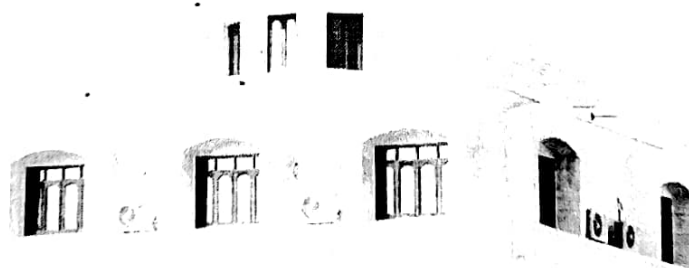# B.Tech. Petrochemical Technology

CURRICULUM AND SYLLABI

I to IV Semesters

Regulation - 2020

EXcêl

ENGINEERING COLLEGE

(Autonomous)

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

Accredited by NBA and NAAC with "A+"and Recognized by UGC (2f&12B)

KOMARAPALAYAM – 637303

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EXCEL ENGINEERING COLLEGE
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DEPARTMENT OF PETROCHEMICAL TECHNOLOGY
B. TECH Petrochemical Technology
REGULATION 2020
I to VIII Semesters Curriculum

I – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20MA106	Mathematics – I for Chemical sciences	BS	3	2	0	4	40	60	100
20EC103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	40	60	100
Theory with Practical Courses									
20ENEXX	Language Elective – I	HSS	2	0	2	3	50	50	100
20CH104	Chemistry for Chemical sciences	BS	3	0	2	4	50	50	100
20PC101	Organic Chemistry	BS	3	0	2	4	50	50	100
20ME101	Engineering Graphics	ES	1	0	4	3	50	50	100
Mandatory Course									
20MC101	Induction Programme	MC	2 Weeks			0	100	-	100
TOTAL			15	2	10	21	380	320	700

Language Electives – I									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20ENE01	Communicative English	HSS	2	0	2	3	50	50	100
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100

Passed in Board of Studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

II- SEMESTER

Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Courses									
20MA206	Mathematics – II for Chemical sciences	BS	3	2	0	4	40	60	100
20PC201	Industrial Chemical Technology	BS	3	0	0	3	50	50	100
Theory with Practical Courses									
20ENEXX	Language Elective – II	HSS	2	0	2	3	50	50	100
20PH204	Physics for Chemical sciences	BS	3	0	2	4	50	50	100
20CS201	Problem Solving using Python	ES	3	0	2	4	50	50	100
Practical Course									
20PC202	chemical Analysis Laboratory	BS	0	0	4	2	50	50	100
Mandatory Course									
20MC201	Environmental Sciences	MC	2	0	0	0	100	0	100
Total			16	2	10	20	390	310	700

Language Electives – II

Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100
20ENE03	Hindi	HSS	2	0	2	3	50	50	100
20ENE04	French	HSS	2	0	2	3	50	50	100
20ENE05	German	HSS	2	0	2	3	50	50	100

Passed in Board of Studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

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III – SEMESTER

Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20MA304	Probability & Statistics	BS	3	2	0	4	40	60	100
20PC301	Fluid mechanics for Chemical Engineers	PC	3	2	0	4	40	60	100
20PC302	Material Technology for Chemical Engineers	ES	3	0	0	3	40	60	100
20PC303	Chemical Process Calculation	ES	3	0	0	4	40	60	100
20PC304	Mechanical operations	PC	3	0	0	3	40	60	100
20PC305	Reservoir Engineering	PC	3	0	0	3	40	60	100
Practical Course									
20PC306	Fluids and solid Operations Laboratory	PC	0	0	2	1	50	50	100
20PC307	Geology Laboratory	PC	0	0	2	1	50	50	100
Mandatory Course									
20MC302	Interpersonal skills	MC	0	0	2	0	100	0	100
	TOTAL		18	4	6	23	440	460	900

IV – SEMESTER

Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20MA405	Numerical Methods	BS	3	2	0	4	40	60	100
20PC401	Chemical Engineering Thermodynamics	ES	3	0	0	3	40	60	100
20PC402	Heat Transfer Operations	ES	3	2	0	3	40	60	100
20PC403	Petroleum Exploration and Exploitation Techniques	PC	3	2	0	4	40	60	100
20PC404	Natural Gas Engineering	PC	3	0	0	3	40	60	100
20PC405	Petroleum Processing I	PC	3	2	0	4	40	60	100
Practical Course(s)									
20PC406	Drilling fluids Laboratory	PC	0	0	2	1	50	50	100
20PC407	Technical Analysis Laboratory	PC	0	0	2	1	50	50	100
Mandatory Course									
20MC401	Soft Skills	MC	2	0	0	0	100	0	100
	TOTAL		20	8	4	23	440	460	900

