLUID MECHANICS LABORATORY	L	T	P	C
		0	0	2	1

Nature of course	Professional Core(PC)
Prerequisites	Nil

Course Objectives

The course is intended to
- Make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation.
- Identify the flow characteristics of fluids.
- Know the quantitative estimation of flow.
- Study application of quantitative estimation of Phenol/aniline.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Identify and characterize of flow patterns and regimes	Analyze
CO 2	Calibrate flow measurement devices	Understand
CO 3	Correlate the difference between fixed and fluidized bed columns and its application.	Analyze
CO 4	Select pumps for the transportation of fluids based on process conditions/requirements and fluid properties	Analyze
CO 5	Compare the results of theoretical analytical models to the actual behavior of real fluid flows and draw sustainable conclusions	Analyze
CO 6	Work effectively as a team with commitment to the professional ethics among the peer group involved.	Analyze

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Flow through venturimeter	CO1	Analyze
2.	Flow through orifice meter	CO2	Understand
3.	Fluidized bed column	CO2	Understand
4.	Calibration of weirs and notches	CO2	Analyze
5.	Open drum orifice and draining time	CO4	Analyze
6.	Flow through rotameter	CO4	Analyze

7.	Flow through helical coil and spiral coil	CO4	Analyze
8.	Losses in pipe fittings and valves	CO4	Understand
9.	Characteristic curves of pumps (Centrifugal pump performance)	CO4	Analyze
10.	Flow through packed bed column	CO5	Analyze

Total:30 Periods

*Minimum 10 experiments shall be offered.

Reference Books

Lab Manual

Mapping of Course Outcomes(COs)with Programme Outcomes(POs) Programme Specific Outcomes(PSOs)

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3										2	3	2
CO 2	3	3	3	3								2	3	2
CO 3	3	3	3	3								2	3	2
CO 4	3	2	3	3	2						2	2	3	2
CO 5	3	2	2		2						2	2	3	2
CO 6	3	2	2		2						2	2	3	2

3	High		2	Medium		1	Low

Assessment based on Continuous Assessment and Final Examination

Bloom's Level	Continuous Assessment(50 marks) (Attendance -5 marks)		Final Examination (50 marks)
	Rubric based Continuous Assessment (20 marks)	Model examination (25 marks)	
Remember			
Understand	20	20	20
Apply	40	40	40
Analyze	40	40	40
Evaluate			
Create			

Passed in Board of Studies

Approved in Academic Council

CHAIRMAN-BOARD OF STUDIES

23PC306	PETROLEUM TESTING LABORATORY	L	T	P	C
		0	0	2	1

Nature of course	Professional Core(PC)
Prerequisites	Nil

Course Objectives

The course is intended to
- Identify the flash and fire point, cloud and pour point of oils.
- Know the quantitative estimation of oil.
- Study application of quantitative estimation of petroleum products.
- Make students should be conversant with the theoretical principles
- Learn the various testing standards for petroleum products.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Perform the testing of various physical properties of the petroleum products in a safe manner.	Analyze
CO 2	Perform the testing of various chemical properties of the petroleum products in a safe manner.	Understand
CO 3	Differentiate various petroleum products by performing the specific tests	Analyze
CO 4	Perform the advanced qualitative and quantitative laboratory tasks, including the operation of advanced analytical instrumentation.	Analyze
CO 5	Ability to communicate and perform in the team	Analyze
CO6	Ability to understand the theoretical knowledge of product testing	Analyze

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Specific gravity determination using API gravity / Specific gravity bottle method	CO1	Analyze
2.	Penetration index determination	CO2	Analyze
3.	Dynamic viscosity measurement / Kinematic viscosity by saybolt viscometer	CO2	Understand
4.	Flash point and Fire Point determination for Petroleum Products	CO2	Analyze
5.	Aniline point determination	CO3	Analyze
6.	Cloud and Pour point determination	CO3	Analyze
7.	Smoke point determination	CO4	Analyze

8.	Copper Strip Corrosion test Apparatus	CO4	Understand
9.	Dynamic viscosity measurement / Kinematic viscosity by Redwood viscometer	CO5	Analyze
10.	Karl-Fisher Conductometer Apparatus for water estimation	CO5	Analyze
			Total:30 Periods

*Minimum 10 Experiments to be conducted

Reference Books

Lab Manual

Mapping of Course Outcomes(COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3			1	2	2					3	2
CO 2	3	3	2			2	2	3					3	2
CO 3	3	3	3			3	3	3					3	2
CO 4	3	2	2			2	2	3					3	2
CO 5	3	2	2			2	2	3					3	2
CO 6	3	2	2			2	2	3					3	2
	3	High				2	Medium					1	Low	

