

# KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA



## REGULATIONS, CURRICULUM & SYLLABI – 2024

(CHOICE BASED CREDIT SYSTEM AND  
OUTCOME BASED EDUCATION)

(For the students admitted from the academic year 2024 - 2025 )

### BACHELOR OF ENGINEERING DEGREE IN CHEMICAL ENGINEERING

### DEPARTMENT OF CHEMICAL ENGINEERING



**B.TECH.CHEMICAL ENGINEERING CURRICULUM – R2024**  
**(For the students admitted from the academic year 2024-25 onwards)**

SEMESTER – I																	
Course Code	Course Title	Hours / Semester							Credit	Maximum Marks			Category	Type			
		CI		LI	TW	SL	TH			CA	ESE	Total					
		L	T	P													
<b>Theory/Theory with Practical</b>																	
24EGT11	English for Effective Communication - I	45	0	0	45	0	90	3	40	60	100	HS	C				
24MAC11	Matrices and Ordinary Differential Equations	45	7	16	52	0	120	4	50	50	100	BS	A				
24CYT14	Chemistry for Chemical Engineering	45	0	0	45	0	90	3	40	60	100	BS	C				
24CSC11	Problem Solving and Programming in C	45	0	30	45	0	120	4	100	0	100	ES	OT				
24MET11	Engineering Drawing	30	15	0	45	0	90	3	40	60	100	ES	A				
24TAM01	Heritage of Tamils	15	0	0	15	0	30	1	100	0	100	HS	OT				
<b>Practical / Employability Enhancement</b>																	
24CYL14	Chemistry Laboratory for Chemical Engineering	0	0	30	0	0	30	1	60	40	100	BS					
24GCL12	Foundation Laboratory – Electrical, IoT and Web Technologies	0	0	90	0	0	90	3	100	0	100	ES					
24MNT12	Quantitative Aptitude – I	20	0	0	10	0	30	0	100	0	100	MC					
24MNT11	Student Induction Program	0	0	90	0	0	90	0	100	0	100	MC					
<b>Total Credits to be earned</b>									<b>22</b>								

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination.

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

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Signature of the Chairman Board of Studies - Chemical



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**B.TECH.CHEMICAL ENGINEERING CURRICULUM – R2024**  
 (For the students admitted from the academic year 2024-25 onwards)

SEMESTER – II														
Course Code	Course Title	Hours / Semester							Credit	Maximum Marks			Category	Type
		CI		LI	TW	SL	TH	CA		ESE	Total			
		L	T	P										
<b>Theory/Theory with Practical</b>														
24EGT21	English for Effective Communication - II	45	0	0	45	0	90	3	40	60	100	HS	C	
24MAC22	Multivariable Calculus and Partial Differential Equations	45	7	16	52	0	120	4	50	50	100	BS	A	
24PHT22	Physics for Chemical Engineering	45	0	0	45	0	90	3	40	60	100	BS	C	
24ITC23	Python Programming	45	0	30	45	0	120	4	50	50	100	ES	OT	
24CHT21	Chemical Process Industries	45	0	0	45	0	90	3	40	60	100	PC	C	
24TAM02	Tamils and Technology	15	0	0	15	0	30	1	100	0	100	HS	OT	
<b>Practical / Employability Enhancement</b>														
24PHL22	Physics Laboratory for Chemical Engineering	0	0	30	0	0	30	1	60	40	100	BS		
24GCL11	Foundation Laboratory – Manufacturing, Design and Robotics	0	0	90	0	0	90	3	100	0	100	ES		
24MNT21	Quantitative Aptitude – II	20	0	0	10	0	30	0	100	0	100	MC		
24VEC11	Yoga and Values for Holistic Development	10	0	10	10	0	30	1	100	0	100	HS		
									23					

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

<i>R. amul.</i> Signature of the Chairman Board of Studies - Chemical
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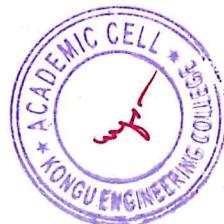
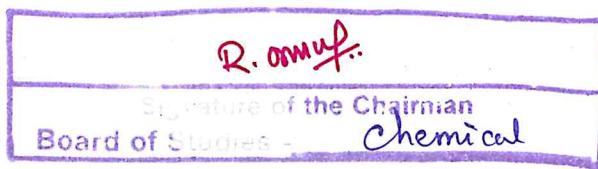


**B.TECH.CHEMICAL ENGINEERING CURRICULUM – R2024**  
**(For the students admitted from the academic year 2024-25 onwards)**

SEMESTER – III														
Course Code	Course Title	Hours / Semester						Credit	Maximum Marks			Category	Type	
		CI		LI	TW	SL	TH		CA	ESE	Total			
		L	T	P										
<b>Theory/Theory with Practical</b>														
24EET34	Basics of Mechanical and Electrical Engineering	45	0	0	45	0	90	3	40	60	100	ES	C	
24CHT31	Chemical Process Calculations	45	15	0	60	0	120	4	40	60	100	PC	A	
24CHT32	Fluid Mechanics	30	15	0	45	0	90	3	40	60	100	PC	A	
24CHT33	Applied Organic Chemistry	45	0	0	45	0	90	3	40	60	100	PC	C	
24CHC31	Chemical Engineering Thermodynamics	45	0	30	45	0	120	4	50	50	100	PC	A	
24GET31	Universal Human Values	30	0	0	30	0	60	2	100	0	100	HS	OT	
<b>Practical / Employability Enhancement</b>														
24CHL31	Fluid Mechanics Laboratory	0	0	30	0	0	30	1	60	40	100	PC		
24CHL32	Applied Organic Chemistry Laboratory	0	0	30	0	0	30	1	60	40	100	PC		
24GEP31	Mini Project - I	0	0	30	0	0	30	1	100	0	100	EC		
<b>Total Credits to be earned</b>								<b>22</b>						

CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination.

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others



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**B.TECH. CHEMICAL ENGINEERING CURRICULUM – R2024**  
 (For the candidates admitted from academic year 2024-25)

SEMESTER – IV														
Course Code	Course Title	Hours / Semester						Credit	Maximum Marks			Category	Type	
		CI		LI	TW	SL	TH		CA	ESE	Total			
		L	T	P										
<b>Theory/Theory with Practical</b>														
24MAT42	Statistics and Numerical Methods	45	15	0	60	0	120	4	40	60	100	BS	A	
24CHT41	Mass Transfer - I	45	15	0	60	0	120	4	40	60	100	PC	A	
24CHT42	Process Heat Transfer	30	15	0	45	0	90	3	40	60	100	PC	A	
24CHT43	Mechanical Operations	30	15	0	45	0	90	3	40	60	100	PC	A	
24CHT44	Material Science and Engineering	45	0	0	45	0	90	3	40	60	100	ES	C	
<b>Practical / Employability Enhancement</b>														
24CHL41	Process Heat Transfer Laboratory	0	0	30	0	0	30	1	60	40	100	PC		
24CHL42	Mechanical Operations Laboratory	0	0	30	0	0	30	1	60	40	100	PC		
24CHL43	Process Computations Laboratory	0	0	30	0	0	30	1	60	40	100	PC		
24GCL41/ 24GCI41	Professional Skills Training – I / Industrial Training – I \$	0	0	45	35	0	80	2	100	0	100	MC		
24GEP41	Mini Project - II	0	0	30	0	0	30	1	100	0	100	EC		
<b>Total Credits to be earned</b>									23					

\$80 hours of Training

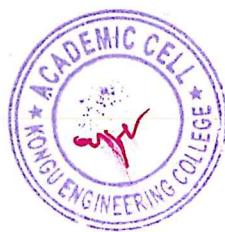
CI – Classroom Instructions, LI – Laboratory Instructions, TW – Term Work, SL – Self Learning, L – Lecture, T – Tutorial, P – Practical, C – Credit, TH – Total Hours, CA – Continuous Assessment, ESE – End Semester Examination.

Type: A – Analytical, D – Design using Hardware, S – Simulation using Coding, C – Concept, OC – Online course, OT - others

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Signature of the Chairman	
Board of Studies -	chemical

V. S. Jayaraman

A. S. Venkateswaran



24EGT11 - ENGLISH FOR EFFECTIVE COMMUNICATION - I																		
(Common to all Engineering and Technology Branches)																		
Programme & Branch	All B.E/B.Tech Branches	Sem	Category	L	T	P	SL*	Total	Credit									
Prerequisites	Nil	1	HS	45	0	0	45	90	3									
Preamble	This course is designed to enhance the communication skills and verbal aptitude in English language required for various workplace communication and social interactions.																	
<b>Unit – I</b>	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>																	
<b>Grammar:</b> Parts of Speech – Articles – Determiners – <b>Verbal Aptitude:</b> Synonyms and Antonyms – Selecting Words – <b>Listening:</b> Listening and Filling in Information – <b>Speaking:</b> Introducing Oneself – Discussion on Social Media Etiquette – <b>Reading:</b> Importance of Good Communication – Comprehension and Inference, Reading for facts and opinions – Building a Positive Attitude: An Excerpt from <i>You Can Win</i> – <b>Writing:</b> Email Etiquette – Email Writing – Responding to Emails																		
<b>Unit – II</b>	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>																	
<b>Grammar:</b> Types of Sentences – Assertive, Interrogative, Imperative and Exclamatory – Question Tags– <b>Verbal Aptitude:</b> Prefixes and Suffixes – Collocations – Idiomatic Expressions – <b>Listening:</b> Identifying main and Secondary Points – <b>Speaking:</b> Asking Questions – Role Play – <b>Reading:</b> Reading for Comprehension – Verbal and Non-Verbal Communication – Winning Strategies: An Excerpt from <i>You Can Win</i> - <b>Writing:</b> Descriptive Writing – Product/Process Description – Letter Writing: Formal Letters – Seeking Permission and Inviting Chief Guest																		
<b>Unit – III</b>	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>																	
<b>Grammar:</b> Tenses – Phrasal Verbs– <b>Verbal Aptitude:</b> Jumbled Sentences – Sentence Formation– <b>Listening:</b> Taking Notes from a Discussion – <b>Speaking:</b> Retelling an Incident – Discussing Tourist Destinations – <b>Reading:</b> Process of Communication–Scanning - Motivating Yourself and Others Every Day: An Excerpt from <i>You Can Win</i> – <b>Writing:</b> Paragraph Writing: Narrative and Compare & Contrast																		
<b>Unit – IV</b>	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>																	
<b>Grammar:</b> Prepositions – Transitional Words/Phrases – Discourse Markers – <b>Verbal Aptitude:</b> One Word Substitution - Sentence Completion – <b>Listening:</b> Listening for Specific Information – <b>Speaking:</b> Small Talk–Telephonic Conversations– <b>Reading:</b> Channels of communication – Building Positive Self-Esteem and Image: An Excerpt from <i>You Can Win</i> – <b>Writing:</b> Instructions – Recommendations and Suggestions																		
<b>Unit – V</b>	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>																	
<b>Grammar:</b> Subject Verb Agreement – Gerunds and Infinitives– <b>Verbal Aptitude:</b> Homonyms, Homophones and Homographs – Cloze Test using Verb Forms, Prepositions and Articles – <b>Listening:</b> Listening and Identifying Parts from a Description – <b>Speaking:</b> Agreeing and Disagreeing – <b>Reading:</b> Skimming – Reading to Summarize – Setting and Achieving your Goals: An Excerpt from <i>You Can Win</i> – <b>Writing:</b> Transcoding: Identifying Trends and Patterns in Graphs and Expressing with Graph Specific Vocabulary																		
<b>TEXT BOOK:</b>																		
1.	Sudharshana N P and Savitha C, <i>English for Technical Communication</i> , 2 <sup>nd</sup> Edition, Cambridge University Press, New Delhi, 2016.																	
<b>REFERENCES:</b>																		
1.	Ashraf Rizvi. <i>Effective Technical Communication</i> , 2 <sup>nd</sup> Edition, McGraw-Hill India, 2017.																	
2.	S. P. Dhanavel. <i>English and Communication Skills for Students of Science and Engineering</i> , Orient Black Swan Publishers, Hyderabad, 2009.																	
3.	Shiv Khera. <i>You Can Win: A Step-by-Step Tool for Top Achievers</i> . Bloomsbury Publishing, 2018.																	

\* includes Term Work (TW) & Assignments, Tutorials and Case Studies

COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)
CO1	learn and use various aspects of English vocabulary to perform well in verbal aptitude tests of different types										
CO2	listen and understand different spoken discourses										
CO3	present ideas clearly and confidently in formal and informal conversations and discussions										
CO4	comprehend the given text and respond appropriately for technical and professional purposes										
CO5	select appropriate words , phrases and grammatical units and apply them in both spoken and written communication										

#### Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						1		1	3	1	1		
CO2									1	3		1	
CO3									2	3	1	2	
CO4						1				3	1	2	
CO5										3		2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understa nding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	35	50	-	-	15	100
CAT2	-	45	35	-	-	20	100
CAT3	-	30	35	35	-	-	100
ESE	-	20	40	20	-	20	100

\* ±3% may be varied (CAT 1,2& 3 – 50 marks & ESE – 100 marks)

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Signature of the Chairman
Board of Studies - S&H (English)

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24MAC11 - MATRICES AND ORDINARY DIFFERENTIAL EQUATIONS										
(Common to all Engineering and Technology branches)										
Programme & Branch	All B.E/B.Tech Branches	Sem.	Category	L	T	P	SL*	Total	Credit	
Prerequisites	Nil	1	BS	45	7	16	52	120	4	
Preamble	To provide the skills to the students for solving different real time problems by applying matrices and ordinary differential equations.									
Unit - I	<b>Matrices:</b>									
Introduction – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation.										
Unit - II	<b>Ordinary Differential Equations:</b>									
Introduction – Solution of First order differential equations: Exact differential equations – Leibnitz's Linear Equation – Bernoulli's equation – Clairaut's equation - Applications: Law of natural growth and decay.										
Unit - III	<b>Ordinary Differential Equations of Higher Order:</b>									
Linear differential equations of second and higher order with constant coefficients - Particular Integrals for the types: $e^{ax}$ – $\cos ax / \sin ax$ – $x^n - e^{ax}x^n$ , $e^{ax} \sin bx$ and $e^{ax} \cos bx$ – Differential Equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation.										
Unit - IV	<b>Applications of Ordinary Differential Equations:</b>									
Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Applications of differential equations: Simple harmonic motion – Electric circuits (Differential equations and associated conditions need to be given).										
Unit - V	<b>Laplace Transform:</b>									
Introduction – Conditions for existence – Laplace transform of elementary functions – Basic properties – Derivatives and integrals of transforms – Transform of periodic functions - Inverse Laplace transform: Inverse Laplace transform of elementary functions – Partial fraction method – Convolution Theorem – Applications: Solution of linear ODE of second order with constant coefficients.										
<b>LIST OF EXPERIMENTS / EXERCISES:</b>										
1.	Introduction to MATLAB									
2.	Computation of eigen values and eigen vectors									
3.	Solving first order ordinary differential equations									
4.	Solving higher order ordinary differential equations									
5.	Solution of Simultaneous first order ODEs									
6.	Solving second order ODE by variation of parameters									
7.	Determining Laplace and inverse Laplace transform of basic functions									
8.	Solution of Second order ODE by employing Laplace transforms									
<b>TEXT BOOK:</b>										
1.	Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2016, S.Chand and Co., New Delhi.									
<b>REFERENCES/ MANUAL / SOFTWARE:</b>										
1.	Kreyszig E, "Advanced Engineering Mathematics ", 10 <sup>th</sup> Edition, John Wiley, New Delhi, India, 2016.									
2.	Ramana B V, "Higher Engineering Mathematics", 1 <sup>st</sup> Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.									
3.	Duraisamy C., Vengatasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - I", 2 <sup>nd</sup> Edition, Pearson India Education, New Delhi, 2018.									
4.	Grewal B.S., "Higher Engineering Mathematics" 44th Edition, Khanna Publishers, New Delhi, 2018.									
5.	Matrices and Ordinary Differential Equations Laboratory Manual.									

\*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)
CO1	Use the matrix algebra methods and MATLAB for solving practical problems.										
CO2	Identify the appropriate method for solving first order ordinary differential equations.										
CO3	Solve higher order linear differential equations with constant and variable coefficients.										
CO4	Apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems.										
CO5	Apply Laplace Transform to solve complex engineering problems.										