Passed in Board of Studies Meeting on 25.02.2022   *Approved in Accademic Council Meeting on 09.03.2022*

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V – SEMESTER

Code No.	Course	Category	L	T	P	C	CA	FE	Total
Theory Course(s)									
20PC501	Petroleum Processing II	PC	3	0	0	3	40	60	100
20PC502	Chemical Reaction Engineering	PC	3	2	0	4	40	60	100
20PC503	Mass Transfer I	PC	3	2	0	4	40	60	100
20PC504	Petrochemical Unit Processes .	PC	3	2	0	4	40	60	100
20PCEXX	Professional Elective-I	PE	3	0	0	3	40	60	100
20PCOXX	Open Elective-I	OE	3	0	0	3	40	60	100
Practical Course(S)									
20PC505	Heat and Mass Transfer Laboratory	PC	0	0	2	1	50	50	100
20PC506	Petroleum Testing Laboratory	PC	0	0	2	1	50	50	100
	TOTAL		18	6	4	23	340	460	800

VI – SEMESTER

Code No.	Course	Category	L	T	P	C	CA	FE	Total
Theory Course(s)									
20PC601	Mass Transfer II	PC	3	0	0	3	40	60	100
20PC602	Professional Ethics in Engineering	HSS	3	2	0	3	40	60	100
20PCEXX	Professional Elective-II	PE	3	0	0	3	40	60	100
20PCOXX	Open Elective-II	OE	3	0	0	3	40	60	100
Theory with Practical Courses									
20PC603	Process Instrumentation Dynamics and Control	PC	3	0	2	4	50	50	100
Practical Course(S)									
20PC604	Process Control Laboratory	PC	0	0	4	2	50	50	100
20PC605	Mini Project	EEC	0	0	4	2	50	50	100
20PC606	Internship	EEC	2 Weeks			1	50	50	100
	TOTAL		15	2	10	21	360	440	800

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VII – SEMESTER									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20PC701	Process Equipment Design and Drawing	PC	3	2	0	3	40	60	100
20PC702	Transport Phenomena	PC	3	0	0	3	40	60	100
20PCEXX	Professional Elective-III	PE	3	0	0	3	40	60	100
20PCEXX	Professional Elective-IV	PE	3	0	0	3	40	60	100
20PCOXX	Open Elective-III	OE	3	0	0	3	40	60	100
Practical Course									
20PC703	Chemical Reaction Engineering Laboratory	PC	0	0	2	1	50	50	100
20PC704	Equipment Design Drawing	EEC	0	0	4	2	50	50	100
Total			15	2	6	18	300	400	700

VIII – SEMESTER									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20PCEXX	Professional Elective-V	PE	3	0	0	3	40	60	100
20PCOXX	Professional Elective-VI	PE	3	0	0	3	40	60	100
20PC801	Major Project	EEC	0	0	20	10	50	50	100
Total			6	0	20	16	130	170	300

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			Periods / Week				Maximum Marks		
Code No.	Course	Category	L	T	P	C	CA	FE	Total
	Open Electives								
20PCO01	Industrial Management	OE	3	0	0	3	40	60	100
20PCO02	Energy Conservation and Management	OE	3	0	0	3	40	60	100
20PCO03	Total Quality Management	OE	3	0	0	3	40	60	100
20PCO04	Air Pollution and Control Engineering	OE	3	0	0	3	40	60	100
20PCO05	Water Treatment and Management	OE	3	0	0	3	40	60	100
20PCO06	Geographic Information System	OE	3	0	0	3	40	60	100

			Periods / Week				Maximum Marks		
Code No.	Course	Category	L	T	P	C	CA	FE	Total
Professional Electives									
Stream I : Petro Chemical Processes									
20PCE01	Polymer Technology	PE	3	0	0	3	40	60	100
20PCE02	Petroleum Crude Processing Technology	PE	3	0	0	3	40	60	100
20PCE03	Novel Separation Process	PE	3	0	0	3	40	60	100
20PCE04	Fertilizer Technology	PE	3	0	0	3	40	60	100
20PCE05	Process Plant Utilities	PE	3	0	0	3	40	60	100
20PCE06	Fluidization Engineering	PE	3	0	0	3	40	60	100
20PCE07	Enhanced Oil Recovery	PE	3	0	0	3	40	60	100
20PCE08	Petroleum Corrosion Technology	PE	3	0	0	3	40	60	100
20PCE09	Petroleum Refining	PE	3	0	0	3	40	60	100
20PCE10	Optimization of Chemical Processes	PE	3	0	0	3	40	60	100
20PCE11	Process Economics	PE	3	0	0	3	40	60	100