Assessment based on Continuous Assessment and Final Examination

Bloom's Level	Continuous Assessment(60marks) (Attendance -5marks)		Final Examination (50 marks)
	Rubric based Continuous Assessment (20 marks)	Model examination (25 marks)	
Remember			
Understand	20	20	20
Apply	40	40	40
Analyze	40	40	40
Evaluate			
Create			

Passed in the Board of Studies

Approved in Academic Council Meeting

CHAIRMAN-BOARD OF STUDIES

23MC203	INTERPERSONAL SKILLS (Common to all B.E. / B.Tech Programme)	L	T	P	C
		0	0	2	0
Nature of Course	Mandatory – Non Credit				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Evaluate current relationships and their communication style.
2. Identify ways for improving important relationships.
3. Explore how the Bible correlates with principles from the chapter.
4. Describe how the communication processes impacts our ability to effectively communicate.
5. Identify challenges that may arise from interpersonal communication.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Practice interpersonal communication skills to influence and build good relationships.	Remember
CO 2	Identify and pursue personal learning goals.	Understand
CO 3	Give evident feedback.	Apply
CO 4	Reveal group dynamics and amiable behaviour.	Apply
CO 5	Emphasis the communication process.	Understand

Course Contents

Module – I	FUNDAMENTALS OF INTERPERSONAL COMMUICATION	6
Facts of communication and Interpersonal communication - culture and gender - Communication and Self disclosure - Presentation of Interpersonal perception - Learning goals - Feeling and feedback.		
Module – II	INTERPERSONAL COMMUNICATION IN ACTION	6
Nature of language - language and culture - usage and abuse of language -Positive communication -Non verbal communication - Listening strategies - Barriers of listening.		
Module – III	EMOTIONAL INTELLIGENCE	6
Influence of emotional experience and expressions - Accepting the responsibilities and changes - Negotiation tactics - Dealing with criticism and appreciation - Collaborative Problem Solving - Resilience Building.		
Module – IV	TRANSACTIONS	6
Different types of transactions - Building Positive Relationship - Managing Conflict - Connecting across Difference -Factors hampering Interpersonal interactions - Assertiveness in communication.		

Passed in Board of Studies Meeting on 28.12.2023

Passed in Academic Council Meeting on 11.01.2024

CHAIRMAN - BOARD OF STUDIES

Module – V	ESSENTIAL INTERPERSONAL COMPETENCIES	6

Behaviour - understanding limiting behaviour - Interpersonal and small and lateral thinking-Win -Win attitude - Positive thinking - Stress feedback - Personal Evaluation of Interpersonal Relationship Skills group behavior - Critical management - Assertive

Total : 30 Periods

Text Books

1. Bozeman, Jeanine C and Argile Smith, "Interpersonal Relationship Skills for Ministers" Gretna, LA: Pelican Publishing Company, 1st Edition, 2004.
2. Floyd, Kory, "Interpersonal Communication", 2d. Boston: Mccraw-Hill, 2nd Edition, 2011.

Reference Books

1. Augsburger, David, "Caring Enough to Confront How to Understand and Express Your Deepest Feelings Towards Others", updated ed Ventura, CA: Regal Books, 2nd Edition 2009.

2. Vohs, Kathleen D., and Eli J., Finkel, eds, "Self and Relationships: Connecting Intrapersonal and interpersonal Processes", New York Guilford Press, 1st Edition, 2006.

Web References:

1. https://nptel.ac.in/courses/111104031
2. https://nptel.ac.in/courses/111106139
3. https://nptel.ac.in/courses/111105134

Laboratory Components:

S.No	List of Experiments	CO Mapping	RBT
1	Presentation of Interpersonal perception	1	Remember
2	Non-Verbal Communication	2	Understand
3	Negotiation tactics	3	Apply
4	Managing Conflict	4	Apply
5	Stress Management	5	Understand

Passed in Board of Studies Meeting on 28.12.2023   Passed in Academic Council Meeting on 11.01.2024

CHAIRMAN - BOARD OF STUDIES

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1										3	2	1	2	
CO 2										3	2	1	2	
CO 3										3	2	1	2	
CO 4										3	2	1	2	
CO 5										3	2	1	2	
	3-High			2-Medium				1-Low						

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	20	20
Understand	10	10
Apply	20	20
Analyse		
Evaluate		
Create		

23PC401	MECHANICAL OPERATIONS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core(PC)				
Pre requisites	Fluid Mechanics and Materials Technology				

Course Objectives

The course is intended to
1. Determine the characteristics of solids and do size analysis for effectiveness of the screen
2. Categorize the size reduction equipment and estimate the power consumption
3. Examine the separation equipment for solid-solid, solid-liquid and solid gas system
4. Investigate various filters and determine the rate of filtration
5. Analyze the working of mixers and agitators