#### Mapping of COs with POs and PSOs

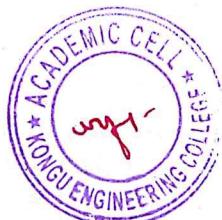
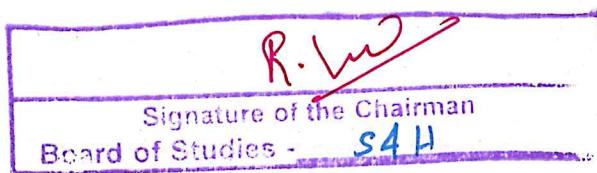
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2		3								
CO2	3	3	2		3								
CO3	3	3	2		3								
CO4	3	3	2		3								
CO5	3	3	3		3								

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		40	60				100
CAT3		30	70				100
ESE		30	70				100

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)



**24CYT14 - CHEMISTRY FOR CHEMICAL ENGINEERING**

Programme & Branch	B.Tech - Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit									
Prerequisites	NIL	1	BS	45	0	0	45	90	3									
Preamble	This course explores the basic principles of water treatment, energy storage devices, electrochemistry, corrosion fuels, combustion and phase rule. It aims to impart the fundamentals of chemistry towards innovations in chemical engineering and also for societal applications.																	
<b>Unit – I</b>	<b>WATER TECHNOLOGY</b>																	
Introduction - types of water - hardness of water- expression of hardness - units of hardness –water quality parameters-estimation of hardness of water by EDTA method – determination of alkalinity - DO, BOD and COD (Definition and Significance only) - disadvantages of using hard water in industry: scale, sludge and boiler corrosion - softening of water: Internal treatment process - carbonate and calgon conditioning - External treatment method - demineralization process and reverse osmosis.																		
<b>Unit – II</b>	<b>ELECTROCHEMISTRY AND CORROSION</b>																	
<b>Electrochemistry:</b> Introduction - cells - types - representation of galvanic cell – Electrode potential – Nernst equation (derivation of cell EMF) – construction, working and applications of glass electrode - conductometric titrations – mixture of weak and strong acid Vs strong base. <b>Corrosion:</b> Introduction - chemical corrosion - pilling - bedworth rule - electrochemical corrosion - mechanism with examples - galvanic series- factors influencing rate of corrosion - corrosion control by organic coating (paints) - constituents and functions with examples.																		
<b>Unit – III</b>	<b>ENERGY STORAGE DEVICES</b>																	
<b>Batteries:</b> Introduction - discharging and charging of battery - characteristics of battery - types of batteries – primary battery: silver button cell - secondary battery: Ni-Cd battery -modern battery: lithium-ion battery - choice of batteries for electric vehicles. <b>Fuel Cells:</b> Introduction - Importance and classification of fuel cells - description, principle, components and working of fuel cells: alkaline fuel cell, phosphoric acid fuel cell and direct methanol fuel cell - comparison of batteries with fuel cells.																		
<b>Unit – IV</b>	<b>FUELS AND COMBUSTION</b>																	
Introduction – classification of fuels - characteristics of a good fuel - combustion - calorific values – gross and net calorific values (simple problems) -Flue gas analysis by Orsat's method- solid fuels - coal and its varieties – proximate analysis – significance – metallurgical coke - Otto-Hoffman byproduct method - liquid fuel - refining of petroleum - knocking: spark ignition engine - octane number, compression ignition engine - cetane number - gaseous fuel - LPG.																		
<b>Unit – V</b>	<b>PHASE RULE</b>																	
Introduction - statement and explanation of terms involved – one component system – water system – polymorphism – experimental determination of transition point – sulphur system - condensed phase rule – construction of phase diagram by thermal analysis – two component system – simple eutectic system – Silver-Lead system–Potassium Iodide-Water System – congruent and incongruent melting point.																		
<b>TEXT BOOK:</b>																		
1.	Roussak , O.V. Gesser, H. D. " Applied Chemistry: A Textbook for Engineers and Technologists", 2 <sup>nd</sup> Edition ,Springer, 2013, for Units I, II, III.																	
2	Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., Kowshalya V.N., "Chemistry for Engineering", Revised Edition, Pearson Education, New Delhi, 2024,for Units III, IV, V.																	
<b>REFERENCES:</b>																		
1.	Payal B. Joshi, Shashank Deep, "Engineering Chemistry", Oxford University Press, New Delhi, 2019.																	
2.	Wiley Editorial Board, "Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019.																	

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES:								BT Mapped (Highest Level)	
On completion of the course, the students will be able to									
CO1	analyze the water quality parameters for suitability of industrial and domestic applications.								Analysing (K4)
CO2	investigate the fundamental principles of electrochemistry and corrosion control measures to prevent corrosion.								Analysing (K4)
CO3	examine the chemistry of energy storing devices and meeting the future prospectus of energy storage.								Analysing (K4)
CO4	investigate the concepts of fuels and combustion for efficient engineering applications.								Analysing (K4)
CO5	examine and identify phase diagram for one and two component systems for various engineering applications.								Analysing (K4)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1		1							
CO2	3	2	1	1									
CO3	3	2	1	1									
CO4	3	2	1	1									
CO5	3	2	1	1									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	50	10			100
CAT2		40	50	10			100
CAT3		40	50	10			100
ESE		40	50	10			100

\* ±3% may be varied (CAT 1, 2 & 3 -- 50 marks & ESE – 100 marks)

(Initials)

	R. Iyer
Signature of the Chairman Board of Studies - 	

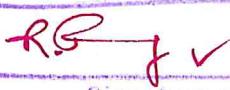


<b>24CSC11 - PROBLEM SOLVING AND PROGRAMMING IN C</b>										
<b>Programme &amp; Branch</b>	All BE/BTech Engineering & Technology branches, except CSE, IT,CSD, AI&ML, AI&DS	<b>Sem</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>	
<b>Prerequisites</b>	Nil	1	ES	45	0	30	45	120	4	
<b>Preamble</b>	The course is designed for use by freshmen students taking their first course in programming. It deals with the techniques needed to practice computational thinking, the art of using computers to solve problems and the ways the computers can be used to solve problems. This course also focuses on developing programming skills using C language.									
<b>Unit – I</b>	<b>Introduction to Computer and Problem Solving:</b> Overview of computers: Types, Generations, Characteristics, Basic computer Organization – Problem solving techniques: Algorithms - Flowcharts – Pseudo codes – Structuring the logic: Sequential, selection and repetitive structure									
<b>Unit – II</b>	<b>Introduction to C and Control Statements:</b> The structure of a C program – Compiling and executing C program – C Tokens – Character set in C – Keywords – identifiers- Basic data Types – Variables – constants – Input / Output statements – operators - decision making and looping statements									
<b>Unit – III</b>	<b>Arrays and Functions:</b> Declaring, initializing and accessing arrays – operations on arrays – Two dimensional arrays and their operations. Functions : Introduction- Using functions, function declaration and definition – function call – return statement – passing parameters to functions: basic data types and arrays – storage classes – recursive functions									
<b>Unit – IV</b>	<b>Strings and Pointers:</b> Strings :Introduction – operations on strings : finding length, concatenation, comparing and copying – string and character manipulation functions, Arrays of strings. Pointers: declaring pointer variables – pointer expression and arithmetic, pointers and 1D arrays , pointers and strings									
<b>Unit – V</b>	<b>User-defined Data Types and File Handling:</b> User-defined data types: Structure: Introduction – nested structures– arrays of structure – structure and functions - unions – enumerated data type. File Handling: Introduction - opening and closing files – reading and writing data to files -Manipulating file position indicator : fseek(), ftell() and rewind()									
<b>LIST OF EXPERIMENTS / EXERCISES:</b>										
1.	Writing algorithms and drawing flowcharts using Raptor Tool for problems involving sequential, Selection and repetition structures									
2.	Programs for demonstrating the use of different types of format Specifiers									
3.	Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators									
4.	Programs for demonstrating using decision making statements									
5.	Programs for demonstrating using repetitive statements									
6.	Programs for demonstrating one-dimensional array									
7.	Programs for demonstrating two-dimensional array									
8.	Programs to demonstrate modular programming concepts using functions									
9.	Programs to demonstrate strings (Using built-in and user-defined functions)									
10.	Programs to illustrate the use of pointers									
11.	Programs to illustrate the use of structures and unions									
12.	Programs to implement file Handling									

\*includes Term Work(TW) & Online / Certification course hours

<b>TEXT BOOK:</b>													
1.	Reema Thareja, "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018												
<b>REFERENCES/ MANUAL / SOFTWARE:</b>													
1.	Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.												
2.	Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.												
3.	Balagurusamy E., "Programming in ANSI C", 7th Edition, McGraw Hill Education, 2017.												
4.	Behrouz A. Forouzan & Richard F.Gilberg, "Computer Science A Structured Programming Approach Using C", 3 <sup>rd</sup> Edition, Cengage,2017.												
5.	<a href="https://www.cprogramming.com/tutorial/c-tutorial.html">https://www.cprogramming.com/tutorial/c-tutorial.html</a>												
<b>COURSE OUTCOMES:</b> <b>On completion of the course, the students will be able to</b>													
CO1	apply problem-solving techniques to express the solutions for the real world problems.												
CO2	develop simple C programs using appropriate looping and control statements												
CO3	develop simple C programs using the concepts of arrays and modular programming												
CO4	apply the concepts of pointers and develop C programs using strings and pointers												
CO5	make use of user-defined data types and file concepts to solve real world problems												
<b>Mapping of COs with POs and PSOs</b>													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1					1	1	1		
CO2	3	2	2	1					1	1	1		
CO3	3	2	2	1					1	1	1		
CO4	3	2	2	1					1	1	1		
CO5	3	2	2	1					1	1	1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy


Signature of the Chairman
Board of Studies - CSE



P.M.  
P. Kalairavam

lalitha

24MET11 – ENGINEERING DRAWING																	
(Common to Civil, Mech, MTS, Auto, Chem, ECE, EEE, EIE, FT branches)																	
Programme & Branch	BE / BTech – Civil, Mech, MTS, Auto, Chem, ECE, EEE, EIE, FT branches	Sem.	Category	L	T	P	SL*	Total	Credit								
Prerequisites	Nil	1 / 2 <sup>#</sup>	ES	30	15	0	45	90	3								
Preamble	To impart knowledge on engineering curves, orthographic projections, sectional views, development of surfaces, isometric projections and AutoCAD through free hand sketching and drawing instruments.																
<b>Unit – I</b>	<b>Introduction to Engineering drawing and Engineering Curves</b>								<b>6+3</b>								
Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning. Projection of points in different quadrants. Engineering Curves: Conic section- Ellipse, Parabola, Hyperbola (Eccentricity method). Cycloidal Curves- Cycloids and Involutes of circle and Hexagon.																	
<b>Unit – II</b>	<b>Projection of planes and Solids</b>								<b>6+3</b>								
Projection of polygonal surface and circular lamina inclined to both reference planes. Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.																	
<b>Unit – III</b>	<b>Sectioning of Solids and Development of Surfaces</b>								<b>6+3</b>								
Sectioning of prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to HP and perpendicular to VP - Obtaining true shape of section. Development of Lateral Surfaces of Simple and truncated Solids Like Prisms, Pyramids, Cylinders and Cones(Cutting planes inclined to HP and perpendicular to VP only).																	
<b>Unit – IV</b>	<b>Isometric Projection</b>								<b>6+3</b>								
Principles of isometric projection - Isometric scale - Isometric projections of simple and truncated solids like prisms, pyramids and cylinders. Conversion of orthographic in to isometric views																	
<b>Unit – V</b>	<b>Orthographic Projection and Introduction to AutoCAD</b>								<b>6+3</b>								
Conversion of isometric projection into orthographic projection (Freehand sketching only). Introduction to Computer Aided Drawing: Role of CAD in design and development of new products. Creating two-dimensional drawing with dimensions using suitable software (Minimum 2 exercises mandatory). Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory).																	
<b>TEXT BOOK:</b>																	
1.	Basant Agrawal, Agrawal C.M., "Engineering Drawing", 3rd Edition, McGraw Hill Education, 2019.																
<b>REFERENCES:</b>																	
1.	Lakh winder pal singh, Harwinder Singh., "Engineering Drawing and Principles and Applications", 1 <sup>st</sup> Edition, Cambridge University Press, 2021																

\*includes Term Work(TW) & Online / Certification course hours

#sem1: Civil, Mech, MTS, Auto, Chem branches & sem 2: ECE, EEE, EIE, FT branches

COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)	
CO1	interpret international standards of drawings and sketch the engineering curves											Applying (K3)
CO2	draw the projection of planes and solids											Applying (K3)
CO3	draw sectioning and developing of 3D primitive objects like prisms, pyramids, cylinders, cones											Applying (K3)
CO4	sketch the isometric projections of simple and truncated solids and convert orthographic projection in to isometric drawing											Applying (K3)
CO5	obtain multi view projections and solid models of objects using CAD tools											Applying (K3)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1			2					3			
CO2	3	1	1		2					3			
CO3	3	1	1		2					3			
CO4	3	1	1		2					3			
CO5	3	1	1		2					3			

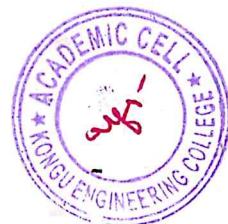
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	100	-	-	-	100
CAT2	-	-	100	-	-	-	100
CAT3	-	-	100	-	-	-	100
ESE	-	-	100	-	-	-	100

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

<i>Chairman</i> Signature of the Chairman of Studies - Mechanical



*K-V-J*  
*✓*

<b>24TAM01- HERITAGE OF TAMILS</b>																	
(Common to All Engineering and Technology Branches)																	
<b>Programme &amp; Branch</b>	<b>All B.E/B.Tech Branches</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>								
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>HS</b>	<b>15</b>	<b>0</b>	<b>0</b>	<b>15</b>	<b>30</b>	<b>1</b>								
<b>Preamble</b>	The objective of this course is to impart knowledge about Tamil language, literature, paintings, sculptures, folk arts, heroic games, doctrines, contribution of Tamils to Indian culture.																
<b>UNIT I</b>	<b>Language and Literature</b>								<b>3</b>								
Language families in india - dravidian languages – tamil as a classical language - classical literature in tamil – secular nature of sangam literature – distributive justice in sangam literature - management principles in thirukural - tamil epics and impact of buddhism & Jainism in tamil land - Bakthi literature azhwars and nayanmars - forms of minor poetry - development of modern literature in tamil - contribution of bharathiya and bharathidhasan.																	
<b>UNIT II</b>	<b>Heritage - Rock Art Paintings to Modern Art – Sculpture</b>								<b>3</b>								
Hero stone to modern sculpture - bronze icons - tribes and their handicrafts - art of temple car making - massive terracotta sculptures, village deities, Thiruvalluvar statue at Kanyakumari, making of musical instruments - mridhangam, parai, veenai, yazh and nadhaswaram - role of temples in social and economic life of tamils.																	
<b>UNIT III</b>	<b>Folk and Martial Arts</b>								<b>3</b>								
Therukoothu – karagattam - villu pattu - kaniyan koothu – oyillattam - leather puppetry – silambattam – valari - tiger dance - sports and games of tamils.																	
<b>UNIT IV</b>	<b>Thinai Concept of Tamils</b>								<b>3</b>								
Flora and fauna of tamils & aham and puram concept from tholkappiyam and sangam literature - aram concept of tamils - education and literacy during sangam age - ancient cities and ports of sangam age - export and import during sangam age - overseas conquest of cholas.																	
<b>UNIT V</b>	<b>Contribution of Tamils to Indian National Movement and Indian Culture</b>								<b>3</b>								
Contribution of tamils to Indian freedom struggle - the cultural influence of tamils over the other parts of India – self-respect movement - role of Siddha medicine in indigenous systems of medicine – inscriptions & manuscripts – print history of Tamil books.																	
<b>TEXT BOOK:</b>																	
1.	S.Muthuramalingam, M.Saravanakumar, Heritage of Tamils, Yes Dee Publishing Pvt Ltd, 2023, for Units I,II,III,IV,V.																
<b>REFERENCES:</b>																	
1.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukarasu) (Published by : International Institute of Tamil Studies).																
2.	The Contribution of Tamil of the Tamils to Indian Culture(Dr.M.Valarmathi)(Published by International Institute of Tamil Studies).																
3.	Keeladi – ‘Sangam City Civilization on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu).																