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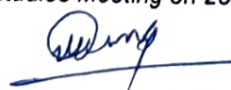
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Stream II : Chemical Process Design									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20PCE21	Petrochemical Derivatives	PE	3	0	0	3	40	60	100
20PCE22	Petroleum Process Equipment Auxiliaries	PE	3	0	0	3	40	60	100
20PCE23	Process Modeling & Simulation	PE	3	0	0	3	40	60	100
20PCE24	Refinery Process Design	PE	3	0	0	3	40	60	100
20PCE25	Design Of Heat Exchangers	PE	3	0	0	3	40	60	100
20PCE26	Reservoir Characterization and Modeling	PE	3	0	0	3	40	60	100
20PCE27	Design Of Pressure Vessels and Piping	PE	3	0	0	3	40	60	100
20PCE28	Chemical Process Design	PE	3	0	0	3	40	60	100
20PCE29	Drilling and Well Engineering	PE	3	0	0	3	40	60	100
20PCE30	Storage Transport of Crude oil and Natural gas	PE	3	0	0	3	40	60	100

Stream III : Advanced Separation Technology									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20PCE41	Modern Separation Techniques	PE	3	0	0	3	40	60	100
20PCE42	Multicomponent Distillation	PE	3	0	0	3	40	60	100
20PCE43	Fundamentals of Nano science	PE	3	0	0	3	40	60	100
20PCE44	Plant Safety and Risk Analysis in Chemical Industries	PE	3	0	0	3	40	60	100
20PCE45	Biochemical Engineering	PE	3	0	0	3	40	60	100
20PCE47	Electrochemical Engineering	PE	3	0	0	3	40	60	100
20PCE48	Petroleum Production Engineering	PE	3	0	0	3	40	60	100
20PCE49	Drugs and Pharmaceutical Technology	PE	3	0	0	3	40	60	100
20PCE50	Instrumentation and Instrumenta Analysis	PE	3	0	0	3	40	60	100

ONE CREDIT COURSES

Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20PCA01	Energy conservation Technology	EEC	1	0	0	1	0	0	100
20PCA02	Membrane Technology	EEC	1	0	0	1	0	0	100
20PCA03	MATLAB	EEC	1	0	0	1	0	0	100
20PCA04	Logistics of Chemicals	EEC	1	0	0	1	0	0	100
20PCA05	Distilleries	EEC	1	0	0	1	0	0	100
20PCA06	Safe handling of chemicals	EEC	1	0	0	1	0	0	100
20PCA07	PRO-E software course I	EEC	1	0	0	1	0	0	100
20PCA08	PRO-E software course II	EEC	1	0	0	1	0	0	100

S. No	Category	CREDITS PER SEMESTER								Total Credit (AICTE)	Credits in %
		I	II	III	IV	V	VI	VII	VIII		
1	HSS	3	3				3			9 (10-14)	5.45%
2	BS	12	13	4	.4					33 (22-28)	20.00%
3	ES	6	4	7	6					23 (24)	13.94%
4	PC			12	13	17	9	7		58 (48)	35.15%
5	PE					3	3	6	6	18 (18)	10.91%
6	OE					3	3	3		9	5.45%
7	EEC						3	2	10	15 (12-16)	9.09%
8	MC	Non-Credit Courses								0	0.0%
Total		21	20	23	23	23	21	18	16	165	100%

HSS - Humanities and Social Sciences
BS - Basic Sciences
ES - Engineering Sciences
PC - Professional Core
PE - Professional Elective
OE - Open Elective
EEC - Employability Enhancement Course
MC - Mandatory Courses (Non-Credit Courses)
CA - Continuous Assessment
FE - Final Examination

Passed in Board of Studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20MA106	Mathematics-I for Chemical Sciences	L	T	P	C
		3	2	0	4