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Characterization of solid particles	Understand
CO 2	Apply the laws of size reduction in energy calculation	Apply
CO 3	Explain the concepts settling and sedimentation	Understand
CO 4	Comprehend the theory of filtration and equipments	Understand
CO 5	Explain the concepts mixing and agitation	Understand
CO 6	Acquaint with various mechanical operations in industries	Apply

Course Contents:

MODULE-I CHARACTERSITICS OF SOLIDS   9

General Characteristics of solids, Different techniques of size analysis ,Shape factor , Surface area determination, Estimation of particle size , Screening methods and equipments ,Screen efficiency, Ideal and actual screens

MODULE-II SIZE REDUCTION IN SOLIDS   9

Laws of size reduction ,Energy relationships in size reduction ,Method of size reduction .Classification of equipments, Crushers ,Grinders and its application in cement industries ,size enlargement, Importance of size enlargement, Principle of granulation, Pelletization and flocculation

MODULE-III SETTLING AND SEPARATIONS   9

Settling: Gravity settling, Sedimentation, Thickening, Elutriation. Double cone classifier, Rake Classifier, Bowl Classifier, Centrifugal separation, Cyclones and Hydro cyclones, Electrostatic and magnetic separators, Heavy media separations, Floatation, Jigging

MODULE-IV FILTRATION   9

Filtration and theory of filtration, Batch and continuous filters, Flow through filter cake and filter media, compressible and incompressible filter. Filtration equipments, Selection and operation of filters. Filter aids

Mixing and agitation , Mixing of liquids (with or without solids),Mixing of powders, Selection of suitable mixers, Storage and Conveying of solids, Bunkers, Silos, Bins, Hoppers, Conveyer selection.

Total: 45 Periods

Text Books:

1. Swain A.K., Patra H. and Roy G.K., "Mechanical Operations", 1st Edition, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2017.
2. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005

Reference Books:

1. Coulson J.M. and Richardson J.F., "Chemical Engineering", 5th Edition, Butterworth-Heinemann Ltd., United States of America, 2013
2. Badger Walter L. and Banchero Julius T., "Introduction to Chemical Engineering", 1st Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2008
3. Julian Smith, Warren McCabe, Peter Harriott, emeritus, "Unit Operations of Chemical Engineering", 7th Edition, McGraw-Hill Education, New York, 2017.

Additional References:

1. SWAYAM PORTAL:https://www.classcentral.com/course/swayam-mechanical-operations-10092
2. IIT GUWAHATI:https://freevideolectures.com/course/4106/nptel-mechanical-unit-operations

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO2	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO4	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO5	3	3	3	1	-	-	-	-	-	-	-	1	3	3
CO6	3	2	2	1	-	-	-	-	-	-	-	1	2	2
3	High			2		Medium			1			Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE I (5)	IAE II (10)	IAE III (10)	
Remember	15	10	10	20
Understand	25	30	30	60
Apply	10	10	10	20
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

CHAIRMAN-BOARD OF STUDIES

23PC402	MASS TRANSFER - I	L	T	P	C
		3	0	0	3

Nature of course	Professional Core (PC)
Pre requisites	23PC303- Chemical process calculations

Course Objectives

The course is intended to

1. Learn about mass transfer rates in diffusion in gas, liquid and solid phases.
2. Interpret the relation between mass transfer coefficients and the theories of mass transfer.
3. Demonstrate the working principles of cooling tower and its types.
4. Understand the phenomena of drying and its applications.
5. Illustrate the fundamentals of crystallization.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Solve molecular diffusion in fluids and solids using correlation and theories	Understand
CO 2	Compare various mass transfer coefficients and analogies for various Chemical Engineering Applications	Apply
CO 3	Interpret the theories of mass transfer for individual and overall mass transfer coefficients	Apply
CO 4	Design of humidification and dehumidification equipment based on material and energy balances	Apply
CO 5	Estimate the Psychometric properties of air-water system using charts and equations	Apply
CO 6	Comprehend different types of mass transfer equipments drier, crystallizer and cooling tower used for industrial applications.	Understand

Course Contents

Module – I   Molecular Diffusion   9

Introduction to mass transfer operations, Diffusion: Molecular and Eddy diffusion, Ficks Law of diffusion; steady state molecular diffusion in liquids, gases and solids; diffusivity measurement and prediction; Diffusion coefficient in gases; Dependence of diffusivity on temperature and pressure; Unsteady state diffusion; multi-component diffusion: Correlation for diffusion coefficient in multi-component gaseous mixture.