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES:		BT Mapped (Highest Level)
படிப்பை முடித்தவுடன், மாணவர்கள்		
CO1	explain valuable concepts in language and literature of tamils.	Understanding (K2)
CO2	illustrate about the tamils sculpture and their paintings.	Understanding (K2)
CO3	summarize about the tamils folk and martial arts.	Understanding (K2)
CO4	explain the thinai concept of tamils.	Understanding (K2)
CO5	explain the contribution of Tamils to the Indian National Movement and Indian culture.	Understanding (K2)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	3	2	2		3		
CO2						2	3	2	2		3		
CO3						2	3	2	2		3		
CO4						2	3	2	2		3		
CO5						2	3	2	2		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

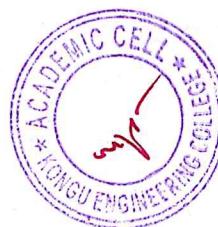
#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE				NA			

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks )

R. Vel

Signature of the Chairman  
Board of Studies - S & H (Chemistry)



24TAM01-தமிழர் மரபு											
(Common to All Engineering and Technology Branches)											
Programme & Branch	All B.E/B.Tech Branches	Sem.	Category	L	T	P	SL*	Total	Credit		
Prerequisites	NIL	1	HS	15	0	0	15	30	1		
Preamble	தமிழர்களின் மொழி, இலக்கியம், ஓவியங்கள், சிற்பக்கலைகள், நாட்டுப்புறக் கலைகள், வீர வினாயாட்டுக்கள், திணைக் கோட்பாடுகள், இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பைப் பற்றிய அறிவை வழங்குவதே இந்த பாடத்தின் நோக்கமாகும்.										
அலகு - I	மொழி மற்றும் இலக்கியம்										3
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற் தன்மை - சங்க இலக்கியத்தில் பசிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ் 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 - ஜம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.											
அலகு - III	நாட்டுப்புறக் கலைகள் மற்றும் வீர வினாயாட்டுக்கள்										3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் வினாயாட்டுகள்.											
அலகு - IV	தமிழர்களின் திணைக் கோட்பாடுகள்										3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்கக்காலத்தில் 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 பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.											
<b>TEXT BOOK:</b>											
1.	ஆ. பூபாலன், தமிழர் மரபு, VRB Publishers Pvt Ltd, 2022,அலகு I,II,III,IV,V.										
<b>REFERENCES:</b>											
1.	தமிழக வரலாறு- மக்களும் பண்பாடும்- கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்)										
2.	கணினித்தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)										
3.	சீழை - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம். (தொல்லியல் துறை வெளியீடு)										
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)										

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES:			BT Mapped (Highest Level)
படிப்பை முடித்தவுடன், மாணவர்கள்			
CO1	தமிழ் மொழி மற்றும் இலக்கியத்தில் மதிப்புமிக்க கருத்துக்களை விளக்க முடியும்.	Understanding (K2)	
CO2	தமிழர்களின் சிற்பம் மற்றும் அவர்களின் ஒவியங்கள் பற்றி விளக்க முடியும்.	Understanding (K2)	
CO3	தமிழர்களின் நாட்டுப்புற மற்றும் தற்காப்புக் கலைகளைப் பற்றி சுருக்கமாகக் கூற முடியும்.	Understanding (K2)	
CO4	தமிழர்களின் திணைக் கோட்பாடுகளைப் பற்றி விளக்க முடியும்.	Understanding (K2)	
CO5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி விளக்க முடியும்.	Understanding (K2)	

**Mapping of COs with POs and PSOs**

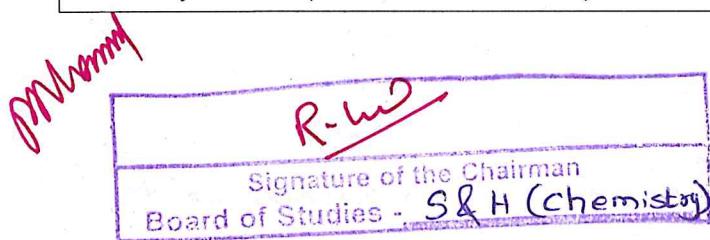
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	3	2	2		3		
CO2						2	3	2	2		3		
CO3						2	3	2	2		3		
CO4						2	3	2	2		3		
CO5						2	3	2	2		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE	NA						

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks )



**24CYL14 – CHEMISTRY LABORATORY FOR CHEMICAL ENGINEERING**

<b>Programme &amp; Branch</b>	<b>BTech - Chemical Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>1</b>	<b>BS</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>0</b>	<b>30</b>	<b>1</b>

**Preamble** This course aims to impart hands on training in the determination of the water quality parameters such as hardness, alkalinity, chloride, DO, COD, iron to develop the skills in handling different basic instruments. It also imparts the basic concepts of transition temperature, volumetric, conductometric and pH meter experiments and thereby, to improve the analytical capability.

**LIST OF EXPERIMENTS / EXERCISES:**

1. Assessment of the given water sample for the suitability of drinking / industrial purpose by estimating the carbonate, non-carbonate and total hardness by EDTA method.
2. Estimation of type and amount of alkalinity present in the given river/bore well water sample.
3. Determination of chloride content in the given water sample using Argentometric method.
4. Perform Winkler's method for the determination of dissolved oxygen in the given wastewater sample.
5. Determination of strength and amount of acid in a given solution using pH meter.
6. Determination of strength and amount of mixture of acids present in the given solution using Conductivity meter.
7. Determination of COD in the given water sample.
8. Estimation of sulphur present in the given fuel using electro-analytical techniques.
9. Performing Permanganometric titration for the determination of corrosion rate of iron in acidic medium.
10. Determination of transition temperature of a hydrated salt.
11. Construction and working of Zinc -Copper Electrochemical Cell (Demonstration).
12. Report preparation -based on the data received from the analysed water quality parameters (Demonstration).

**REFERENCES/ MANUAL /SOFTWARE:**

1. Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1 st Edition, Rajagana Pathy Publishers, Erode, 2024.

**COURSE OUTCOMES:**

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

**BT Mapped (Highest Level)**

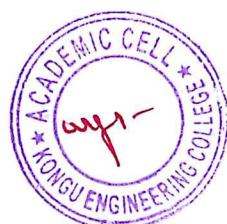
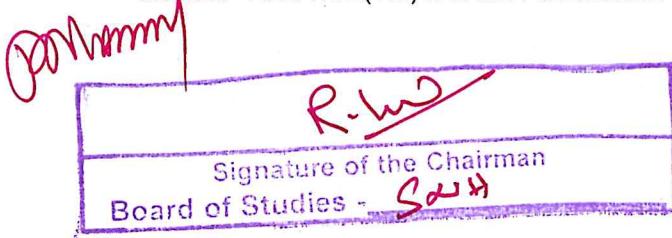
CO1	estimate the temporary, permanent and total hardness, alkalinity, chloride, DO and COD of the given water sample.	Analyzing (K4), Precision (S3)
CO2	estimate the strength and amount of acids using pH meter and conductivity meter.	Analyzing (K4), Precision (S3)
CO3	demonstrate the determination of transition temperature of hydrated salt, sulphur present in fuel by electro analytical method and corrosion rate of iron in acidic medium using Permanganometric method.	Analyzing (K4), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2		2	1						
CO2	2	2	3	2		2	1						
CO3	2	2	3	2		2	1						

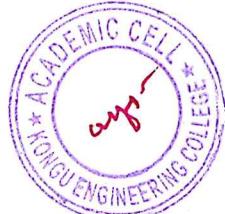
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

\*includes Term Work(TW) & Online / Certification course hours



24GCL12 - FOUNDATION LABORATORY – ELECTRICAL, IOT AND WEB TECHNOLOGIES													
(Common to all BE/BTech branches)													
Programme & Branch		All BE/BTech Branches			Sem.	Category	L	T	P	SL*	Total	Credit	
Prerequisites		Nil			1/2	ES	0	0	90	0	90	3	
Preamble		This course is designed to provide a foundational knowledge on engineering with hands-on experience on the house wiring, Internet of Things and Web Technologies.											
<b>LIST OF EXPERIMENTS / EXERCISES:</b>													
<b>PART A – Electrical Installation (30 Hours)</b>													
1.	Determination of load currents and select suitable components for Protection												
2.	Develop a wiring circuit for incandescent lamp and fluorescent lamp using Simple and Staircase Wiring												
3.	Develop and Investigate wiring circuits for Calling Bell System and Dimmable Light												
4.	Create wiring circuit for single phase motor												
5.	Development of IOT based energy monitoring and control												
6.	Measurement and analysis of electrical parameters for Photovoltaic Solar Panel												
<b>PART B – Internet of Things (30 Hours)</b>													
1.	Design a Single layer PCB layout designing												
2.	Fabricate Single layer PCB printing												
3.	Assembling, soldering and desoldering practice on single layer PCB												
4.	Sensor and actuator interfacing with internet enabled microcontroller												
5.	Sensor and actuator calibration												
6.	Integration of microcontroller based system with Cloud platform												
<b>PART C – Web Technologies (30 Hours)</b>													
1.	Design a simple web page using basic HTML tags and CSS properties												
2.	Design a responsive webpage using Bootstrap framework												
3.	Design a webpage for signup and login validation form using Javascript and PHP												
4.	Create a database connectivity using PHP, MySQL and host the website in the server.												
<b>REFERENCES/ MANUAL /SOFTWARE:</b>													
1.	Laboratory Manual												
2.	Eric T.Freeman,Elisabeth Robson, "Head First JavaScript Programming A Brain-Friendly Guide", 1st Edition, O'Reilly , 2014.												
3.	Eric T.Freeman,Elisabeth Robson, "Head First HTML and CSS",2nd Edition, O'Reilly , 2012												
4.	Lynn Beighley,"Head First SQL",1st Edition, O'Reilly,2007.												
<b>COURSE OUTCOMES:</b> <b>On completion of the course, the students will be able to</b>													
CO1 Design electrical wiring circuits for buildings based on their requirement										BT Mapped (Highest Level)			
CO2 Develop IoT based solutions and PCB for real world use cases.										Applying(K3), Precision (S3)			
CO3 Design and host an interactive dynamic website.										Applying(K3), Precision (S3)			
<b>Mapping of COs with POs and PSOs</b>													
COs/POs /PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3			1	3	2	2	2	
CO2	3	3	3	2	3			1	3	2	2	2	
CO3	3	2	1	1				3	3	2	2	3	
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy													

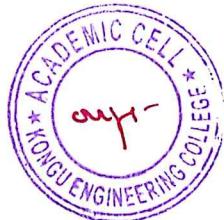
Signature of the Chairman
Board of Studies - EEE



24MNT12 - QUANTITATIVE APTITUDE - I																							
(Common to all Engineering and Technology branches)																							
Programme & Branch	All B.E/B.Tech Branches			Sem.	Category	L	T	P	SL*	Total	Credit												
Prerequisites	Basic Mathematical skills		1	MC	20	0	0	10	30	0													
Preamble	To impart problem solving skills and enhance analytical skills.																						
Unit - I	<b>Number system and Equations:</b> <span style="float: right;">6</span>																						
<b>Number systems:</b> Classification of numbers – Rules of divisibility – BODMAS Rule – HCF and LCM – Decimal fractions – Simplification – Problems.																							
<b>Equations:</b> Solving equations with one variable – Solving simultaneous linear equations with two variables – Applications of simultaneous linear equations – Problems on ages – Simple problems.																							
Unit - II	<b>Ratio, Proportion and Percentage:</b> <span style="float: right;">6</span>																						
<b>Ratio and Proportion:</b> Third, Fourth and mean proportional – Comparison of ratios – Compound ratio – Duplicate ratio – Sub duplicate ratio – Triplicate ratio – Sub triplicate ratio – Chain rule – Simple problems.																							
<b>Percentages:</b> Basic Concepts – Problems on percentages – Problems on population – Problems on depreciation.																							
Unit - III	<b>Profit and Loss, Interest:</b> <span style="float: right;">8</span>																						
<b>Profit and Loss:</b> Basic concepts – Cost price – Selling price – Profit and Loss – Simple problems.																							
<b>Simple and Compound interest:</b> Concepts – Percentage of interest – Difference between simple interest and compound interest – Simple problems.																							
<b>TEXT BOOK:</b>																							
1.	Dr R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S.Chand and company limited, 2022.																						
<b>REFERENCES/ MANUAL / SOFTWARE:</b>																							
1.	Abhijit Guha,"Quantitative Aptitude for Competitive Examination", 7 <sup>th</sup> Edition, McGraw Hill Education, India, 2020.																						
2.	<a href="https://www.indiabix.com/aptitude/questions-and-answers">https://www.indiabix.com/aptitude/questions-and-answers</a>																						
3.	<a href="https://www.geeksforgeeks.org/aptitude-questions-and-answers">https://www.geeksforgeeks.org/aptitude-questions-and-answers</a>																						
<b>COURSE OUTCOMES:</b> <b>On completion of the course, the students will be able to</b>											<b>BT Mapped (Highest Level)</b>												
CO1	Solve equations with one and two variables.										Applying (K3)												
CO2	Solve ratio, proportion and percentage problems.										Applying (K3)												
CO3	Solve profit and loss, simple interest and compound interest problems.										Applying (K3)												
<b>Mapping of COs with POs and PSOs</b>																							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2										
CO1	2	2																					
CO2	2	2																					
CO3	3	3																					
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy																							
<b>ASSESSMENT PATTERN - THEORY</b>																							
Test / Bloom's Category*	Remembering (K1) %		Understanding (K2) %		Applying (K3) %		Analyzing (K4) %		Evaluating (K5) %		Creating (K6) %		Total %										
CAT1			30		70								100										
CAT2			30		70								100										
CAT3			30		70								100										
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)																							
*includes Term Work (TW) & Online / Certification course hours																							

*R.W*

Signature of the Chairman  
Board of Studies - S4H



24EGT21 - ENGLISH FOR EFFECTIVE COMMUNICATION - II																		
(Common to all Engineering and Technology branches)																		
Programme & Branch	All B.E/B.Tech Branches	Sem	Category	L	T	P	SL*	Total	Credit									
Prerequisites	Nil	2	HS	45	0	0	45	90	3									
Preamble	This course aims at up skilling the learners to listen, speak, read, and write as well as to facilitate the students in practicing the language skills to acquire verbal and communicative proficiency in professional and academic contexts.																	
sUnit – I	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>								9									
<b>Grammar:</b> Simple, Compound, and Complex Sentences – <b>Verbal Aptitude:</b> Odd Words – Paired words – <b>Listening:</b> Listening to a Match Commentary and Filling in a Table – Listening to TED talks - <b>Speaking:</b> Apologizing – Talking about Manners and Etiquette – <b>Reading:</b> Scanning a Text, Power Point Presentations – The Best Way to Start a New Habit : An Excerpt from <i>Atomic Habits</i> <b>Writing:</b> Business Letters: Enquiry and Complaint																		
Unit – II	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>								9									
<b>Grammar:</b> Direct and Indirect Speech – <b>Verbal Aptitude:</b> Words often Confused – Verbal Analogy – <b>Listening:</b> Listening to a Lecture and Sorting Information – Career Related Conversation – <b>Speaking:</b> Group Discussion – Speaking about Career Choices and Professional Skills – <b>Reading:</b> Reading for Local and Global Comprehension – How to Find and Fix the Causes of Your Bad Habits: An Excerpt from <i>Atomic Habits</i> - <b>Writing:</b> Job Application: Cover Letter and Resume – Student Portfolio																		
Unit – III	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>								9									
<b>Grammar:</b> Active and Passive Voice – <b>Verbal Aptitude:</b> Error Spotting – Sentence Improvement – Abbreviations and Acronyms – <b>Listening:</b> Listening to Podcast Interviews and News/Motivational Speeches – <b>Speaking:</b> Presenting a Point of View – Giving Opinions about Podcast – <b>Reading:</b> Reading a Procedure – Cross Cultural Communication - How to Make Good Habits Inevitable and Bad Habits Impossible: An Excerpt from <i>Atomic Habits</i> – <b>Writing:</b> Types of Essays: Argumentative and Opinion based Essays																		
Unit – IV	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>								9									
<b>Grammar:</b> If/Conditional Clause – Modals Verbs – Conversational Devices - <b>Verbal Aptitude:</b> Sentence Correction – Sentence Selection – <b>Listening:</b> Listening and Filling a Mind Map – Listening to Interviews, Celebrity talks – <b>Speaking:</b> Giving Advice and Suggestions – Interviewing Classmates - <b>Reading:</b> Reading for Information, Researching for Supporting Evidence – Technical Communication: Modes of Technology-based Communication – How to Stick with Good Habits Every Day : An Excerpt from <i>Atomic Habits</i> <b>Writing:</b> Dialogue Writing – Writing Reviews: Product and Documentary films/Web Series																		
Unit – V	<b>Grammar, Verbal Aptitude, Listening, Speaking, Reading &amp; Writing</b>								9									
<b>Grammar:</b> Common Errors in Tenses – Verb - Preposition combinations – <b>Verbal Aptitude:</b> Coding and Decoding – <b>Listening:</b> Listening for key points – Speeches of New Inventions – <b>Speaking:</b> Asking for and Giving Permission – Talking about Gadgets, Inventions and Technology – <b>Reading:</b> Categorizing Information – Technical Communication: Effective use of Technology-based Communication – The Goldilocks Rule: How to Stay Motivated in Life and Work: An Excerpt from <i>Atomic Habits</i> – <b>Writing:</b> Report Writing: IV Report and Case Study Report																		
<b>TEXT BOOK:</b>																		
1.	Sudharshana N P and Savitha C, <i>English for Technical Communication</i> , 2 <sup>nd</sup> Edition, Cambridge University Press, New Delhi, 2016.																	
<b>REFERENCES:</b>																		
1.	Ashraf Rizvi. Effective Technical Communication, 2 <sup>nd</sup> Edition, McGraw-Hill India, 2017.																	
2.	S. P. Dhanavel. English and Communication Skills for Students of Science and Engineering, Orient Black Swan Publishers, Hyderabad, 2009.																	
3.	James Clear. <i>Atomic Habits</i> By James Clear. Dharman, 2023.																	