Nature of Course	Basic Sciences
Pre requisites	Fundamentals of Basic Mathematics

Course Objectives

The course is intended to

1. Acquire the concept of matrix algebra techniques.
2. Acquaint the mathematical tools needed in evaluating limits,derivatives and differentiation of one variable.
3. Learn the concept of calculus for solving the problems mathematically andobtaining solutions.
4. Study the functions of several variables, Taylor's series expansionand Jacobian techniques.
5. Introduce the mathematical concepts to solve the differentialequations.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1.	Apply the concept of orthogonal reduction to diagonalise the given matrix.	Understand
CO2.	Interpret the limit definition and rules of differentiation to differentiate the functions.	Apply
CO3.	Identify the circle of curvature, evolutes and envelope of the curves.	Understand
CO4.	Classify the maxima and minima for a given function with several Variables through by stationary points.	Apply
CO5.	Solve the linear and simultaneous differential equations.	Understand

Course Contents:

Unit – I Matrices 12
Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties(statement only) - Cayley-Hamilton theorem and its applications - Orthogonal transformation of a symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by orthogonal transformation.

Unit – II Limits and Continuity 12
Functions of single variable - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

Unit – III Differential Calculus 12
Curvature - Radius of curvature (Cartesian and polar co-ordinates) - Centre of curvature –Circle of curvature - Involute and evolute – envelope.

Unit – IV Functions of Two Variables 12
Limits and Continuity - Partial derivatives - Total Derivative - Chain rule - Jacobians - Taylor's expansion for function of two variables - Extreme values of functions of two variables - Differentiation under the integral sign.

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Differential equations with variable co-efficient: Cauchy's and Legendre's form of linear equation —Method of variation of parameters – Introduction of first order non- linear differential equation.

Total: 60 Periods

Text Books:
1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt Ltd., 10th Edition, 2015.
2. Veerarajan.T, "Engineering Mathematics for Semester I and II", Tata McGraw Hill, 3rd Edition, 2014.

Reference Books:
1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 1st edition, 2017.
2. Bali N.P, Manish Goyal, "A text book of Engineering Mathematics: Semester-I", Laxmi Publications (P) LTD, 8th Edition, 2015.

Additional References:
1. https://nptel.ac.in/courses/111/105/111105121
2. https://nptel.ac.in/courses/122/101/122101003

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

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

Formative assessment

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

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE 1 (7.5)	IAE 2 (7.5)	IAE 3 (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

CHAIRMAN - BOARD OF STUDIES

20EC103	Basics of Electrical and Electronics Engineering	L	T	P	C
		3	0	0	3

Nature of Course	Engineering Sciences
Pre requisites	Fundamentals of Electrical Engineering

Course Objectives

The course is intended to
1. Understand the basic concepts of electrical elements and measuring instruments.
2. Gain knowledge of circuit laws.
3. Understand the various components used in electrical installations.
4. Illustrate the construction and operation of various electrical machines.
5. Explore the knowledge on semiconductor and digital circuits

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the basic concepts of electrical elements and measuring instruments	Understand
CO2	Apply various circuit laws for solving complex circuits	Apply
CO3	Analyze the functions of various components used in electrical systems	Apply
CO4	Classify the static and dynamic machines and explain their operation.	Apply
CO5	Understand the basic functionalities of electronic circuits and devices	Apply

Course Contents:

Unit–I   Electrical Elements andMeasuringInstruments   9
Resistance, Inductance, Capacitance, Wires and Cables Ammeter, Voltmeter, Wattmeter, Energy meter, Thermistor and Anemometer

Unit—II   Electrical CircuitsandTheorems   9
Ohm's Law - Kirchoff's Laws - Steady State Solution of DC Circuits - Introduction to AC Circuits - Theorems; Thevinin's, Norton's, Superposition, Maximum power transfer

Unit–III   ElectricalInstallationsDevices   9
Types of Protection devices: Fuses, MCB, ELCB, equipments for house wiring, simple house wiring and pump motor wiring.

Unit -IV   ElectricalMachines   9
Construction and operating characteristics: DC Motor, Single Phase Transformer, Three phase Induction motor, Single-phase induction motors, Synchronous Motor, and Stepper Motor.