Module – II   Convective Transfer and Interphase Mass Transfer   9

Concept of mass transfer coefficients, Theories of mass transfer: Film, penetration and Surface renewal theory; Analogies: Reynolds analogy, Chilton Colburn analogy and Von karman analogy; Inter phase mass transfer: Relationship between individual and overall mass transfer coefficient; Number of transfer units (NTU) and Height of transfer units (HTU) concepts, Equipment for mass transfer: Stage-wise and differential contractors.

Module – III   Humidification   9

Humidification: Molal absolute humidity, saturation absolute humidity, relative humidity dry bulb temperature, wet bulb temperature, dew point and percentage humidity; Equilibrium, humidity chart, adiabatic operations; theory and design of cooling towers, Atmospheric, natural draft, forced draft, counter current and cross current draft cooling tower; Recirculating water gas humidification system;

Module – IV   Drying   9

Drying: moisture content, Equilibrium moisture. bound moisture, unbound moisture, free moisture and critical moisture content; Classification of drying operations, batch and continuous drying, Parameter affecting the drying rate during constant rate drying period; Continuous direct heat dryer-material and energy balance; Drying equipment and applications: tray, freeze ,rotary, mechanical agitated and tunnel dryer.

Module – V   Crystallization   9

Crystallization: Classification of the crystals, Equilibrium, yield and purity of products. theory of super saturation, nucleation and stages of crystal growth, factors influencing the nucleation and crystal growth; Product size distribution by MSMPR model; classification of crystallizers and applications, design of batch crystallizers and continuous crystallizers;.

Total : 45 Periods

Text Books

1. Treybal, R.E., "Mass Transfer Operations", 3rd Edn, McGraw-Hill, 2017.
2. Anantharaman N., Meera Sheriffa Begum K.M., "Mass Transfer Theory and Practice", Prentice Hall of India Pvt. Ltd., New Delhi, 2011.

Reference Books

1. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I and II, 5th Edition. Asian Books Pvt. Ltd., India, 2002.
2. Seader J.D. and Henley E.J., "Separation Process Principles", 4th Ed., John Wiley, 2016
3. Binay K. Dutta, "Principles of Mass Transfer and Separation Processes", PHI Learning Ltd. 2013.
4. Narayanan K.V. and Lakshmikutty, B "Mass Transfer – Theory and Applications", 1st Edition. CBS Publishers & Distributors Pvt Ltd, New Delhi, 2014.

Additional References

1. **SWAYAM   PORTAL:**   https://www.classcentral.com/course/swayam-mass-transfer-operations-i-12899
2. **MOOC Courses :**https://www.mooc-list.com/tags/mass-transfer

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)														
COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	3	2	1			2			1	1	3	3
CO 2	3	3	2	3	1			2			1	1	3	3
CO 3	2	3	3	3	1			2			1	1	3	3
CO 4	2	3	3	3	1			2			1	1	3	3
CO 5	2	2	3	3	1			2			1	1	3	3
	3-High				2-Medium				1- Low					

Formative Assessment

Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	
Understand	Tutorial class / Assignment	5	15
Apply			
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations (IAE) (40)			Final Examinations (FE)
	IAE – I (5)	IAE – II (10)	IAE – III (10)	(60)
Remember	10			10
Understand	30	20	20	30
Apply	10	30	30	60
Analyse				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

Passed in Board of Studies

Approved in Academic Council

23PC403	HEAT TRANSFER	L	T	P	C
		3	1	0	3
Nature of Course	Professional Core(PC)				
Pre requisites	NIL				

Course Objectives

The course is intended
1. Understand the concept of Modes of heat transfer.
2. Impact knowledge in various heating methodologies in process engineering
3. Understand the fundamentals of heat transfer equipments.
4. To investigate the Design for heat transfer equipments.
5. Design of single effect evaporators and multiple effect evaporators.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Characterization of conduction, convection and radiation	Understand
CO 2	Explain the concepts of free and natural convection	Apply
CO 3	Apply the laws of radiation	Apply
CO 4	Examine the design aspects for heat transfer equipments	Apply
CO 5	Categorize the fundamentals of Evaporation equipments	Understand
CO 6	Estimate the Condensors and Reboilers.	Apply

Course Contents:

MODULE-I   CONDUCTION
9

Modes of heat transfer - Steady and unsteady state heat transfer - Concept of heat conduction Fourier's law of heat conduction - General heat conduction equation in spherical coordinates - One-dimensional steady state heat conduction equation for flat plate, hollow cylinder, hollow sphere -Analogy between flow of heat and flow of electricity - Effect of temperature on thermal conductivity - Critical insulation thickness -Transient heat conduction.