\* includes Term Work (TW) & Assignments, Tutorials and Case Studies

COURSE OUTCOMES:											BT Mapped (Highest Level)	
On completion of the course, the students will be able to												
CO1	construct contextual and functional grammar to enhance the linguistic competence											Applying (K3)
CO2	listen, comprehend and infer implied meanings of the given text											Applying (K3)
CO3	speak clearly to develop competence to participate in oral discourses such as discussions / meetings / interviews and deliver presentations											Creating (K6)
CO4	critically read various texts by understanding contextual meanings and respond appropriately											Understanding (K2)
CO5	Analyze different genres of writing and making precise non-technical and technical documents											Analyzing (K4)

**Mapping of COs with POs and PSOs**

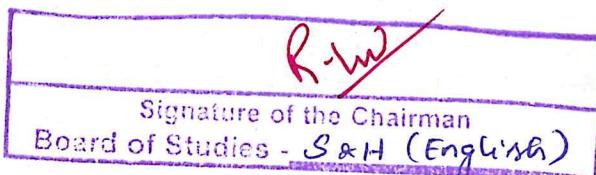
COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						1		1	3	1	1		
CO2								2	3		1		
CO3								2	3	1	2		
CO4						1			3	1	2		
CO5									3		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

Test / Bloom's Category*	Remembering (K1) %	Understand ing (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	30	70	-	-	-	100
CAT2	-	30	35	-	-	35	100
CAT3	-	20	45	35	-	-	100
ESE	-	20	55	10	-	15	100

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)



J. Rajai



24MAC22 - MULTIVARIABLE CALCULUS AND PARTIAL DIFFERENTIAL EQUATIONS									
(Common to AUTO and CHEMICAL branches)									
Programme & Branch	B.E - Automobile Engineering & B.Tech – Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	BS	45	7	16	52	120	4
Preamble	To impart the knowledge of partial derivatives, evaluation of real integrals, vector calculus to the students and solving the partial differential equations related to engineering.								
Unit – I	<b>Functions of Several Variables:</b> Functions of two or more variables – Partial derivatives – Total differential – Applications: Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method.								
Unit – II	<b>Multiple Integrals:</b> Double integration in cartesian coordinates – Change of order of integration – Application: Area between two curves – Triple integration in cartesian coordinates – Volume as triple integrals.								
Unit – III	<b>Vector Calculus:</b> Directional derivative – Gradient of a scalar point function – Divergence of a vector point function – Curl of a vector – Solenoidal and Irrotational vectors – Vector Integration: Introduction – Green's and Gauss divergence theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.								
Unit – IV	<b>Partial Differential Equations:</b> Introduction – Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients.								
Unit – V	<b>Applications of Partial Differential Equations:</b> Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation (zero boundary conditions only) – Steady state solution of two dimensional heat equation (excluding insulated & infinite edges).								
<b>LIST OF EXPERIMENTS / EXERCISES:</b>									
1.	Finding ordinary and partial derivatives.								
2.	Computing extreme values of function of two variables.								
3.	Evaluating double and triple integrals.								
4.	Finding the area between two curves.								
5.	Computing gradient, divergence and curl of point functions.								
6.	Solving second order partial differential equations.								
7.	Solving One dimensional wave equation.								
8.	Solving Two dimensional heat equation.								
<b>TEXT BOOK:</b>									
1.	Ramana B V, "Higher Engineering Mathematics", 1 <sup>st</sup> Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.								
<b>REFERENCES/ MANUAL / SOFTWARE:</b>									
1.	Kreyszig E, "Advanced Engineering Mathematics ", 10 <sup>th</sup> Edition, John Wiley, New Delhi, India, 2016.								
2.	Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi								
3.	Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., " Engineering Mathematics – II ", 2 <sup>nd</sup> Edition, Pearson India Education, New Delhi, 2018.								
4.	Grewal B.S, "Higher Engineering Mathematics" 44 <sup>th</sup> Edition, Khanna Publishers, New Delhi, 2018.								
5.	Multivariable Calculus and Partial Differential Equations Laboratory Manual.								

\*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Compute the total derivatives and extreme values of multivariable functions.	Applying (K3) Manipulation (S2)
CO2	Apply multiple integrals to compute the area and volume of the regions.	Applying (K3) Manipulation (S2)
CO3	Apply the concepts of derivatives and line integrals of point functions in engineering problems.	Applying (K3) Manipulation (S2)
CO4	Formulate and solve higher order partial differential equations.	Understanding (K2) Manipulation (S2)
CO5	Solve boundary value problems involving partial differential equations.	Applying (K3) Manipulation (S2)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2		3								
CO2	3	3	2		3								
CO3	3	3			3								
CO4	3	2	1		3								
CO5	3	3	3		3								

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

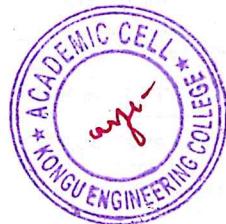
#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		40	60				100
CAT3		50	50				100
ESE		30	70				100

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

*R. Venkatesan*

Signature of the Chairman  
Board of Studies - S & H Maths



**24PHT22 – PHYSICS FOR CHEMICAL ENGINEERING**

Programme& Branch	B.Tech - Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	2	BS	45	0	0	45	90	3
Preamble	This course aims to impart the knowledge on crystal physics, quantum physics, ultrasonics, nano materials and select materials characterization techniques. It also describes the applications of aforementioned topics in chemical engineering.								
<b>Unit – I</b>	<b>Crystal Physics:</b>								
	Classification of solids – Space lattice – Unit cell – Crystal structure – Bravais lattice – Single and polycrystalline materials – Lattice planes – Miller indices – Interplanar spacing in cubic crystal – Number of atoms per unit cell – Atomic radius – Coordination number – Atomic packing factor – Body centered cubic– Face centered cubic – Hexagonal close packed crystal structure – Crystal imperfections: line, surface and volume imperfections.								
<b>Unit – II</b>	<b>Quantum Physics and Applications:</b>								
	Blackbody radiation – Planck's theory – Compton scattering – Matter waves – Properties – Heisenberg uncertainty principle – Schrodinger's time-independent and time-dependent wave equations – Physical significance of wave function – Particle in a one-dimensional box.								
<b>Unit – III</b>	<b>Ultrasonics:</b>								
	Properties of ultrasonic waves – Generation of ultrasonic waves – Magnetostrictive generator – Piezoelectric generator – Determination of velocity of ultrasonics in a liquid – Acoustic grating – Non-destructive testing – Flaw detection – Applications of ultrasonic technology in chemical industries (qualitative) – Ultrasonic degradation of wastewater.								
<b>Unit – IV</b>	<b>Nanomaterials:</b>								
	Nano scale – Surface-to-volume ratio – Quantum confinement – Nano structures: Quantum well, Quantum wire and Quantum dot – Nanomaterial synthesis: Top-down and bottom-up approaches – Ball milling – Electron beam lithography – Physical vapour deposition – Chemical vapour deposition – Sol-gel method – Applications.								
<b>Unit – V</b>	<b>Materials Characterization:</b>								
	Importance of materials characterization – X-ray diffraction (powder method) – Scanning electron microscope – Transmission electron microscope – UV-visible spectroscopy – Raman spectroscopy – Nuclear Magnetic Resonance – Thermo gravimetric analysis.								
<b>TEXT BOOK:</b>									
1.	Katiyar A.K, Pandey C.K, "Engineering Physics: Theory and Practical", 2 <sup>nd</sup> edition, Wiley, 2015 (Unit I, II).								
2.	Tamilarasan K and Prabu K, "Physics for Engineering I", 1 <sup>st</sup> Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2023(Unit III, IV, V).								
<b>REFERENCES:</b>									
1.	Avadhanulu M.N, Kshirsagar P.G and Arun Murthy T.V.S, "A Textbook of Engineering Physics", 11 <sup>th</sup> edition, S Chand, 2021.								
2.	Euth Ortiz Ortega, HamedHosseini, Ingrid Berenice Aguilar Meza, Maria Jose Rosales Lopez, Andrea Rodriguez Vera, Samira Hosseini, "Material Characterization Techniques and Applications", Springer 2022.								

\*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1	analyze seven crystal systems, interplanar spacing in cubic lattice, BCC, FCC, HCP crystal systems and the types of crystal imperfections and their impacts.	Analyzing (K4)
CO2	investigate the concepts of quantum mechanics to describe Planck's theory, Compton effect and the behavior of electrons in a metal by solving Schrodinger's wave equations.	Analyzing (K4)
CO3	explore the production techniques of ultrasonic wave, working of acoustic grating, non-destructive testing using ultrasonic waves and their applications in chemical engineering.	Analyzing (K4)
CO4	examine appropriate methods to prepare the nanomaterials and also to comprehend their properties and applications.	Analyzing (K4)
CO5	inspect the concepts of Raman effect, X-ray diffraction, matter waves, nuclear magnetic resonance and thermogram to describe the principle and working of select material characterization techniques.	Analyzing (K4)

#### Mapping of COs with POs and PSOs

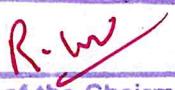
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2					1	1		1		
CO2	3	2	2					1	1		1		
CO3	3	2	2					1	1		1		
CO4	3	2	2					1	1		1		
CO5	3	2	2					1	1		1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	50	10			100
CAT2		40	50	10			100
CAT3		40	50	10			100
ESE		40	50	10			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

 Signature of the Chairman <b>Board of Studies - S&amp;H (Physics)</b>
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24ITC23 - PYTHON PROGRAMMING (Common to Civil, Mechanical, Mechatronics, Chemical, Food Technology & Automobile Engineering branches )									
Programme & Branch	B. E Civil , Mechanical, Automobile B.Tech Chemical Engineering ,Food Technology	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Programming in C	2	ES	45	0	30	45	120	4
Preamble	This course deals with core python programming. It gives a comprehensive introduction to problem solving using python constructs and libraries.								
Unit -I	<b>Introduction:</b>								
	Problem solving strategies – program design tools – Types of errors – Testing and Debugging- Basics: Literals – variables and identifiers – data types – input operation – comments – reserved words – indentation – Operators and Expressions – Decision Control Statements: Introduction – conditional statement – iterative statements – Nested Loops – break, continue and pass statements– elsein loops.								
Unit -II	<b>Lists, Tuples and Dictionary:</b>								
	Lists: Access, update, nested, cloning, operations, methods , comprehensions, looping – Tuple: Create, utility, access, update, delete, operations, assignments, returning multiple values, nested tuples, index and count method – Dictionary: Create, access, add and modify, delete, sort, looping, nested, built-in methods – list vs tuple vs dictionary.								
Unit -III	<b>Strings and Regular Expressions:</b>								
	Strings: Concatenation , append, multiply on strings – Immutable – formatting operator – Built-in string methods and functions – slice operation – functions – operators – comparing – iterating – string module – Regular Expressions – match, search, sub, findall and finditer functions – flag options.								
Unit -IV	<b>Functions and Modules:</b>								
	Functions: Introduction – definition – call – variable scope and lifetime – return statement – function arguments – lambda function – documentation strings – programming practices recursive function- Modules: Modules – packages – standard library methods – function redefinition.								
Unit -V	<b>Object Orientation:</b>								
	Class and Objects: Class and objects–class methods and self–constructor–class and object variables–destructor–public and private data member. NumPy : NumPy Arrays – Computation on NumPy Arrays. Matplotlib : Line plots – Scatter Plots								
<b>LIST OF EXPERIMENTS / EXERCISES:</b>									
1.	Programs using conditional and looping statements								
2.	Implementation of list and tuple operations								
3.	Implementation of dictionary operations								
4.	Perform various string operations								
5.	Use regular expressions for validating inputs								
6.	Demonstration of different types of functions and parameter passing								
7.	Develop programs using classes and objects								
8.	Perform computation on Numpy arrays								
9.	Draw different types of plots using Matplotlib								
<b>TEXT BOOK:</b>									
1.	Reema Thareja., "Python Programming using problem solving approach", 3 <sup>rd</sup> impression, Oxford University Press., New Delhi, 2017.								
<b>REFERENCES:</b>									
1.	Nageswara Rao, "Core Python Programming", 2 <sup>nd</sup> Edition, DreamTech Press, New Delhi, 2018.								
2.	Jake Vander Plas, " Python Data Science Handbook Essential Tools for Working with Data", O'Reilly Publishers, 1 <sup>st</sup> Edition, 2016.								

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES:											BT Mapped (Highest Level)
On completion of the course, the students will be able to											
CO1	use basic python constructs to build simple programs										
CO2	apply list, tuple and dictionary to handle variety of data.										
CO3	apply strings and regular expression for searching and retrieval										
CO4	solve the problems using functions and modules.										
CO5	apply object oriented concepts and perform data science operations using python										

#### Mapping of COs with POs and PSOs

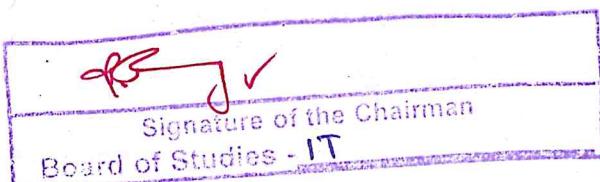
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1				1	1	1	3	1
CO2	3	2	2	2	1				1	1	1	3	1
CO3	3	2	2	2	1				1	1	1	3	1
CO4	3	2	2	2	1				1	1	1	3	1
CO5	3	2	2	2	1				1	1	1	3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		25	75				100
CAT2		25	75				100
CAT3		25	75				100
ESE		25	75				100

\*±3% may be varied (CAT 1,2,3–50marks & ESE–100marks)



**24CHT21 - CHEMICAL PROCESS INDUSTRIES**

<b>Programme&amp; Branch</b>	<b>B.Tech Chemical Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>									
<b>Prerequisites</b>	<b>Nil</b>	<b>2</b>	<b>PC</b>	<b>45</b>	<b>0</b>	<b>0</b>	<b>45</b>	<b>90</b>	<b>3</b>									
<b>Preamble</b>	This course will educate students about manufacture process of various chemical products																	
<b>Unit – I</b>	<b>Overview of Chemical Industries</b>																	
Importance of Chemical Industries and Products in Global Market, Anatomy of a chemical industry, Outline of Unit Operations and Unit Processes, Construction of Block Diagrams and Process Flow Diagrams. Inorganic Chemical Industries – Manufacture of Sulfur by Finnish Process, Manufacture of Sulphuric acid by Contact process, Steam reforming process of manufacture of Synthesis Gas																		
<b>Unit – II</b>	<b>Fertilizers and Chemicals</b>																	
Components of Fertilizer, Major fertilizer manufacturers in India, Manufacture of Ammonia, Nitric Acid, Urea, Phosphoric Acid by strong acid process, Manufacture of SSP and TSP, Manufacture of DAP, Potassium Sulphate, Complex Fertilizers.																		
<b>Unit – III</b>	<b>Chlor-Alkali and Cement</b>																	
Manufacture of Soda Ash by Solvay Process, Chlorine and Caustic Soda, Sodium Bicarbonate, Hydrochloric acid. Cement Industries – Types of cement and its constituents, Manufacture of Portland Cement, Slaked Lime.																		
<b>Unit – IV</b>	<b>Consumer Products</b>																	
Soaps and Detergents – Classification, Batch and Continuous Saponification, Manufacture of Glycerin and Detergents. Extraction of Sucrose from Sugarcane, Manufacture of Starch from Maize, Manufacture of Ethanol from Molasses. Manufacture of wood pulp by sulfate process and paper making process.																		
<b>Unit – V</b>	<b>Petrochemicals and Polymers</b>																	
Synthesis routes for Petrochemical Industries, Manufacture of Methanol from Synthesis Gas, Manufacture of VCM, Manufacture of Iso-propyl alcohol. Outline of Polymerization, Manufacture of Polyolefin by low-pressure Zeigler Process, Manufacture of Vinyl Polymer, Manufacture of Phenol-formaldehyde resin, SBR manufacture process, Nylon 6,6.																		
<b>TEXT BOOK:</b>																		
1.	Gopala Rao M. and Marshall Sittig, "DRYDEN'S Outlines of Chemical Technology ", 3rd Edition, East-West Press, New Delhi, 2008																	