Unit – V Semiconductor Devices andDigitalElectronics   9
CharacteristicsofPNJunctionDiode-ZenerEffect-ZenerDiodeanditsCharacteristics-Halfwave   and Full wave Rectifiers - Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Binary Number System - Logic Gates - Boolean Algebra - Half and Full Adders - Flip-Flops -

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Registers and Counters - A/D and D/AConversion

Total: 45 Periods

Text Books:
1. DPKothariandl.JNagarath,ElectricalMachines⁻BasicElectricalandElectronicsEngineering, McGraw Hill Education(India) Private Limited, Third Reprint,2016.
2. LeonardSBobrow, FoundationsofElectricalEngineering‖,OxfordUniversityPress,2013.
3. Thereja .B.L., ⁻Fundamentals of Electrical Engineering and Electronics‖, S. Chand &Co.Ltd., 2008

Reference Books:
1. Laszlo Solymar, Donald Walsh, Richard R. A. Syms, Electrical Properties of materials, Oxford University press, 2014.
2. V. D. Toro, Electrical Engineering Fundamentals, Prentice Hall India,2014.
3. T.K.Nagsarkar and M.S.Sukhija, Basic of Electrical Engineering, Oxford University Press,2011.
4. Mehta V K, "Principles of Electronics", S.Chand& Company Ltd,(1994).

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	.									3	1	2
CO2	3	3	2										3	1	2
CO3	3	3	2										3	1	2
CO4	3	3	2										3	1	2
CO5	3	3	2										3	1	2
	3	\multicolumn{3}{c}{High}		2		\multicolumn{3}{c}{Medium}			1	\multicolumn{3}{c}{Low}	

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

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	IAE 1 (7.5)	IAE 2 (7.5)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse				
Evaluate				
Create				

Passed in Board of studies Meeting on 01.10.2021   *Approved in Academic Council Meeting on 06.10.2021*

CHAIRMAN - BOARD OF STUDIES

20ENE01	COMMUNICATIVE ENGLISH	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Social Science				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Improve lexical, grammatical and semanticcompetence.
2. Enhance communicative skills in real lifesituations.
3. Augment thinking in all forms ofcommunication.
4. Equip with oral and written communicationskills.
5. Gain employabilityskills.

Course Outcomes

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

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

Course Contents

UNITI   Basic structureandUsage   6
Parts of Speech – Articles -Tenses - Subject-Verb Agreement - Different Grammatical forms of the same word - Listening to Speeches and Conversations from Globareana software - Listening to Announcements – Listening and-Gap Filling

UNITII   Vocabulary andLanguageDevelopment   6
Intentional vocabulary used in and around Airport, Hospital, Hotel, Court - Abbreviations and acronyms - One Word Substitution - Compound words - Homophones and Homonyms - Types of sentences - Ordering Jumbled Sentences Letter writing – informal.

UNIT III   OralCommunicationSkills   6
Improving fluency - Articulation with pronunciation - Voice modulation in Speaking – One minute talk -Self Introduction and introducing ones friend - Telephonic conversations - GroupDiscussion – Modal Auxiliaries - discoursemarkers.

UNITIV   Comprehensive Listeningand Reading   6
Effective listening Strategies – Listening to Interviews from Globareana software - Phrasalverbs – ReadingComprehension-"AnAstrologer'sDay"byR.K.Narayanand"BuildingaNewState"by Dr. A.P.J. AbdulKalam.

UNITV   Effective Writing   6
Interpretation and presentation of data - developing Hints - general essays and paragraphwriting – Report Writing - survey report and accident report - Instructions andRecommendations.

TOTAL: 30 PERIODS

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Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Role-play - One minute talk	3	Understand
2	Role-play - Telephonic conversations	3	Understand
3	Listening to speeches and lectures and gap filling	4	Understand
4	Group Discussion	4	Understand
5	Articulation with pronunciation practice	3	Apply
6	Listening to Announcements - Listening and Gap Filling	4	Understand
7	Listening to Interviews & Native speakers' Conversations	4	Understand
8	Reading practice with articles in magazine and newspapers	4	Understand
9	Model - Job Interviews	4	Understand
10	Introspective report - Personal analysis	5	Understand
11	Telephone etiquette	3	Remember
12	Reading - Shorter texts and News Articles	4	Understand
13	Role Play - Getting and Giving Permission	3	Remember
14	Self Introduction(Formal)	3	Understand
15	Recommendations/Suggestions	3	Apply
			Total: 30 Periods

Text Books
1. Board of Editers, "Using English - A Coursebook for Undergraduate Engineers and Technologists", Orient Black Swan Private Limited, Hyderabad, 2nd Edition,2017.
2. Rizvi, Ashraf M., "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5th Edition,2007.

Reference Books:
1. SPDhanavel"EnglishandSoftSkills",OrientBlackSwanPrivateLimited,Hyderabad,1stEdition, 2010
2. MeenakshiRaman   and Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 10th Edition,2007.
3. John CunnisonCatford, "A Practical Introduction to Phonetics", Clarendon Press, Jamaica, 2nd Edition,2001.
4. Hewings. M, "Advanced English Grammar", Cambridge University Press, Chennai, 3rd Edition, 2000.