MODULE-II CONVECTION
9

Concepts of heat transfer by convection - Natural and forced convection, analogies between transfer of momentum and heat - Reynold's analogy, Prandtl and Coulburn analogy. Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate, flow through packed beds.

MODULE-III RADIATION
9

Concept of thermal radiations - Black body concept-Stefan Boltzman's law. Emissive power, Black body radiation. Emissivity,Planck's law Radiation between black surfaces,Gray surfaces Radiation shields - Radiation applications - Pipe still heaters.

MODULE-IV HEAT EXCHANGERS
9

Heat exchanger types – Parallel and counter flow heat exchangers – Overall heat transfer coefficient Log mean temperature difference for single pass – Correction factor for multipass heat exchangers -Heat exchanger effectiveness – Number of transfer units – Chart for different configurations – Dirt factor.

Passed in the Board of Studies

Approved in Academic Council

MODULE-V EVAPORATORS 9

Evaporation – Single effect and multiple effect evaporation – Boiling point elevation – Effect of liquid head – Capacity and economy of multiple effect evaporators – Evaporation equipments, Condensors and Reboilers.

Total: 45 Periods

Text Books:
1. Kumar, D.S., "Heat and Mass Transfer", 5th Edition, S.K. Kataria and Sons, 2013
2. K.A.Gavhane ,"Heat transfer", Nirali prakashan, Pune ,2017.

Reference Books:
1. Kern, D.Q., "Process Heat Transfer", McGraw Hill Publishing Co., 2017.
2. Holman J.P, "Heat Transfer", 8th Edition, McGraw Hill, 2001.

Additional References:
1. SWAYAM PORTAL: https://www.classcentral.com/course/udemy-an-introduction-to-heat-transfer-122820
2. IIT Kharagpur: https://freevideolectures.com/course/4951/nptel-conduction-convection-heat-transfer

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO2	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO4	3	2	2	1	-	-	-	-	-	-	-	1	2	2
CO5	3	3	3	1	-	-	-	-	-	-	-	1	3	3
CO6	3	3	3	1	-	-	-	-	-	-	-	1	3	3
	3	High			2		Medium				1		Low	

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE I (5)	IAE II (10)	IAE III (10)	(60)
Remember	15	10	10	20
Understand	25	30	30	60
Apply	10	10	10	20
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Passed in the Board of Studies   *Approved in Academic Council*

CHAIRMAN-BOARD OF STUDIES

23PC404	Natural Gas Engineering	L	T	P	C
		3	0	0	3

Nature of Course	Professional Core (PC)
Pre requisites	Nil

Course Objectives

The course is intended to

1. Teach the students about the basic concepts and applications of natural gas engineering
2. Understand the Natural gas processing and compression.
3. Examine the different types of deliverability test.
4. Illustrate the compressor selection in natural gas unit.
5. To find out the Seperation and transportation of natural gas pipelines.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Recall the origin of petroleum and their applications	Remembering
CO 2	Discuss the properties and gas compressibility factor	Understand
CO 3	Illustrate the working of different types of compressor systems	Understand
CO 4	Explain the separation of gas and liquid in natural gas processing	Understand
CO 5	Predict transportation design for natural gas unit	Understand
CO 6	Create new process technology for NGE and LNG processes.	Understand

Course Contents

UNIT I   INTRODUCTION TO NATURAL GAS ENGINEERING   9

Natural gas, Origin of petroleum, Sources of Information for natural gas engineering and its applications.Types of Natural Gas Resources, Utilization of Natural Gas. Natural Gas Industry and its future, LP gas, Condensate, & Crude oil.

UNIT II   PRODUCTION OF NATURAL GASES   9

Introduction to offshore oil and gas operations. Offshore Fixed and mobile Units, Offshore Drilling. Difference in drilling from land, from fixed platform, jack up, ships and semi submersibles. Offshore Well Completion, Offshore Production systems. Onshore drilling-Onshore oil rig, Onshore drilling equipments..

UNIT III   DEHYDRATION AND ACID GAS TREATING   9

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Dehydration of Natural Gas: Dehydration Systems, Water Content of Natural Gas Streams, Glycol Dehydrator Design. Acid gas treating of natural gas, Removal of Acid Gases: Iron-Sponge Sweetening, Alkanolamine Sweetening, Glycol/Amine Process and Sulfinol Process.

UNIT IV COMPRESSION AND VOLUMETRIC MEASUREMENT 9

Gas compression: Types of Compressors, Selection of Reciprocating Compressors: Volumetric Efficiency, Stage Compression and Isentropic Horsepower. Selection of Centrifugal Compressors and Selection of Rotary Blowers. Volumetric Measurement: Measurement with Orifice Meters Displacement Metering, Turbine Meter and Elbow Meter. Natural Gas Liquid Measurement.