\*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to										BT Mapped (Highest Level)	
CO1	explain the concepts of unit operations and unit processes, and construct block diagrams and PFD for the manufacture of chemicals										Understanding (K2)
CO2	apply the principles of chemical engineering to illustrate the manufacturing process of chemical fertilizers using flow diagram										Applying (K3)
CO3	explain the manufacturing process of inorganic chemicals and cement										Understanding (K2)
CO4	apply process engineering concepts to develop and interpret process flow sheets for the manufacturing of polymers and allied products										Applying (K3)
CO5	outline the manufacture of petrochemicals and polymers										Understanding (K2)

**Mapping of COs with POs and PSOs**

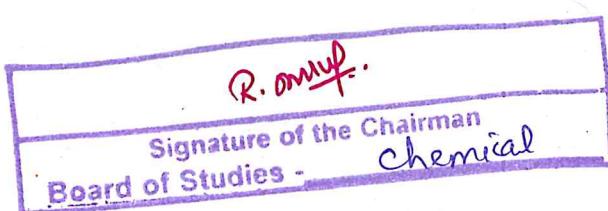
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2								1	2	2	3
CO2	3	2								1	2	2	3
CO3	3	2								1	2	2	3
CO4	3	2								1	2	2	3
CO5	3	2								1	2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	80	20				
CAT2	-	80	20				
CAT3	-	80	20				
ESE	-	80	20				

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



*V. Jay*

*R. Omur*

## 24TAM02 - TAMILS AND TECHNOLOGY

## (Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	SL*	TOT	Credit
Prerequisites	Nil	2	HS	15	0	0	15	30	1

Preamble	This course aims to impart the essential knowledge on the tamil culture and related technology	
UNIT – I	WEAVING AND CERAMIC TECHNOLOGY	3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
UNIT – II	DESIGN AND CONSTRUCTION TECHNOLOGY	3
Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.		
UNIT – III	MANUFACTURING TECHNOLOGY	3
Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads –Terracotta beads –Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.		
UNIT – IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3
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.		
UNIT – V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		

**TEXT BOOK:**

1. Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

**REFERENCES:**

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்), உலகத் தமிழராய்ச்சி நிறுவனம், சென்னை, 2002
2. கணினித்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசரம், 2016
3. சீழை வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)
6. The Contribution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Published by International Institute of Tamil Studies).
7. Keeladi – 'Sangam City Civilization on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
8. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by : The Author)
9. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu)
10. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

\*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)	
CO1 explain weaving and ceramic technology in tamil culture and tamil society.											Understanding (K2)	
CO2 Illustrate about the design and construction technology.											Understanding (K2)	
CO3 summarize about the manufacturing technology.											Understanding (K2)	
CO4 explain the agriculture and irrigation technology.											Understanding (K2)	
CO5 explain the significance of tamil in scientific and computing.											Understanding (K2)	

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3		3	2	2			
CO2						3		3	2	2			
CO3						3		3	2	2			
CO4						3		3	2	2			
CO5						3		3	2	2			

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

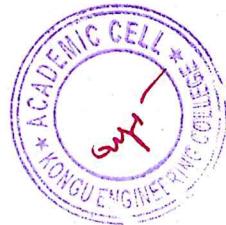
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE	NA						

\* ±3% may be varied (CAT 1,2,3 – 50 marks)

R-W
Signature of the Chairman
Board of Studies - S & H (Physics)

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Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	SL*	TOT	Credit
Prerequisites	Nil	2	HS	15	0	0	15	30	1
முன்னுரை	தமிழ் கலாச்சாரத்தோடு ஒன்றிய தொழில் நுட்பங்களைப் பற்றிப் படுத்துவதற்காக								
அலகு - I	நெசவு மற்றும் பானை தொழில்நுட்பம்								3
சங்க காலத்தில் நெசவு தொழில் - பானைத் தொழில்நுட்பம் கருப்பு சிவப்பு பாண்டங்கள் - பாண்டகளில் கீறல் குறியீடுகள்									
அலகு - II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்								3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டில் காலத்தில் சென்னை இந்தோ-சாரோசெனிக் கட்டிடத்தைக் கலை.									
அலகு - III	உற்பத்தித் தொழில்நுட்பம்								3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச்சான்றுகளாக 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 நிர்ப்பாசனத் தொழில்நுட்பம்								3
அணை, ஏரி, குளங்கள், மதகு - சோழர்கால குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.									
அலகு - V	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்								3
அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்.									

## TEXT BOOK:

- தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002
- கணினித்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016

## REFERENCES:

- கீழடிவைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
- பொருநை-ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
- Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
- Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).
- Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)
- The Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (Published by International Institute of Tamil Studies).
- Keeladi – Sangam City Civilization on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
- Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu)
- Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

\*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES:			BT Mapped (Highest Level)
படிப்பை முடித்தவுடன், மாணவர்கள்			
CO1	தமிழ் கலாச்சாரம் மற்றும் தமிழ் சமூகத்தினுடைய நெசவு மற்றும் பானை தொழில்நுட்பம் பற்றி விளக்க முடியும்.		Understanding (K2)
CO2	தமிழர்களின் வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்ப ஆற்றல் பற்றி விளக்க முடியும்.		Understanding (K2)
CO3	தமிழர்களின் உற்பத்தித் தொழில்நுட்பம் பற்றி சுருக்கமாகக் கூற முடியும்.		Understanding (K2)
CO4	தமிழர்களின் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் பற்றி விளக்க முடியும்.		Understanding (K2)
CO5	தமிழர்களின் அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் பற்றி விளக்க முடியும்.		Understanding (K2)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3		3	2	2			
CO2						3		3	2	2			
CO3						3		3	2	2			
CO4						3		3	2	2			
CO5						3		3	2	2			

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE	NA						

\* ±3% may be varied (CAT 1,2,3 – 50 marks)

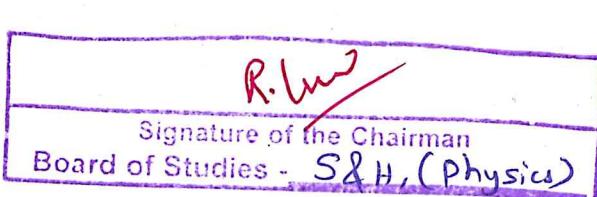
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Board of Studies - S & H (Physics)  
*[Handwritten signature]*



24PHL22 - PHYSICS LABORATORY FOR CHEMICAL ENGINEERING													
Programme & Branch	B.Tech - Chemical Engineering				Sem.	Category	L	T	P	SL*	TOT	Credit	
Prerequisites	Nil				2	BS	0	0	30	0	30	1	
Preamble	This course aims to impart hands on training in the determination of the physical parameters such as Young's modulus, rigidity modulus, thermal conductivity, AC frequency, compressibility of a liquid, viscosity, specific resistance, band gap, thickness of a thin film, particle size, and also to impart skills on writing coding / developing project / product related to societal requirement.												
<b>LIST OF EXPERIMENTS / EXERCISES:</b>													
1.	Determination of the Young's modulus of the material of a given beam using uniform bending method.												
2.	Determination of the rigidity modulus of the given metallic wire using torsional pendulum.												
3.	Determination of the thermal conductivity of a bad conductor using Lee's disc.												
4.	Determination of the frequency of alternating current using electrically vibrating tuning fork (Melde's apparatus).												
5.	Determination of the coefficient of viscosity of liquid using Poiseuille's method.												
6.	Determination of the specific resistance of the given metallic wire using Carey Foster's bridge.												
7.	Determination of the band gap of a given semiconducting material using post-office box.												
8.	Determination of the thickness of a thin film using air-wedge arrangement.												
9.	Determination of the particle size of the given powder using laser.												
10.	Writing coding for any one of the above experiments / developing a project / a product.												
<b>REFERENCES/ MANUAL /SOFTWARE:</b>													
1.	Laboratory Manual.												
<b>COURSE OUTCOMES:</b>													
<b>On completion of the course, the students will be able to</b>												<b>BT Mapped (Highest Level)</b>	
CO1	determine the Young's modulus of a material, the rigidity modulus of a wire and the thermal conductivity of a bad conductor.											Analyzing (K4), Precision (S3)	
CO2	determine the frequency of an alternating current, the coefficient of viscosity of a liquid and the specific resistance of a metallic wire.											Analyzing (K4), Precision (S3)	
CO3	determine the band gap of semiconductor materials, the thickness of a thin film, the particle size of a powder material and develop a coding / project / product.											Analyzing (K4), Precision (S3)	
<b>Mapping of COs with POs and PSOs</b>													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	3				3	1		2		
CO2	3	2	2	3				3	1		2		
CO3	3	2	2	3				3	1		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

\*includes Term Work (TW) & Online / Certification course hours



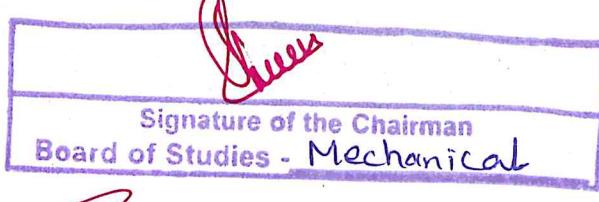
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24GCL11 – FOUNDATION LABORATORY - MANUFACTURING, DESIGN AND ROBOTICS (Common to all BE/BTech branches)													
Programme & Branch		All BE/BTech Branches			Sem.	Category	L	T	P	SL*	Total	Credit	
Prerequisites		Nil			1/2	ES	0	0	90	0	90	3	
Preamble		This course provides the hands-on experience to develop a prototype model with the basic knowledge of Computer-aided Design, Manufacturing Processes, 3D Printing Technology, Robotics and Embedded Control.											
<b>LIST OF EXPERIMENTS / EXERCISES:</b>													
<b>PART A – Manufacturing Laboratory (30 Hours)</b>													
1	Selection of product, free hand sketching and detailing												
2	Construction of model using Arc/TIG/MIG/Gas/Spot welding operations												
3	Enhancing the model with sheet metal												
4	Creating the parts of the model using lathe												
5	Creating the parts of the model using milling and drilling machines												
<b>PART B – Product Design and Development Laboratory (30 Hours)</b>													
1	Free hand sketching and detailing of the component												
2	3D part modelling of the component using CAD software												
3	Engineering Analysis of the component model												
4	Generate the component using 3D printer												
<b>PART C – Robotics Laboratory (30 Hours)</b>													
1	Design of electronic circuit and its debugging												
2	Assembly and interfacing of sensors, actuators and wireless communion modules with audrino UNO												
3	Development of embedded programming and interfacing for motion control and obstacle avoidance												
4	Demonstration and testing of robot in static environment												
<b>REFERENCES/ MANUAL /SOFTWARE:</b>													
1	Foundation Engineering Laboratory Manual												
2	SOLID WORKS 2022 Software												
<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to													
CO1	develop the prototype model using mechanical operations like welding, forming and machining processes												
CO2	sketch 3D model and develop the prototype using 3D printer												
CO3	design and develop the autonomous robot for real-time applications												
<b>Mapping of COs with POs and PSOs</b>													
COs/POs /PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2				3	2		2		
CO2	3	3	3	3				3	2		2		
CO3	3	3	3	2				3	2		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy



24MNT21 - QUANTITATIVE APTITUDE - II																								
(Common to all Engineering and Technology branches)																								
Programme & Branch		All B.E/B.Tech Branches			Sem.	Category	L	T	P	SL*	Total	Credit												
Prerequisites	Basic Mathematical skills			2	MC	20	0	0	10	30	0													
Preamble	To impart problem solving skills and enhance analytical skills.																							
Unit – I	<b>Averages, Alligations, Time and Work:</b>																							
<b>Averages, Alligations or Mixtures:</b> Concepts – Definition – Formula – Simple problems on averages – Alligation or Mixture rule – Applications – Problems.																								
<b>Time and Work:</b> Concepts – Work and wages – Pipes and Cisterns – Simple problems.																								
Unit – II	<b>Time and Distance:</b>																							
<b>Time and Distance:</b> Time, speed and distance – Conversions – Average speed – Relative speed – Problems on boats and streams – Upstream and downstream – Simple problems.																								
Unit – III	<b>Permutation and Combination, Probability:</b>																							
<b>Permutation and Combination:</b> Concepts – Simple problems.																								
<b>Probability:</b> Basic Concepts – Applications – Simple problems.																								
<b>TEXT BOOK:</b>																								
1.	Dr.R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S.Chand and company limited, 2022.																							
<b>REFERENCES/ MANUAL / SOFTWARE:</b>																								
1.	Abhijit Guha,"Quantitative Aptitude for Competitive Examination", 7 <sup>th</sup> Edition, McGraw Hill Education, India, 2020.																							
2.	<a href="https://www.indiabix.com/aptitude/questions-and-answers">https://www.indiabix.com/aptitude/questions-and-answers</a>																							
3.	<a href="https://www.geeksforgeeks.org/aptitude-questions-and-answers">https://www.geeksforgeeks.org/aptitude-questions-and-answers</a>																							
<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to										<b>BT Mapped (Highest Level)</b>														
CO1	Solve averages, alligations or mixtures, time and work problems.										Applying (K3)													
CO2	Solve the problems on time and distance, upstream and downstream oriented applications problems.										Applying (K3)													
CO3	Solve problems involving permutation, combination and probability concepts.										Applying (K3)													
<b>Mapping of COs with POs and PSOs</b>																								
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2											
CO1	2	2																						
CO2	2	3																						
CO3	3	2																						
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy																								
<b>ASSESSMENT PATTERN - THEORY</b>																								
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %																	
CAT1		30	70				100																	
CAT2		30	70				100																	
CAT3		30	70				100																	
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)																								

\*includes Term Work (TW) & Online / Certification course hour

 Signature of the Chairman	
Board of Studies - <b>S4H</b>	





<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	realize the importance of yoga in physical health.	Applying (K3)
CO2	realize the importance of yoga in mental health.	Applying (K3)
CO3	realize the role of yoga in personality development and diet.	Applying (K3)
CO4	do the loosening practices, Asanas and realize its benefits.	Applying (K3)
CO5	do the practice of Pranayama, meditation and realize its benefits	Applying (K3)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						3		2	1		
CO2						3		2			
CO3						3		3			
CO4						3		2	3		
CO5						3		3			

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	20	30	50	-	-	-	100
ESE	-	-	-	-	-	-	-

\* ±3% may be varied (CAT3 – 100 marks)





COURSE OUTCOMES:											BT Mapped (Highest Level)	
On completion of the course, the students will be able to												
CO1	explain the various IC engine parts, ignition, cooling, lubrication systems and different pollution control methods											Understanding (K2)
CO2	apply the concepts of refrigeration and air conditioning in estimating the performance of VCR system.											Applying (K3)
CO3	illustrate the construction, connection of single and three phase transformers											Applying (K3)
CO4	explain the working of DC and AC generators											Understanding (K2)
CO5	describe the principles of DC and AC motors											Understanding (K2)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1				3	2		2	2	
CO2	3	2	2	1				3	2		2	2	
CO3	3	1									1	3	
CO4	3	1									1	3	
CO5	3	1									1	3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		70	30				100
CAT2		70	30				100
CAT3		70	30				100
ESE		70	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

N. Jayaraman

<del>Chairman</del>
Signature of the Chairman
Board of Studies - EEE





## 24CHT31 - CHEMICAL PROCESS CALCULATIONS

Programme& Branch	B.Tech. – Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit									
Prerequisites	Nil	3	PC	45	15	0	60	120	4									
Preamble	This course provides basic knowledge of materials and energy balance calculation in chemical industries.																	
Unit - I	<b>Basics of Process Calculations</b> <span style="float: right;">9+3</span>																	
Compositions of mixtures and solutions – mass fraction, mole fraction, molality, molarity, normality; Calculations of pressure, volume and temperature using ideal gas law. Application of Dalton's law and Amagat's law for gas mixture calculation.																		
Unit II	<b>Vapour pressure and Humidity calculations</b> <span style="float: right;">9+3</span>																	
Vapour pressure of liquids – Clausius-Clapeyron equation - Antoine equation - vapor pressure of immiscible liquids – Raoult's law – Henry's law. Humidification and Dehumidification - Calculation of absolute, molal, relative, percentage and saturation humidity; use of Psychrometric chart.																		
Unit - III	<b>Material Balance for Unit Operations</b> <span style="float: right;">9+3</span>																	
Material balance calculations- distillation, evaporation, crystallization, drying, extraction and mixing; Unit operations with bypass, recycle and purging.																		
Unit - IV	<b>Material Balance for Unit Processes</b> <span style="float: right;">9+3</span>																	
Stoichiometric principles - limiting and excess reactants, conversion, yield and selectivity; Material balance with reactions, theoretical and excess air for combustion of solid, liquid and gaseous fuels; Flue gas and analysis.																		
Unit – V	<b>Energy Balance Calculations</b> <span style="float: right;">9+3</span>																	
Enthalpy change calculations for solids, liquids, and gases using molal and mean molal heat capacity; Enthalpy change of reaction, formation, combustion, solution, mixing; Effect of temperature on heat of reaction; Adiabatic flame temperature. Material and energy balances calculations using MS Excel & Process simulators																		
<b>TEXT BOOK:</b>																		
1.	Himmelblau D.M. , "Basic Principles and Calculations in Chemical Engineering", 8 <sup>th</sup> Edition, Prentice Hall of India, New Delhi, 2015.																	
<b>REFERENCES:</b>																		
1.	Narayanan K.V., Lakshmikutty B., "Stoichiometry and Process Calculations", 2 <sup>nd</sup> Edition, Prentice Hall of India, New Delhi, 2017.																	
2.	Venkataramani V., Anantharaman N. and Meera Sheriffa Begum K.M. , "Process Calculations", 2 <sup>nd</sup> Edition, Prentice Hall of India, New Delhi, 2011.																	
3.	Bhatt B.I., Thakore S. B., Stoichiometry, 2011, 5th ed., Tata McGraw – Hill Book Company, New Delhi, India.																	