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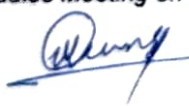
CHAIRMAN - BOARD OF STUDIES

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

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

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

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20CH104	CHEMISTRY FOR CHEMICAL SCIENCES (Common to Petrochemical Technology and Textile Technology)	L	T	P	C
		3	0	2	4

Nature of Course	Basic Sciences
Prerequisites	Nil

Course Objectives

The course is intended to
1. Impart knowledge and understanding about the constituents present in water and the need for purification of water.
2. Introduce the basic principles of analytical techniques.
3. Explain the nature and physical properties of lubricating oils.
4. Interpret the basic principles of dyes and dyeing
5. Provide knowledge about various chromatographic techniques.

Course Outcomes

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

CO.No	Course Outcome	Bloom's Level
CO1	Develop innovative and eco-friendly method for water purification to meet the growing industrial demand	Apply
CO2	Implement the analytical techniques like filtration and evaporation	Understand
CO3	Interpret the importance of viscosity measurement of lubricating oils	Understand
CO4	Classify various dye materials according to their characteristics	Understand
CO5	Select the suitable chromatographic technique for the separation of different substances	Apply

Course Contents

Unit-I   Water Analysis and Water Treatment   9
Water analysis: Sources of water, Hard water and soft water, Hardness of water, acidity, alkalinity, pHvalue, amount of free CO_2, fluoride content and chloride content. Biological Oxygen Demand (BOD), Chemical Oxygen Demand(COD). Water treatment: Definition, Zeolite process, Conditioning methods: Internalconditioning (Phosphate, Calgon) and external conditioning (Demineralisation), Desalination, Reverseosmosis(RO).

Unit-II   Analytical Techniques   9
Basic Principles: Precipitation, filtration, sample drying, transfer of precipitates. Distillation, vacuum distillation, fractional distillation and steam distillation, sublimation and crystallization.

Unit-III   Lubricants   9
Meaning, mechanism of lubrication, liquid lubrication, properties, viscosity index, flash point and fire point, cloud point andpour point, oiliness, kinematic viscosity and common types of kinematic viscometer. Solid lubricants: graphite and molybdenum sulphide.

Unit-IV   Dye Chemistry   9
Nomenclature, Classification according to structure: Nitro Dyes, Azo Dyes (Methyl Orange, Congo Red), Diphenylmethane Dyes (Auramine O), Triphenylmethane Dyes (Malachite Green, Crystal Violet), Phthaleins(Phenolphthalein),Anthraquinoid Dyes (Alizarin). Classification according to method of application: Direct Dyes, Mordant Dyes, Vat Dyes, Ingrain Dyes and Disperse Dyes.

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Unit-V   Chromatographic Techniques   9

Definition, Types, Principle, Detection of Compounds and Advantages: Column Chromatography, Paper Chromatography, Thin Layer Chromatography, Gas-Liquid Chromatography and Gas Chromatography.

Total: 45 Periods

Laboratory Component

S.No.	Name of the Experiment	CO Mapping	RBT
1	Determination of hardness of water	CO1	Apply
2	Determination of chloride content in water sample	CO1	Apply
3	Potentiometric precipitation titration of barium chloride and sodium sulphate	CO2	Understand
4	Finding out the melting point of ice and boiling point of water	CO2	Understand
5	Estimation of copper in brass by EDTA method	CO3	Apply
6	Determination of viscosity of a liquid using Ostwald Viscometer	CO3	Understand
7	Potentiometric titration of ferrous sulphate and potassium dichromate	CO4	Apply
8	Paper chromatographic separation of Fe^{3+}, Al^{3+} and Cr^{3+}	CO5	Understand

Total: 30 Periods

Text Books

1. P.C.Jain and Monicka Jain, "Engineering Chemistry",DhanapatRaiPublishing Company Pvt. Ltd, 16th Edition,2015.
2. O B. S. Bahl and ArunBahl, "Advanced Organic Chemistry", S.Chand& Company Ltd, 22nd Edition, 2010.

Reference Books

1. Dr.SivanesanandNandagopal, "Engineering Chemistry-I", V.K.Pub.Pvt.Ltd, 2nd Edition 2011.

2. B.Sivasankar"EngineeringChemistry"TataMcGraw-HillPub.Co.Ltd, New Delhi, 2ndEdition, 2009.
3. R.Sivakumar and N. Sivakumar,"EngineeringChemistry"TataMcGraw-Hill Pub.Co.Ltd,New Delhi, 1st Edition, 2009.