UNIT V SEPARATION TECHNIQUES 9

Separation of Gas and Liquids: Principles of Separation, Types of Separators and Factors Affecting Separation. Separator Design: Stage Separation, Flash Calculation and Low-Temperature Separation.

Total : 45 Periods

Text Books

1. Dr. Boyun Guoand Dr. Ali Ghalambor "Natural Gas Engineering Handbook" Gulf Publishing Company, Houston, Texas, ISBN-13: 978-1-933-762-21-8, 2nd Edition 2005.
2. Lyons, W.C., "Standard Handbook of Petroleum and Natural Gas Engineering", Vol.2, Gulf Professional Publishing, Elsevier Inc., 2006.

Reference Books

1. William C Lyons, Gary C Plisga "Standard Handbook of Petroleum and Natural Gas Engineering" Gulf Professional Publishing, 2nd Edition.
2. Smith, R. V "Practical Natural Gas Engineering", Penwell Publishing Company- 2nd Edition 1990.
3. Dring, M.M "The Natural Gas Industry – A Review of World Resources and Industrial Applications", Butterworth, 1974.
4. Saied Mokhatab, William A. Poe, and James G. Speight, "Handbook of Natural Gas Transmission and Processing 1st Edition 2006.
5. Katz and Lee "Hand Book of Natural Gas Engineering" McGraw Hill, 1968.

Additional References

1. MOOC Courses - https://www.mooc-list.com/course/natural-gas-course/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	1		3							2	2	3
CO 2	3	2	1		3							2	2	3
CO 3	3	2	1		3							2	1	3
CO 4	3	2	1		3							2	1	3

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CO 5	3	2	1		3						2	1	3
CO 6	3	2	1		3						2	1	3

3-High	2-Medium	1-Low	

Formative Assessment

Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	
Understand	Tutorial class / Assignment	5	15
Apply			
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	60
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyse				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

Passed in Board of Studies

Approved in Academic Council

23PC405	PROFESSIONAL ETHICS IN ENGINEERING	L	T	P	C
		3	0	0	3

Nature of course	HUMANITIES AND SOCIAL SCIENCE
Pre requisites	Nil

Course Objectives
The course is intended to
1. Introduces students about the ethics.
2. Understand about the various morals and values for professional excellence.
3. Know the different ideas of engineering fields.
4. Make the students to understand and aware about global issues of ethics and its applicability.
5. Enable them to managing the stress during work.

Course Outcomes
On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Know the concept and importance of engineering ethics	Understand
CO 2	Aware about the overall ethical aspects of engineering	Remember
CO 3	Able to apply the ethics in engineering	Understand
CO 4	Practice democratic and scientific values in both their personal and professional life	Remember
CO 5	Realize engineering ethical issues at global level	Remember
CO 6	Work effectively as a team with commitment to the professional ethics among the peer group involved.	Understand

Course Contents
Unit – I   HUMAN VALUES   9

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management

Unit – II   ENGINEERING ETHICS   9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Unit – III   ENGINEERING AS SOCIAL EXPERIMENTATION   9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

Unit – IV   SAFETY, RESPONSIBILITIES AND RIGHTS
9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR)– Discrimination.

Unit – V   GLOBAL ISSUES
9

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

Total : 45 Periods

Text Books

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

Reference Books

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall. New Jersey. 2004
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins. "Engineering Ethics -Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

Additional / Web References

1. www.onlineethics.org
2. www.nspe.org

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1		3										3	1	1
CO 2		2				3		3					3	1
CO 3	3		3				2		2		2			2
CO 4		2			3					3			3	1

CO 5	2			2										1		1
CO 6		1	1						2	2	2		1		1
	3	High			2	Medium			1	Low					

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	
Understand	Tutorial Class / Assignment	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (5)	IAE – 2 (10)	IAE – 3 (10)	
Remember	10	20	20	20
Understand	40	30	30	80
Apply				
Analyze				
Evaluate				
Create				

CHAIRMAN-BOARD OF STUDIES

Passed in Board of Studies   Approved in Academic Council

23MA402	STATISTICAL AND NUMERICAL METHODS (Common to Aero, Agri, Civil, Food, Mech, PCT & S&F)	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Pre requisites	Foundations of Mathematics				

Course Objectives

The course is intended to

1. Acquaint with the knowledge of testing of hypothesis for small and large samples
2. Familiarize with the basic concept on types of design of experiments used in the field of engineering
3. Introduce the basic concepts of algebraic and transcendental equations
4. Acquire the concept of numerical techniques of differentiation and integration
5. Study the numerical techniques in solving ordinary differential equations
6. Equip student with the ability to analyze data and solve mathematical problems using Statistical techniques and numerical algorithm.
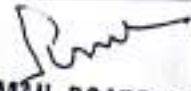
Course Outcomes