\*Includes Term Work (TW) & Online / Certification course hours



COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)		
CO1	apply the basic laws for calculating the compositions of mixtures and solutions											Applying (K3)	
CO2	solve material balance equations for vapour pressure and humidity calculations											Applying (K3)	
CO3	apply stoichiometric principles to unit operations											Applying (K3)	
CO4	solve material balance equations for unit processes with bypass, purge and recycle											Applying (K3)	
CO5	perform enthalpy change calculations for chemical reactions											Analyzing (K4)	
Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3		1							2	3	2
CO2	3	3	1	2							2	3	2
CO3	3	3	1	2							2	3	2
CO4	3	3	1	2							2	3	2
CO5	3	3	1	2							2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

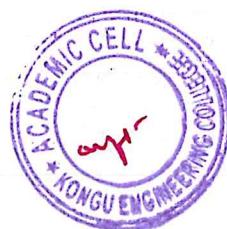
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		30	70				100
CAT2		20	80				100
CAT3		20	60	20			100
ESE		10	70	20			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

*R. amy..*

Signature of the Chairman
of Studies - <i>Chemical</i>

*V. S. Jayaraman*





## 24CHT32 - FLUID MECHANICS

Programme& Branch	B.Tech. – Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	3	PC	30	15	0	45	90	3
Preamble	This course provides knowledge on momentum transfer fundamentals, transportation and metering of fluids								
Unit - I	<b>Fluid Statics and Dimensional Analysis</b>								
Nature of fluids: Liquids and Gases - Properties of fluids – Fluid Statics: Hydrostatic Equilibrium – Application of Fluid Statics: Manometers- Continuous gravity decanter- Centrifugal decanter-Units and Dimensions - Dimensional analysis. Similarity - dimensionless numbers									
Unit - II	<b>Fluid Flow Phenomena</b>								
Newtonian and non-Newtonian fluids - Time dependent and viscoelastic fluids, Types of fluid flow, Boundary layers, Reynolds number and significance. Basic equation of fluid flow: Mass balance equation- Mechanical energy equation									
Unit - III	<b>Flow of incompressible fluids in Pipes</b>								
Shear stress and Skin friction - Laminar flow- Turbulent flow – Friction factor chart – Friction from changes in velocity: Sudden Expansion and Contractions - Fitting losses. Introduction to compressible flow. Isentropic flow through convergent and divergent nozzles and sonic velocity									
Unit - IV	<b>Flow Past Immersed Bodies</b>								
Drag and Drag coefficients – Flow through packed bed: Determination of pressure drop using Ergun equation - Motion of particles through fluids- Fluidization: Conditions for fluidization- Minimum fluidization velocity - Types of fluidization - Expansion of fluidized beds - Applications of fluidization.									
Unit - V	<b>Transportation and Metering of Fluids</b>								
Pipe- Fittings and Valves- Pumps: Positive displacement and centrifugal pumps- Performance characteristics- Fans, Blowers and Compressors- Measurement of flowing fluids: Venturimeter- Orificemeter- Rotameter- Vortex meters- Turbine meters- Coriolis meters- Magnetic meters- Pitot tube- notches and weirs.									

**TEXT BOOK:**

1. McCabe W.L, Smith J.C. and Harriot P, "Unit Operations of Chemical Engineering", 7<sup>th</sup> Edition, McGraw Hill Education, United States of America, 2017.

**REFERENCES:**

1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers", 3<sup>rd</sup> Edition, McGraw-Hill Chemical Engineering Series, 2004.  
 2. Yunus Cengel "Fluid Mechanics: Fundamentals and Applications" McGraw-Hill Higher Education; 4 edition, 2017

\*Includes Term Work (TW) & Online / Certification course hours



COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)	
CO1	explain characteristics of fluids at rest, and perform dimensional analysis											Applying (K3)
CO2	apply the basic equations of fluid flow											Applying (K3)
CO3	determine the flow behavior for incompressible fluids											Applying (K3)
CO4	analyze the flow characteristics in packed and fluidized bed											Analyzing (K4)
CO5	analyze the performance of pumps, fans, blowers, compressors and flow meters											Analyzing (K4)

## Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1							1	3	2
CO2	3	3	2	1							1	3	2
CO3	3	3	3	2							1	3	2
CO4	3	3	3	2							1	3	2
CO5	3	3	3	2							1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

## ASSESSMENT PATTERN - THEORY

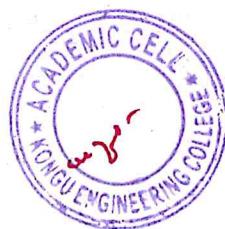
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		80	20				100
CAT2		70	30				100
CAT3		70	20	10			100
ESE		70	20	10			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks &amp; ESE – 100 marks)

R. Omprakash
Signature of the Chairman
Board of Studies : Chemical

RJ

W/M



**24CHT33 - APPLIED ORGANIC CHEMISTRY**

<b>Programme&amp; Branch</b>	<b>B.Tech. – Chemical Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>
<b>Prerequisites</b>	Nil	3	PC	45	0	0	45	90	3
<b>Preamble</b>	To gain knowledge about basic organic compounds and understand the reaction mechanism of various organic reactions								
<b>Unit - I</b>	<b>Basic Principles</b>								
	Classification of organic compounds - Aliphatic, Aromatic compounds - saturated and unsaturated compounds - Functional groups – aldehyde, ketone, amine, amide, acids, Structural representation of organic compounds-IUPAC names, Isomerism, Steric-hindrance, Inductive effect and Resonance structures. Separation and Purification of organic compounds-Distillation-Simple and Fractional Distillation, Chromatography-Column, Paper and Thin layer Chromatography.								
<b>Unit - II</b>	<b>Organic Reactions</b>								
	Mechanism of Electrophilic reaction and applications – Friedel craft reaction, Riemer-Tiemann Reaction, Beckmann rearrangements; Mechanism of Nucleophilic reactions and applications -Aldol condensation, Perkins reaction, Benzoin condensation; Mechanism of Free radical reactions and applications - Halogenations of Alkanes, Addition of HBr on Alkenes in presence of peroxide, Thermal halogenations reaction.								
<b>Unit - III</b>	<b>Carbohydrates and Protein</b>								
	Classification of carbohydrates, Mono saccharides – Glucose and Fructose-Preparation and Properties, Disaccharides – Sucrose and maltose – Preparation and Properties-Polysaccharides – Starch and Cellulose – Preparation and Properties, Structural aspects. Industrial uses of starch and cellulose. Amino Acids and Proteins – classification and properties.								
<b>Unit - IV</b>	<b>Oils, Fats, Soaps and Detergents</b>								
	Oil and Fat – Occurrence and Extraction, Physical and chemical characteristics, Analysis of oil/fat and Uses. Soap and Detergent – raw material, biodegradability, mechanism of cleaning action of soap. Classification of detergents.								
<b>Unit - V</b>	<b>Synthesis of Dyes and Drugs</b>								
	Classification based on structure and application, Synthesis and applications of Dyes – Congo red, Triphenylmethane dyes, Malachite green, Para Rosaniline, Alizarin, Eosin. Synthesis and applications of drugs – Antibacterial-Sulphanilamide, Sulphapyridine, Antimalarial - Chloroquine, Antibiotic-penicillin, erythromycin.								

\*Includes Term Work (TW) & Online / Certification course hours



COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)	
CO1	classify organic compounds and explain separation techniques											Understanding (K2)
CO2	utilize knowledge of reaction mechanisms to analyze and predict organic reaction outcomes											Applying (K3)
CO3	categorize carbohydrates, amino acids and explain their characteristics											Understanding (K2)
CO4	employ methods to evaluate the characteristics and synthesis of oils, fats, soaps, and detergents											Applying (K3)
CO5	outline the synthesis of dyes and drugs											Understanding (K2)

## Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1			1	1				2	2	1
CO2	3	3	1			1	1				2	3	2
CO3	3	3	2			1	1				2	3	2
CO4	3	2	1			1	1				2	2	2
CO5	3	3	2			1	1				2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

## ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	80	20	-	-	-	100
CAT2	-	80	20	-	-	-	100
CAT3	-	80	20	-	-	-	100
ESE	-	80	20	-	-	-	100

\* ±3% may be varied (CAT 1,2,3 – 50 marks &amp; ESE – 100 marks)

R. <i>[Signature]</i>
Signature of the Chairman
Board of Studies - <i>Chemical</i>

*dele**RJ*

**24CHC31 - CHEMICAL ENGINEERING THERMODYNAMICS**

<b>Programme &amp; Branch</b>	<b>B.TECH. – Chemical Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Nil</b>	<b>3</b>	<b>PC</b>	<b>45</b>	<b>0</b>	<b>30</b>	<b>45</b>	<b>120</b>	<b>4</b>

<b>Preamble</b>	This course introduces the laws and concepts of thermodynamics to analyze and evaluate the performance of various systems and processes in the field of chemical engineering
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<b>Unit – I</b>	<b>Laws of Thermodynamics</b>	<b>9</b>
Basic concepts: categorization of systems, properties and processes - internal energy – enthalpy. Zeroth law. First law: applications to non-flow and flow processes. Second law: heat engines - Carnot cycle and theorem- Entropy calculations. Third law of thermodynamics.		

<b>Unit – II</b>	<b>Properties of Real Gases and Thermodynamics Formulations</b>	<b>9</b>
PVT behaviour of fluids: compressibility factor - two-and three-parameter theorems of corresponding states. Equation of states: Viriai, van der Waals, Redlich - Kwong equations. Basic energy relations. Maxwell relations.		

<b>Unit – III</b>	<b>Properties of Solutions</b>	<b>9</b>
Partial molar properties. Chemical potential. Fugacity and activity coefficients. Gibbs-Duhem equation. Enthalpy, entropy and Gibbs free energy changes of mixing of ideal solution.		

<b>Unit – IV</b>	<b>Phase Equilibria</b>	<b>9</b>
Phase equilibrium and stability. Criteria for equilibrium between phases in single and multi- component non-reacting systems. Vapour-liquid equilibrium of binary ideal and non-ideal solutions. Azeotropes. Raoult's law and Henry's law. P-x-y diagrams using Antoine equations.		

<b>Unit – V</b>	<b>Chemical Reaction Equilibria</b>	<b>9</b>
Criteria for chemical equilibrium. Standard free energy change and reaction equilibrium constant. Effect of temperature and pressure on reaction equilibrium constant. Homogeneous chemical reactions. Thermodynamic analysis and prediction of equilibrium compositions.		

**LIST OF EXPERIMENTS / EXERCISES:**

1.	Determination of PVT behavior of gases
2.	Determination of saturation solubility
3.	Estimation of heat of solution
4.	Determination of entropy change of quenching process
5.	Determination of entropy change of mixing process
6.	Determination of specific heat capacity of substances
7.	Estimation of calorific value of solids and liquids
8.	Determination of reduced pressure and reduced temperature of fluids
9.	Determination of partial molar properties of liquids
10	Determination of reaction coordinate of saponification reaction

**TEXT BOOK:**

1.	Joseph Mauk Smith, Hendrick C. Van Ness, Michael M. Abbott, Mark Thomas Swihart, Introduction to Chemical Engineering Thermodynamics, 8th Edition, McGraw Education, New Delhi, 2017
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**REFERENCES/ MANUAL / SOFTWARE:**

1.	Noel De Nevers, Physical and Chemical Equilibrium for Chemical Engineers, 2nd Edition, John Wiley & Sons, Inc., New Jersey, 2012.
2.	Milo D. Koretsky, Engineering and Chemical Thermodynamics, 2nd Edition, Wiley, 2012.

\*Includes Term Work (TW) & Online / Certification course hours



COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)
CO1	apply the laws of thermodynamics to practical systems and processes										
CO2	make use of the equations of state to determine the volumetric properties of pure fluids										
CO3	apply the summability relation to estimate the molar and partial molar properties of solutions										
CO4	apply phase equilibrium concepts to systems at VLE										
CO5	analyze the homogeneous chemical reactions and evaluate the equilibrium composition										

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2							1	3	2
CO2	3	3	2	2							1	3	2
CO3	3	3	2	2							1	3	2
CO4	3	3	3	2							1	3	2
CO5	3	3	3	2							1	3	2

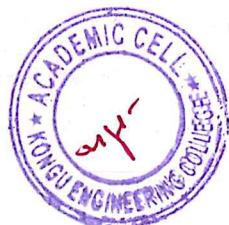
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	40	60	-	-	-	100
CAT2	-	40	60	-	-	-	100
CAT3	-	40	60	-	-	-	100
ESE	-	40	60	-	-	-	100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

R. <i>[Signature]</i>
Signature of the Chairman Board of Studies - Chemical



V. *[Signature]*

*[Signature]*

**24GET31- UNIVERSAL HUMAN VALUES**

(Common to All Engineering and Technology Branches)

<b>Programme &amp; Branch</b>	All B.E & B.Tech Branches	Sem.	Category	L	T	P	SL*	Total	Credit									
<b>Prerequisites</b>	Nil.	3 / 6	HS	30	0	0	30	60	0									
Preamble	To make the student to know what they 'really want to be' in their life and profession, understand the meaning of happiness and prosperity for a human being. Also to facilitate the students to understand about harmony at all the levels of human living, and live accordingly																	
<b>Unit – I</b>	<b>Introduction</b>																	
Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.																		
<b>Unit – II</b>	<b>Harmony in the Self and Body</b>																	
Human Being and Body – Understanding Myself as Co-existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I') – Understanding Myself – Harmony with Body.																		
<b>Unit – III</b>	<b>Harmony in the Family and Society</b>																	
Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.																		
<b>Unit – IV</b>	<b>Harmony in Nature and Existence</b>																	
Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co-existence of units of Space – Limited and unlimited – Active and No-activity – Existence is Co-existence.																		
<b>Unit – V</b>	<b>Implications of the above Holistic Understanding of Harmony on Professional Ethics</b>																	
Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.																		
<b>TEXT BOOK:</b>																		
1.	Gaur R.R., Sangal R., Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", 1 <sup>st</sup> edition, Excel Books Pvt. Ltd., New Delhi, 2009.																	
<b>REFERENCES:</b>																		
1.	Ivan Illich, "Energy & Equity", The Trinity Press, USA, 1974.																	
2.	Schumacher E.F., "Small is Beautiful: a study of economics as if people mattered", 1 <sup>st</sup> Edition, Britain, 1973.																	