Additional Resources

1. https://www.academia.edu/30859937/Textile_Auxiliaries_and_Chemicals_Ebook
2. https://www.academia.edu/35720761/Basic_Principles_of_Textile_Coloration_2001_Society_of_Dyers_and_Colourists
3. https://www.khanacademy.org/science/class-11-chemistry-india/xfbb6cb8fc2bd00c8:in-in-organic-chemistry-some-basic-principles-and-techniques/xfbb6cb8fc2bd00c8:in-in-methods-of-purification-of-organic-compounds/a/principles-of-chromatography

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

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3		.									2	

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CO2	3	2	3											2	
CO3	3	2	3											2	
CO4	3	2	3											2	
CO5	3	2	3											2	
	3	High			2	Medium				Low					

	Summative Assessment					Final
	Continuous Assessment					
	Theory					
	IAE-I [7.5]	IAE-II [7.5]	IAE-III[10]	Attendance [5]	Rubric based CIA [20]	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

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20PC101	ORGANIC CHEMISTRY	L	T	P	C
		3	0	2	4

Nature of Course	Professional Core
Pre requisites	Nil

Course Objectives

The course is intended to
1. Learn basic principles involved in analysis and synthesis of different organic derivatives.
2. Provide an advanced understanding of the core principles and topics ofOrganic chemistry.
3. Learn the basic principles of analyticaltechniques.
4. Acquire a specialized knowledge and understanding inPolynuclear Aromatics.
5. Understand the concept of mechanism of Organic Reactions.

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Implement the Organic Reaction Mechanism	Understand
CO2	Interpret the properties of Carbohydrates	Analyze
CO3	Summarize the chemistry Polynuclear Aromatics And Heterocycles	Understand
CO4	Identify the nature of Amino Acids And Proteins	Understand
CO5	Decide the Characterization and properties of Drugs & Dyes	Apply

Course Contents:

UNIT I   Organic Reaction Mechanism   9
Electrophilic reactions- Friedel crafts reaction- RiemerTiemenn reaction- Beckmann rearrangements; nucleophilic reactions- aldol condensation, perkin reaction, benzoin condensation; free radical reaction- halogenation of alkane- Addition of HBr on alkene in presence of peroxide- allylic halogenation - using N-BromoSuccinamide (NBS)- Thermal halogenation of alkene CH3 – CH = CH2.

UNIT II   Carbohydrates   9
Introduction - mono and disaccharides - Important reactions - polysaccharides - starch and cellulose - derivatives of cellulose - carboxy methyl cellulose and gun cotton - structural aspects of cellulose

UNIT III   Polynuclear Aromatics AndHeterocycles   9
Classification of polynuclear aromatics- naphthalene- preparation, properties and uses. Classification of heterocyclic compounds ;Furan- thiophene- pyrrole- pyridine- quinoline, isoquinoline - preparation, properties and uses.

UNIT IV   Amino Acids And Proteins   9
Classification- preparation of Strecker, Skraup, Gabriel phthalimide- properties of Amino acids- Composition and classification of proteins- Structure of proteins - tests for proteins - general properties and relations of proteins - hydrolysis of proteins.

UNIT V   Drugs & Dyes   9
Classification and properties of drugs.Penicillin sulpha drugs- mode of action- synthesis of sulphanilamide- chloroquine- chloroamphenicol- Colour and constitution- chromogen and chromophore- Classification of dyes based on structure and mode of dyeing- Synthesis of dyes- Malachite green- methyl orange- congo red- phenolphthalein.

Total: 45 Periods

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LIST OF EXPERIMENTS

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

TEXT BOOKS:
1. B.S.Bhal and ArunBhal, "A Text Book of Organic Chemistry", 17th Ed., S Chand & Co. New Delhi, 2005Satyanarayana U. and Chakerapani U., "Biochemistry", Books & Allied (P) Ltd, 3rd Rev. Edition 2006.
2. R.T. Morrison and R.N. Boyd "Organic Chemistry", 7th Ed., Prentice Hall Inc. USA, 2010.
3. Jonathan Clayden, Nick Greeves, Staurt Warren and Peter Wothers, "Organic Chemistry", Oxford University Press, 2nd Ed., New Delhi, 2013.
4. K.S. Tiwari, N.K. Vishnoi, S.N. Mehrotra, "A Text Book of Organic Chemistry", Vikas Publishing House, 2nd Ed., New Delhi, 2006.