On successful completion of the course, students will be able to

CO1	Interpret the testing of hypothesis for small and large samples.	Apply
CO2	Explain the basic concepts of classifications of design of experiments in the field of engineering.	Apply
CO3	Demonstrate the algebraic and transcendental equations.	Apply
CO4	Apply the numerical techniques of interpolation and error approximations in various intervals in real life situations	Apply
CO5	Execute the numerical techniques for solving first and second order ordinary differential equations.	Apply
CO6	Create new statistical techniques and numerical algorithms for data analysis and problem solving.	Apply

Course Contents:

Module – I	TESTING OF HYPOTHESIS	9

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t for single mean and difference of means, Chi-square - Contingency table (test for independent) -Goodness of fit.

Module – II	DESIGN OF EXPERIMENTS	9

One way and two way classifications – completely randomized design – Randomized block design – Latin square design.

Module – III	SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	9

Solution of linear system of equations – Gauss elimination method – Gauss Jordan method - Iterative methods of Gauss Jacobi method and Gauss Seidel method- Eigen values of a matrix by Power method

CHAIRMAN-BOARD OF STUDIES

Module – IV	INTERPOLATION AND NUMERICAL INTEGRATION	9

Lagrange's interpolations - Newton's divided difference interpolations – Newton's forward difference and backward difference formulae – Numerical integration using Trapezoidal and Simpson's 1/3 rules.

Module – V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	9

Single step methods: Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne's predictor corrector methods for solving first order equations.

Total: 60 Periods

Text Books:

1. Gupta S.C and Kapoor V.K., Fundamentals of Mathematical Statistics", Sultan chand & sons, New Delhi, 12th Edition, 2020
2. Grewal B.S, and Grewal J.S " Numerical methods in engineering and science "Khanna Publishers, 10th Edition, 2015.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference Books:

1. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, New Delhi, 3rd Edition, 2017
2. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, 9th Edition, 2016.
3. Walpole. R.E., Myers. R.H., Myers. S.L and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, 8th Edition, 2016

Additional References:

1. https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html
2. https://reference.wolfram.com/language/tutorial/Numerical methods.html
3. https://www.researchgate.net/publication/349657530_Statistics_and_Numerical Methods

Laboratory Components using MATLAB:

S.No	List of Experiments	CO Mapping	RBT
1	Student's t - test	1	Apply
2	Chi – Square test	1	Apply
3	One way classification	2	Apply
4	Two way classification	2	Apply
5	Gauss Elimination Method	3	Apply
6	Gauss Seidel Method	3	Apply

CHAIRMAN-BOARD OF STUDIES

7	Lagrange's Interpolation Formula	4	Apply
8	Simpson's 1/3 rd rule	4	Apply
9	Euler's Method	5	Apply
10	Runge – Kutta Method	5	Apply

Total: 30 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

| COs | POs | | | | | | | | | | | | PSOs | | |
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	2		
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2		
CO3	3	3	1	-	-	-	-	-	-	-	-	-	1		
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2		
CO5	3	3	2	-	-	-	-	-	-	-	-	-	2		
CO6	3	2	3	-	-	-	-	-	-	-	-	-	2		
	3		High		2		Medium			1	Low		2		

| Bloom's Level | Continuous Assessment Theory | | | | Summative Assessment Practical | | Final Examination (Theory) [50] |
	IAE I (5)	IAE II (10)	IAE III (10)	Attendance [5]	Rubric based [10]	Model Exam [10]	
Remember	10	10	10				10
Understand	10	10	10		40	40	30
Apply	30	30	30		60	60	60
Analyze							
Evaluate							
Create							

CHAIRMAN- BOARD OF STUDIES

Passed in Board of Studies Meeting on 08.07.2024

Approved in Academic Council Meeting on 20.07.2024

23PC406	HEAT TRANSFERLABORATORY	L	T	P	C
		0	0	2	1
Nature of course	Professional Core(PC)				
Prerequisites	Nil				

Course Objectives

The course is intended to

- Develop a sound working knowledge on different types of conductivity.
- Know about separation characteristics of different heat exchangers
- Gain knowledge about the packed bed column
- Study about the heat transfer rate between various matters.
- Gain knowledge about the various cooling towers.