\*includes Term Work(TW) & Online / Certification course hours

<b>COURSE OUTCOMES:</b> <b>On completion of the course, the students will be able to</b>		<b>BT Mapped (Highest Level)</b>
CO1	identify the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society	Applying (K3)
CO2	interview between the Self and the Body, understand the meaning of Harmony in the Self, the Co-existence of Self and Body	Applying (K3)
CO3	build harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society	Applying (K3)
CO4	experiment with themselves to co-exist with nature by realising interconnectedness and the four orders of nature	Applying (K3)
CO5	identify the differences between ethical and unethical practices, and apply ethical and moral practices for a better living	Applying (K3)

#### Mapping of COs with POs and PSOs

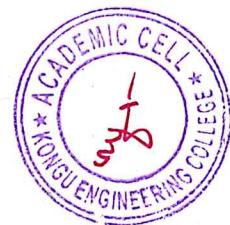
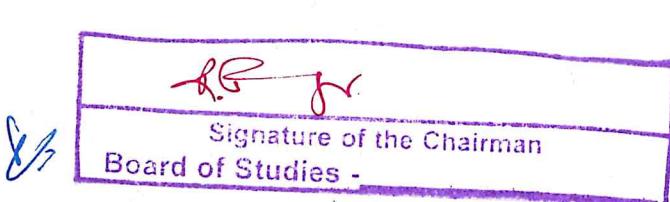
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	2	2		1	2				2	3	2
CO2	3	2	2	2		1	2				2	3	2
CO3	3	2	2	2		1	2				2	3	2
CO4	3	2	2	2		1	2				2	3	2
CO5	3	2	2	2		1	2				2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

<b>Test / Bloom's Category*</b>	<b>Remembering (K1) %</b>	<b>Understanding (K2) %</b>	<b>Applying (K3) %</b>	<b>Analyzing (K4) %</b>	<b>Evaluating (K5) %</b>	<b>Creating (K6) %</b>	<b>Total %</b>
CAT1		80	20				100
CAT2		80	20				100
CAT3		80	20				100
ESE	NA						

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks)





## 24CHL31 - FLUID MECHANICS LABORATORY

Programme & Branch	B.Tech. – Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit
Prerequisites	Nil	3	PC	0	0	30	0	30	1

Preamble This course provides an experiential understanding of flow meters, pumps, valves and fittings to the students.

## LIST OF EXPERIMENTS / EXERCISES:

1. Estimate the discharge coefficient of variable head flow meters
2. Investigate the flow characteristics of a rotameter
3. Estimate the discharge coefficient of V-notch
4. Measure the point velocity of air using a pitot tube
5. Determine the loss coefficient of valves and pipe fittings
6. Verify the Moody diagram for flow through straight pipe and helical coils
7. Study the effect of Reynolds number on friction factor for flow through concentric pipes
8. Verify Bernoulli's Theorem by Bernoulli's apparatus
9. Determine the pressure drop for flow through packed bed
10. Determine the minimum fluidization velocity
11. Study the characteristics of centrifugal and reciprocating pumps
12. Study the characteristics of vacuum and gear pumps

## REFERENCES/ MANUAL /SOFTWARE:

1. Laboratory Manual

## COURSE OUTCOMES:

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

BT Mapped  
(Highest Level)

CO1	determine the coefficient of discharge for flow through open and closed channels, and verify Moody chart for closed conduits	Applying (K3), Manipulation (S2)
CO2	estimate pressure drop and minimum fluidization velocity through packed bed and fluidized bed	Applying (K3), Manipulation (S2)
CO3	perform characteristic studies of centrifugal and reciprocating pumps	Applying (K3), Manipulation (S2)

## Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1			1	1	3	2		2	3	2
CO2	3	2	1			1	1	3	2		2	3	2
CO3	3	2	1			1	1	3	2		2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

\*Includes Term Work (TW) & Online / Certification course hours

*R. Dinesh*

Signature of the Chairman
Board of Studies - Chemical

*V. Jay*





24CHL32 - APPLIED ORGANIC CHEMISTRY LABORATORY													
Programme & Branch	B.Tech. – Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit				
Prerequisites	Nil	3	PC	0	0	30	0	30	1				
Preamble	This course enables the students to understand the analysis and preparation of organic compounds.												
LIST OF EXPERIMENTS / EXERCISES:													
1.	Analysis of organic compounds – Carbohydrates.												
2.	Analysis of organic compounds-Esters												
3.	Analysis of organic compounds-Thiourea												
4.	Analysis of organic compounds-Nitro compounds												
5.	Analysis of organic compounds-Amides, Acids.												
6.	Preparation of m-dinitro benzene from nitro benzene												
7.	Preparation of benzoic acid from ethyl benzoate												
8.	Preparation of benzoic acid from benzaldehyde												
9.	Estimation of phenol/aniline using Winkler's method												
10.	Qualitative separation of acid from hydrocarbon mixtures												
11.	Estimation of acid value, saponification value and iodine value of the given oil												
12.	Determination of the alkali content and fatty acid content in the given soaps												
REFERENCES/ MANUAL /SOFTWARE:													
1.	Laboratory Manual												
COURSE OUTCOMES: On completion of the course, the students will be able to													
CO1	analyze the given organic compound for aliphatic or aromatic, saturated or unsaturated, elements and functional groups.												
CO2	synthesize the required organic compounds and estimate the phenol or aniline content by Winkler's method												
CO3	analyze the given oil and soap samples, and estimate the separation efficiency of binary mixtures												
Mapping of COs with POs and PSOs													
COs/P Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1				2	1	3	2		1	3	1
CO2	3	2				2	1	3	2		1	3	2
CO3	3	1				2	1	3	2		1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

\*Includes Term Work (TW) &amp; Online / Certification course hours

R. domup.
Signature of the Chairman
Board of Studies - Chemical

*date**R*

24MAT42 – STATISTICS AND NUMERICAL METHODS																				
Programme & Branch	B.Tech & Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit											
Prerequisites	Nil	4	BS	45	15	0	60	120	4											
Preamble	To impart knowledge in testing of samples, ANOVA and interpolation. Also develop the skills to apply numerical algorithms to identify roots of algebraic and transcendental equations and solve linear and ordinary differential equations.																			
<b>Unit – I</b>	<b>Testing of Hypothesis:</b>																			
Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single mean and difference of means – Small sample tests: Student's t-test for testing significance of single mean and difference of means – F-test for comparison of variances – Chi-square test for independence of attributes.																				
<b>Unit – II</b>	<b>Design of Experiments:</b>																			
Introduction – Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design.																				
<b>Unit – III</b>	<b>Solution to Algebraic and Transcendental Equations:</b>																			
Method of false position – Newton-Raphson method – Solution of linear system of equations – Direct methods: Gauss elimination method and Gauss - Jordan method – Iterative methods: Gauss Jacobi and Gauss-Seidel methods.																				
<b>Unit – IV</b>	<b>Interpolation, Numerical Differentiation and Integration::</b>																			
Interpolation: Interpolation with equal intervals: Newton's forward and backward difference formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula. Numerical Differentiation: Differentiation using Newton's forward and backward difference formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule.																				
<b>Unit – V</b>	<b>Numerical Solution of First order Ordinary Differential Equations:</b>																			
Single step methods: Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method.																				
<b>TEXT BOOK:</b>																				
1.	Veerarajan T, Ramachandran T., "Statistics and Numerical Methods", 1 <sup>st</sup> Edition, McGraw Hill Education, Chennai, 2019.																			
<b>REFERENCES:</b>																				
1.	Walpole R.E., Myers R.H., Myers S.L. and Ye K., "Probability and Statistics for Engineers and Scientists", 9 <sup>th</sup> Edition, Pearson Education, Asia, 2012.																			
2.	Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9 <sup>th</sup> Edition, Cengage Learning, USA, 2016.																			
3.	Steven C. Chapra, Raymond P. Canale., "Numerical Methods for Engineers", 7 <sup>th</sup> Edition, McGraw-Hill Education, 2014.																			
4.	Ramana B V, "Higher Engineering Mathematics", 1 <sup>st</sup> Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.																			

\*includes Term Work (TW) & Online / Certification course hours

COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1	Apply statistical tests for solving engineering problems involving small and large sample tests.	Applying (K3)
CO2	Use appropriate experimental designs to analyze the experimental data with the knowledge of ANOVA.	Applying (K3)
CO3	Apply various numerical techniques to solve algebraic and transcendental equations.	Applying (K3)
CO4	Compute the derivatives, definite integral values numerically and perform the interpolation on given data using standard numerical techniques.	Applying (K3)
CO5	Compute the solution of first order ordinary differential equations by numerical techniques..	Applying (K3)

#### Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3								3	
CO2	3	2	3	3								3	
CO3	3	3	2									1	
CO4	3	2											
CO5	3	3	1										

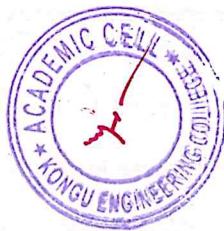
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		20	80				100
CAT2		20	80				100
CAT3		20	80				100
ESE		20	80				100

\* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)


Signature of the Chairman
Board of Studies - Chemical



### 24CHT41 - MASS TRANSFER – I

Programme& Branch	B.Tech. & Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit									
Prerequisites	Chemical Process Calculations	4	PC	45	15	0	60	120	4									
Preamble	This subject focuses on the diffusion, mass transfer co-efficient, theories and applications of interphase mass transfer																	
<b>Unit – I</b>	<b>Diffusion</b>																	
Molecular diffusion in gases and liquids, Measurement and calculation of diffusivities, Steady state diffusion in multi component mixtures, Diffusion in solids – Classification, Molecular and Knudsen diffusion in porous solids.																		
<b>Unit – II</b>	<b>Interphase Mass Transfer</b>																	
Mass transfer in turbulent flow – Mass transfer coefficients – Individual and overall mass transfer coefficients- Theories of mass transfer - Analogies in mass transfer - Co-current and counter current operations – Equilibrium and operating line concept – Stages and stage efficiencies - Operating characteristics of stage wise and differential contactors.																		
<b>Unit – III</b>	<b>Humidification</b>																	
Humidification; vapour - gas mixtures; Adiabatic saturation curves; Wet bulb temperature and measurement of humidity; use of Psychrometric chart; Equipment for humidification operations; Cooling towers – principle and design, Spray Chamber																		
<b>Unit – IV</b>	<b>Absorption</b>																	
Gas Absorption; Choice of solvent- absorption factor- calculation of number of theoretical stages- Kremser equation for plate tower- Packed tower absorber – HETP, HTU and NTU calculations; Equipment for gas absorption: Gas dispersed – Sparged vessel, Liquid dispersed – Venturi scrubber																		
<b>Unit – V</b>	<b>Adsorption and Ion Exchange</b>																	
Adsorption – Types – nature of adsorbents- Equilibria- Hysteresis- isotherms- break through curves- Adsorption operations – calculations for single and multiple cross current and counter current operations- equipment for adsorption- Industrial applications. Ion Exchange – Principles- Equilibria-Rate of ion exchange-Industrial applications																		
<b>TEXT BOOK:</b>																		
1.	Treybal R. E., "Mass-Transfer Operations", 3 <sup>rd</sup> Edition, McGraw Hill Education, India, 1981.																	
<b>REFERENCES:</b>																		
1.	Binay K Dutta, "Principles of Mass Transfer and Separation Process", 4 <sup>th</sup> Edition, PHI learning private limited, 2007.																	
2.	Anantharaman N., Meera Sheriffa Begum K.M., "Mass Transfer Theory and Practice", Prentice Hall of India Pvt. Ltd, New Delhi, 2017.																	
3.	Geankoplis C.J., "Transport Processes and Separation Process Principles", 4 <sup>th</sup> Edition, Prentice-Hall of India, New Delhi, 2005.																	

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)	
CO1	calculate diffusion coefficients for gases and liquids										Applying (K3)	
CO2	determine mass transfer coefficient in stage contactors										Applying (K3)	
CO3	make use of the Psychrometric chart for humidification and cooling tower operations										Applying (K3)	
CO4	determine the number of stages for absorption										Applying (K3)	
CO5	perform calculations for adsorption and explain ion exchange process										Applying (K3)	

#### Mapping of Cos with POs and PSOs

COs /POs /PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	1							2	3	1
CO2	3	3	3	1							2	3	2
CO3	3	3	3	2							2	3	2
CO4	3	3	3	2							2	3	2
CO5	3	3	3	2							2	3	2

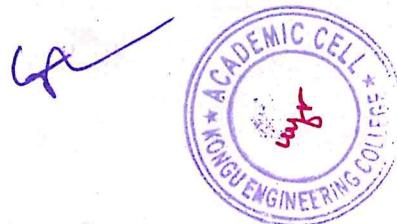
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	60				100
CAT2		40	60				100
CAT3		40	60				100
ESE		40	60				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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Signature of the Chairman
Board of Studies - Chemical



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## 24CHT42 - PROCESS HEAT TRANSFER

Programme & Branch	B.TECH. – Chemical Engineering	Sem.	Category	L	T	P	SL*	Total	Credit									
Prerequisites	Nil	4	PC	30	15	0	45	90	3									
Preamble	This course focuses on various modes of heat transfer and their application in design and operation of heat transfer equipment																	
Unit – I	<b>Conduction</b>																	
Modes of heat transfer and governing laws. Concept of heat conduction, thermal conductivity of materials, one dimensional steady state heat conduction equation for flat plate, hollow cylinder and sphere- composite walls, cylinders, spheres, concepts of thermal diffusivity, critical thickness of insulation; fundamental concepts in extended surfaces; Transient heat conduction.																		
Unit – II	<b>Convection</b>																	
Natural and forced convection –Application of dimensional analysis for convection and dimensionless numbers, Reynolds, and Chilton-Colburn analogy – jH factor, Relationship between Individual and overall heat transfer coefficients; Forced convection under laminar and turbulent flow conditions in pipes, Natural convection in vertical plates, and vertical and horizontal cylinders																		
Unit – III	<b>Radiation</b>																	
Introduction to thermal radiations, radiation intensity, Concept of Black and grey bodies; Heat Transfer Laws: Stefan Boltzmann, Kirchhoff's, Planck's and Wien's. Radiation between surfaces –configuration factor; radiation shield, radiation combined with conduction and convection.																		
Unit – IV	<b>Heat Transfer with Phase Change</b>																	
Boiling heat transfer-General aspects, boiling regimes, factors affecting boiling, boiling correlations, condensation - film and drop wise condensation, Evaporator-Types and methods of feed – capacity and steam economy, surface area calculations for single effect evaporator, boiling point elevation, Duhring's rule.																		
Unit – V	<b>Heat Exchangers</b>																	
Types of heat exchangers; different flow patterns, LMTD; use of temperature correction factor charts; Fouling factor; Heat transfer area calculations for double pipe and shell and tube heat exchangers; effectiveness and number of transfer units, Heat exchangers for low temperature applications.																		
<b>TEXT BOOK:</b>																		
1.	Holman. J.P. and Souvik Bhattacharyya, "Heat Transfer", 10 <sup>th</sup> Edition, McGraw-Hill Education, Europe, 2011.																	
<b>REFERENCES:</b>																		
1.	Rajput R.K, "Heat and Mass Transfer", 7 <sup>th</sup> Edition, S.Chand, New Delhi, 2019																	
2.	Kern D.Q, "Process Heat Transfer", 2 <sup>nd</sup> Edition, Tata McGraw Hill Europe, 1997																	
3.	Necati Ozisik.M, Helcio R. B. Orlande, "Inverse Heat Transfer", 1 <sup>st</sup> Edition Taylor and Francis, New York, 2000																	

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)	
CO1	apply the basic laws of heat transfer for steady state and transient heat conduction											Applying (K3)
CO2	estimate the heat transfer coefficient for natural and forced convection for various geometry											Applying (K3)
CO3	apply the laws of radiative heat transfer for different configurations											Applying (K3)
CO4	solve engineering problems on boiling, condensation and evaporation											Applying (K3)
CO5	analyze the performance of heat exchangers											Analyzing (K4)

#### Mapping of COs with POs and PSOs

COs/ POs /PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1		1					2	3	2
CO2	3	3	2	1		1					2	3	2
CO3	3	3	2	2		1					2	3	2
CO4	3	3	3	2	2	1					2	3	3
CO5	3	3	3	2	2	1					2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	40	60				100
CAT2	-	40	60				100
CAT3	-	30	50	20			100
ESE	-	30	50	20			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

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Signature of the Chairman Board of Studies - <i>Chemical</i>



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**24CHT43 - MECHANICAL OPERATIONS**

<b>Programme &amp; Branch</b>	<b>B.TECH. – Chemical Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>								
<b>Prerequisites</b>	Nil	4	PC	30	15	0	45	90	3								
<b>Preamble</b>	This course focuses on the properties, size reduction, separation, mixing and transportation of solids																
<b>Unit-I</b>	<b>Properties and Handling of Particulate Solids</b>								<b>6+3</b>								
Introduction to characterization of solid particles, Differential and cumulative analysis, Storage of Solids, Bulk storage, Flow out of bins, Agglomeration techniques, Transportation of solids.																	
<b>Unit-II</b>	<b>Size Reduction</b>								<b>6+3</b>								
Principles of comminution, Energy requirements for comminution, Laws and mechanism of size reduction - Rittinger's, Kick's, Bond's law, Work index calculations, Size reduction equipment for coarse, intermediate, fine and ultrafine particles.																	
<b>Unit-III</b>	<b>Separation and Filtration</b>								<b>6+3</b>								
Industrial screens, Differential and Cumulative analysis and screen effectiveness, Filtration theory, Classification of filtration process, Selection of filters, Industrial filtration equipment.																	
<b>Unit-IV</b>	<b>Separation of Solid-Solid and Fluid-Solid Systems</b>								<b>6+3</b>								
Gravity separation, Classifier, Clarifier, Thickener, Flocculation, Batch and Continuous sedimentation; Centrifugal separation, Cyclone separation, Centrifuge; Flotation, Magnetic and Electrostatic separation.																	
<b>Unit-V</b>	<b>Agitation and Mixing</b>								<b>6+3</b>								
Significance of Agitation and Mixing, Mixing of solids, Types of Mixers - Mixers for cohesive solids, Change-Can mixers, Kneaders, Dispersers, and Masticators, Mixing index, Equipment for Agitation, Types of impellers, Power requirement for mixing of Newtonian liquids.																	
<b>TEXTBOOK:</b>																	
1.	Julian Smith, Warren McCabe, Peter Harriott, emeritus, "Unit Operations of Chemical Engineering", 7 <sup>th</sup> Edition, McGraw-Hill Education, New York, 2017 for Units I, II, III & IV.																
2.	Badger Walter L. and Banchero Julius T, "Introduction to Chemical Engineering", 1 <sup>st</sup> Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2008, for Unit V.																
<b>REFERENCES:</b>																	
1.	Coulson,J.M., Richardson,J.F, "Chemical Engineering Volume2", 5 <sup>th</sup> Edition, Butterworth-Heinemann, United States of America, 2013.																
2.	Swain A.K, PatraH. and RoyG.K, "Mechanical Operations", 1 <sup>st</sup> Edition,Tata Mc Graw Hill Education Pvt. Ltd, New Delhi, 2017.																