Course Outcomes

On successful completion of the course,students will be able to

CO. No	CourseOutcome	Bloom's Level
CO 1	Apply the concepts of heat transfer and fluid dynamics to the operation of heat transfer equipments.	Analyze
CO 2	Estimate the heat transfer rate and heat transfer co-efficient	Analyze
CO 3	To perform heat transfer operation and to compare observed with predicted performance	Analyze
CO 4	Evaluate the performance/calculate the parameters in heat transfer equipments.	Analyze
CO 5	Collect and analyse the heat transfer data practically and Conduct experiments to get optimal result.	Analyze
CO 6	Solve complex engineering problems effectively as an individual as well as team work.	

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Measurement of Thermal Conductivity of metal rod	CO1	Analyze
2.	Performance studies on Cooling Tower	CO2	Analyze
3.	Heat Transfer through Packed Bed	CO2	Analyze
4.	Heat Transfer in a Double Pipe Heat Exchanger	CO2	Analyze
5.	Heat Transfer in a Bare and Finned Tube Heat Exchanger	CO4	Analyze
6.	Heat Transfer in a Vertical and Horizontal Condenser	CO4	Analyze

7.	Heat Transfer in Helical Coils	CO4	Analyze
8.	Heat Transfer in Agitated Vessels	CO4	Understand
9.	Batch drying kinetics using Tray Dryer	CO4	Analyze
10.	Heat transfer in Open Pan Evaporator	CO5	Analyze
11.	Boiling Heat Transfer	CO5	Analyze

Total:30 Periods

Reference Books

Lab Manual

Mapping of Course Outcomes(COs) with Programme Outcomes(POs) Programme Specific Outcomes(PSOs)

| Cos | Pos | | | | | | | | | | | | PSOs | |
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3	1	1	1						1	3	2
CO 2	3	3	3	2	1	1						1	3	2
CO 3	3	3	3	1	1	1						1	3	2
CO 4	3	2	2	2	2	2						1	3	2
CO 5	3	2	2	1	1	1						1	3	2
CO 6	2	2	1	1	1	1						1	2	2

| 3 | High | | 2 | Medium | | 1 | Low |

Assessment based on Continuous Assessment and Final Examination

| Bloom's Level | Continuous Assessment(60marks) (Attendance -5marks) | | Final Examination (60 marks) |
	Rubric based Continuous Assessment (30 marks)	Model examination (25 marks)	
Remember			
Understand	20	20	20
Apply	40	40	40
Analyze	40	40	40
Evaluate			
Create			

CHAIRMAN-BOARD OF STUDIES

23PC407	MECHANICAL OPERATIONS LABORATORY	L	T	P	C
		0	0	2	1

Nature of course	Professional Core(PC)
Prerequisites	Nil

Course Objectives

The course is intended to
- Develop a sound working knowledge on different types of crushing equipments .
- Know about separation characteristics of different mechanical operation separators
- Gain knowledge about the various crushers
- Study about the size characteristics of particles.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	CourseOutcome	Bloom's Level
CO 1	Compare the results of theoretical analytical models to the actual behavior of real fluid flows and draw sustainable conclusions	Analyze
CO 2	Determine the size analysis in solid- solid separation systems	Understand
CO 3	Evaluate the size reduction and various crushing parameters	Analyze
CO 4	Differentiate various filtration techniques	Analyze
CO 5	Work effectively as a team with commitment to the professional ethics among the peer group involved	Analyze
CO 6	Determine the various screen effiency	Analyze

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Sieve analysis.	CO1	Analyze
2.	Batch filtration studies using a Leaf filter	CO2	Analyze
3.	Reduction ratio in Ball mill	CO3	Understand
4.	Drop weight crusher	CO3	Analyze
5.	Reduction ratio in Jaw Crusher	CO4	Understand
6.	Effectiveness of Screen	CO5	Analyze
7.	Batch filtration studies using a Plate and Frame Filter press	CO5	Analyze
8.	Characteristics of batch Sedimentation	CO6	Analyze

Total:30 Periods

Reference Books

Lab Manual

Mapping of Course Outcomes(COs) with Programme Outcomes(POs) Programme Specific Outcomes(PSOs)

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3	1								1	3	2
CO 2	3	3	3	2								1	3	2
CO 3	3	3	3	1								1	3	2
CO 4	3	2	2	2								1	3	2
CO 5	3	2	2	1								1	2	2
CO 6	2	2	2	1								2	2	1

3	High			2	Medium		1	Low

Assessment based on Continuous Assessment and Final Examination

Bloom's Level	Continuous Assessment(60marks) (Attendance -5marks)		Final Examination (60 marks)
	Rubric based Continuous Assessment (30 marks)	Model examination (25 marks)	
Remember			
Understand	20	20	20
Apply	40	40	40
Analyze	40	40	40
Evaluate			
Create			

CHAIRMAN-BOARD OF STUDIES