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)	
CO1	explain the characteristics, transportation and storage of solids												Understand (K2)
CO2	calculate the power consumption for comminution												Applying (K3)
CO3	determine the effectiveness of the screen and filtration characteristics												Applying (K3)
CO4	outline the separation of solid-solid, solid-fluid systems												Understanding (K2)
CO5	determine the characteristics and power consumption for mixing and agitation												Applying (K3)

#### Mapping of Cos with POs and PSOs

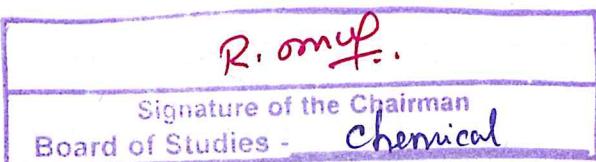
Cos/ POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1								1	3	1
CO2	3	3	1								1	3	1
CO3	3	2	1								1	3	2
CO4	3	2	1								1	3	2
CO5	3	2	1								1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	60	40				100
CAT2	-	60	40				100
CAT3	-	60	40				100
ESE	-	60	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



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**24CHT44 - MATERIALS SCIENCE AND ENGINEERING**

<b>Programme &amp; Branch</b>	<b>B.Tech-Chemical Engineering</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>							
<b>Prerequisites</b>	<b>Nil</b>	<b>3</b>	<b>ES</b>	<b>45</b>	<b>0</b>	<b>0</b>	<b>45</b>	<b>90</b>	<b>3</b>							
<b>Preamble</b>																
<b>Unit – I</b>	<b>Mechanical Properties of Metals</b>							<b>9</b>								
Mechanical Properties of Metals, Stress-Strain Behavior, Elastic Property of materials, Elastic and Plastic Deformation, Elastic Recovery after plastic deformation, Tensile stress, Compressive stress, Shear and Torsional Deformation, Design and safety factors																
<b>Unit – II</b>	<b>Dislocations, Strengthening and Failure</b>							<b>9</b>								
Dislocations – Introduction, Characteristics, Slip in Single Crystal, Plastic Deformation of polycrystalline materials, Twining, Strengthening in metals, Recovery, Recrystallization and crystal growth; Failure of materials – Ductile and brittle fractures, Fatigue – Cyclic stresses, Crack initiation and propagation, Creep – General creep behavior, stress and temperature effects																
<b>Unit – III</b>	<b>Thermal Properties and Phase Diagram</b>							<b>9</b>								
Heat Capacity, Thermal expansion, Thermal Conductivity, Thermal Stress; Phase Diagram – Introduction, Solubility limits, Microstructure, Phase Equilibria, Unary Phase diagrams, Binary Phase diagrams – Binary Isomorphous systems, Mechanical properties of isomorphous systems, eutectic alloys, Iron – Carbon systems - Iron –Iron Carbide Phase diagram, development of microstructures, Influence of alloying elements																
<b>Unit – IV</b>	<b>Metal Processing, Alloys and Heat Treatment</b>							<b>9</b>								
Metal Forming Operations: Forging, Rolling, Extrusion, Drawing, Casting, Powder Coating, Welding, Additive Manufacturing: 3D printing; Ferrous alloys, Stainless steels, Non-ferrous alloys, Heat treatment of steel, Precipitation Hardening																
<b>Unit – V</b>	<b>Material Selection</b>							<b>9</b>								
Template and steps for material selection, Selection Criteria – Contamination, Reliability, Material Selection Procedure for Pipes, pumps, Fabricated equipment, Specific material selection procedure and diagram – Low temperature, high temperature, and corrosion conditions, Grouping of process regions, Upset conditions. Case studies – Hydrocarbon process, Petrochemical industries and Chemical processes.																
<b>TEXT BOOK:</b>																
1.	Callister Jr, William D., and David G. Rethwisch. Materials science and engineering: an Introduction. Wiley, 10 <sup>th</sup> Edition, 2018. Unit I, II, III, and IV															
2.	David A Hansen, Robert B Puyear, "Material Selection for Hydrocarbon and Chemical Plants", 1st Edition, Taylor and Francis Group, 1996. Unit V															
<b>REFERENCES:</b>																
1.	James A. Lee, — Materials of Construction for Chemical Process Industries  , Mc Graw Hill, 1950															
2.	Frank Rumford, —Chemical Engineering Materials  , Nabu Press, 2013.															

\*includes Term Work(TW) & Online / Certification course hours

COURSE OUTCOMES: On completion of the course, the students will be able to											BT Mapped (Highest Level)	
CO1	describe the mechanical properties of metals											Applying (K3)
CO2	explain the dislocations, strengthening and their failure mechanics											Applying (K3)
CO3	illustrate the thermal properties and phase diagrams of metals											Applying (K3)
CO4	describe the metal processing, alloys and heat treatment											Applying (K3)
CO5	outline the criteria for material selection using case studies											Applying (K3)

#### Mapping of COs with POs and PSOs

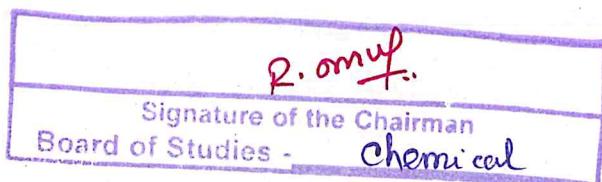
COs/POs /PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2								1	2	2	3
CO2	3	2								1	2	2	3
CO3	3	2								1	2	2	3
CO4	3	2								1	2	2	3
CO5	3	2								1	2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

#### ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	80	20				100
CAT2	-	80	20				100
CAT3	-	80	20				100
ESE	-	80	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



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24CHL41 - PROCESS HEAT TRANSFER LABORATORY													
Programme & Branch	B.TECH. – Chemical Engineering			Sem.	Category	L	T	P	SL*	Total	Credit		
Prerequisites	Nil			4	PC	0	0	30	0	30	1		
Preamble	This course enables the students to apply the laws of heat transfer and analyze the performance of heat transfer equipment.												
<b>LIST OF EXPERIMENTS / EXERCISES:</b>													
1.	Determine the thermal conductivity of the given material												
2.	Estimate transient heat conduction at constant flux and constant temperature												
3.	Evaluate the overall heat transfer coefficient and heat transfer rate in a packed column												
4.	Calculate the heat transfer coefficient and fin efficiency in an extended surface												
5.	Determine the heat transfer coefficient under natural convective heat transfer												
6.	Estimate the heat transfer coefficient under forced convective heat transfer												
7.	Evaluate the Stefan Boltzmann constant												
8.	Determine the combined convective and radiative heat transfer coefficient												
9.	Investigate the boiling mechanism in heat transfer equipment												
10.	Estimate the steam economy and efficiency of a single effect evaporator												
11.	Evaluate the heat transfer coefficient in horizontal and vertical condensers												
12.	Calculate the heat transfer coefficient in a jacketed vessel												
13.	Estimate and compare the heat transfer coefficient in a double pipe heat exchanger for co-current and counter current flow pattern												
14.	Determine the overall heat transfer coefficient in a shell and tube heat exchanger for parallel flow pattern												
<b>REFERENCES/ MANUAL /SOFTWARE:</b>													
1.	Laboratory Manual												
<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to													
CO1	determine the rate of heat transfer for steady state and unsteady state conditions												
CO2	calculate the heat transfer coefficients for convective and radiative modes												
CO3	estimate the heat transfer coefficient for various heat transfer equipment												
<b>Mapping of COs with POs and PSOs</b>													
COs/ POs/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3				1	1	3	2		2	3	2
CO2	3	3				1	1	3	2		2	3	2
CO3	3	3				1	1	3	2		2	3	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy													

\*includes Term Work(TW) & Online / Certification course hours

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Signature of the Chairman	
Board of Studies -	Chemical

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### 24CHL42 - MECHANICAL OPERATIONS LABORATORY

<b>Programme &amp; Branch</b>	B.TECH. – Chemical Engineering	<b>Sem</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>
<b>Prerequisites</b>	Nil	4	PC	0	0	30	0	30	1

**Preamble** This course gives an insight into various mechanical operations carried out in industries

**LIST OF EXPERIMENTS / EXERCISES:**

1. Determine the crushing law constants and the power consumption using Jaw crusher
2. Determine the crushing law constants and the power consumption using Roll crusher
3. Estimate the critical speed and the power consumption of ball mill
4. Calculate the average particle size using sieve analysis and find the effectiveness of screen
5. Estimate the particle size distribution and the average particle size using Beaker decantation
6. Determine the specific surface area of the given powder using Air permeability
7. Determine of the specific cake resistance and filter medium resistance using plate and frame filter press
8. Determine of the specific cake resistance and filter medium resistance using leaf filter
9. Analyze the performance of screw conveyor
10. Estimate the separation efficiency of cyclone separator
11. Conduct the batch sedimentation test to design a thickener
12. Determine the power consumption in agitated vessel

**REFERENCES/ MANUAL /SOFTWARE:**

1. Laboratory Manual

**COURSE OUTCOMES:**

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

**BT Mapped  
(Highest Level)**

CO1	estimate the power requirements and law constants for different size reduction equipment	Applying (K3), Manipulation (S2)
CO2	determine the screen effectiveness, average particle size and particle size distribution for different samples	Applying (K3), Manipulation (S2)
CO3	analyze the performance of separators, conveyor and mixing vessel	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

COs/POs/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2				1	1	3	2		2	3	3
CO2	3	2				1	1	3	2		2	3	3
CO3	3	2				1	1	3	2		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

\*includes Term Work(TW) & Online / Certification course hours

<i>R. omuf.</i>	
Signature of the Chairman	
Board of Studies -	Chemical



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**24CHL43- PROCESS COMPUTATION LABORATORY**

<b>Programme &amp; Branch</b>	B.TECH. – Chemical Engineering	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>SL*</b>	<b>Total</b>	<b>Credit</b>
<b>Prerequisites</b>	Nil	4	PC	0	0	30	0	30	1

**Preamble** This subject focuses on the design and computation aspects of software's like SPREADSHEET, MATLAB, and PYTHON.

**LIST OF EXPERIMENTS / EXERCISES:**

1.	a) Perform basic Thermodynamic calculations using iterations, v-lookup and dropdown list in spreadsheet b) Plot and fit the curve and determine rate constant and order of given chemical reaction
2.	Perform economic and inventory analysis of a chemical plant using Pivot Table in spreadsheet
3.	Solving Material and Energy Balance for Non-Reactive systems using Macros in spread sheet
4.	Development of a Process Flow Diagram using AutoCAD
5.	Development of Piping and Instrumentation Diagram using AutoCAD and MS Visio
6.	3D drawing of a pressure vessel/ tubular reactor/ flash column using AutoCAD and MS Visio
7.	Basic Commands and Operations in MATLAB: a) Matrix computations b) Solving algebraic, ODE and PDE problems c) 2D and 3D Plots using MATLAB
8.	Design of Heat Exchangers using MATLAB / C Programming
9.	Calculation of Transfer Function of I, II and higher order processes using MATLAB
10.	Design of Single / Multiple effect evaporator using PYTHON Programming
11.	Design of Plug Flow / Mixed Flow Reactor for a given reaction using PYTHON Programming

**REFERENCES/ MANUAL /SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

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

		<b>BT Mapped (Highest Level)</b>
CO1	Perform Chemical Process Calculations using Spreadsheet	Analyzing(K4), Manipulating(S2)
CO2	Develop Process Flow and Process Instrumentation Diagrams in AUTOCAD	Applying(K3), Manipulating(S2)
CO3	Design Chemical Engineering Equipment/Processes using MATLAB / C Programming / PYTHON Programming	Applying(K3), Manipulating(S2)

**Mapping of COs with POs and PSOs**

<b>COs/POs /PSOs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	3	2	2				2	2		1	3	1
CO2	3	2	3	3				2	2		1	3	1
CO3	3	2	3	3				2	2		1	3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

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Signature of the Chairman

of Studies : Chemical

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24GCL41 - PROFESSIONAL SKILLS TRAINING – I																						
(Common to all Engineering & Technology Branches)																						
Programme & Branch	All B.E/B.Tech Branches			Sem.	Category	L	T	P	SL*	Total	Credit											
Prerequisites	Nil			4	EC	0	0	45	35	80	2											
Preamble	This subject is to enhance the employability skills and to develop career competency.																					
Unit – I	<b>Soft Skills - I</b>																					
Soft skills and its importance: Pleasure and pains of transition from an academic environment to work environment-Need for change- Fear, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge upgradation-Self-confidence. Professional grooming and practices: Basics of corporate culture-Key pillars of business etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language.																						
Unit – II	<b>Quantitative Aptitude &amp; Logical Reasoning - I</b>																					
Problem solving level I: Quantitative Aptitude: Numbers, H.C.F. and L.C.M. of Numbers, Square Root and Cube Root, Simplification, Percentage, Average, Ratio and Proportion, Partnership, Profit and Loss, Alligation or Mixture, Permutations and Combinations, Probability. Logical Reasoning : Series, Analogy, Coding Decoding, Directions Decision Making, Blood Relations.																						
<b>TEXT BOOK:</b>																						
1.	Nishit Sinha, Dinesh Khattar& Showick Thorpe, "Placement Training Companion: Think. Solve. Succeed", Pearson Education 2025																					
<b>REFERENCES:</b>																						
1.	Dr. R.S. Agarwal, "Quantitative Aptitude for Competitive Examinations". S. Chand publications New Delhi, 2025.																					
2.	Gopalaswamy Ramesh & Mahadevan Ramesh - The Ace of Soft Skill: Attitude, Communication and Etiquette for Success, Pearson Education, 2024.																					
<b>COURSE OUTCOMES:</b>																						
<b>On completion of the course, the students will be able to</b>											<b>BT Mapped (Highest Level)</b>											
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individual and as a team.										Applying(K3), Precision(S3)											
CO2	solve real time problems using numerical ability.										Applying(K3), Precision(S3)											
CO3	solve basic problems in logical reasoning by applying standard problem-solving techniques.										Applying(K3), Precision(S3)											
<b>Mapping of COs with POs and PSOs</b>																						
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11											
CO1	3	2				3		3		3	2											
CO2	3	2				3		3		3	2											
CO3	3	2				3		3		3	2											
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy																						
<b>ASSESSMENT PATTERN - THEORY</b>																						
<b>Test / Bloom's Category*</b>	<b>Remembering (K1) %</b>	<b>Understanding (K2) %</b>	<b>Applying (K3) %</b>	<b>Analyzing (K4) %</b>	<b>Evaluating (K5) %</b>	<b>Creating (K6) %</b>	<b>Total %</b>															
CAT1		50	50				100															
CAT2		50	50				100															
CAT3		50	50				100															
ESE	NA																					
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks)																						

<i>RGR ✓</i>
Signature of the Chairman
Board of Studies - CSE



*(C.N. SHANTHA)*