REFERENCES:
1. Organic Chemistry Lab Manual, Chemistry Division, Chemical Engineering Department, A.C. Tech, Anna University, 2007.
2. Vogels's Text Book of Practical Organic Chemistry, Fifth Edition, Longman Singapore Publishers Pte. Ltd., Singapore, 1989

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

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

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

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20ME101	ENGINEERING GRAPHICS	L	T	P	c
		1	0	4	3

Nature of Course	Engineering Sciences
Pre requisites	Nil

Course Objectives:

The course is intended to
1. Understand technical drawings in various fields of engineering
2. Imagine and visualize the geometric details of engineering objects.
3. Translate the geometric information of engineering objects into engineering drawings.
4. Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings.
5. Visualize and draw isometric and perspective views

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Develop the conic sections, special curves, and draw orthographic views from pictorial views.	Apply
CO2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in firstquadrant.	Apply
CO3	Construct the projections of simple solids like prisms, pyramids, cylinder and cone.	Apply
CO4	Build the sectional views of solids like cube, prisms, pyramids, cylinders & cones and development of its lateralsurfaces.	Apply
CO5	Organize and draw isometric and perspective sections of simple solids.	Apply

Course Contents:

Concepts and Conventions (NotforExamination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

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

UNIT –II   Projection of Points, Lines andPlane Surfaces(3+12)
Orthographic projection- principles-Principal Planes-First angle projection-projection of points Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating objectmethod.

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

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UNIT- IV   Projection of Sectioned Solids and Development of Surface   (3+12)

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular other obtaining true shape of section, Development of lateral surfaces of simple and sectioned solids-Prisms, pyramidscylindersandcones.Development of lateral surfaces of solids with cut-outs and holes

UNIT-V   Isometric and Perspective Projections(3+12)

Principles of isometric projection – isometric scale -Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual raymethod.

TOTAL: (15+60) Periods

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Web References:

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

Publication of Bureau of Indian Standards:

1. IS 10711 - 2001: Technical products Documentation - Size and lay out ofdrawingsheets.
2. IS 9609 (Parts 0 & 1) - 2001: Technical products Documentation -Lettering.
3. IS 10714 (Part 20) - 2001 & SP 46 - 2003: Lines for technicaldrawings.
4. IS 11669 - 1986 & SP 46 - 2003: Dimensioning of TechnicalDrawings.
5. IS 15021 (Parts 1 to 4) - 2001: Technical drawings - ProjectionMethods.

Special points applicable only to Final Examinations of Engineering Graphics:
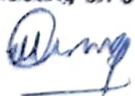
1. There will be five questions, each of either-or type covering all units of thesyllabus.
2. All questions will carry equal marks of 20 each making a total of100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3size.
4. The examination will be conducted in appropriate sessions on the sameday

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

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

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

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20MC101	INDUCTION PROGRAMME	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory, Non Credit				
Pre requisites	Completion of Schooling at Higher Secondary Level				

Course Objectives

The course is intended to
1. Nurture the character and behavior as astudent.
2. Provide broad understanding of society and relationships.
3. Impart interpersonal and softskills.
4. Inspire the students in the field ofengineering.
5. Provide exposure to industries.

Course Outcomes

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

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

S.No	Name of the Experiment	CO Mapping	RBT
1	Field study of simple eco system: pond, river and hill slopes	2	Understand
2	Case study regarding environmental management	1	Knowledge

Course Contents

PHYSICAL ACTIVITY
Yoga, Sports

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

UNIVERSAL HUMAN VALUES
Enhancing soft skills

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

LECTURES BY EMINENT PEOPLE
Guest lecture by subject experts

VISIT TO LOCAL CITIES
Meditation centers / Industry

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

Total: 45 Hours

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TEXT BOOKS

1. Dr. A. Ravikrishan, Envrionmental Science and Engineering, Sri Krishna Hi-tech Publishing co. Pvt. Ltd., Chennai,12thEdition,2016

2. AnubhaKaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, NewDelhi,2015

REFERENCE BOOKS

1. Santosh Kumar Garg, Rajeshwarigarg, smfRanjniGarg ¯Ecological and Environmental Studies Khanna Publishers, NaiSarak, Delhi,2014

2. Masters,GilbertM,IntroductiontoEnvironmentalEngineeringandScience‖,SecondEdition, Pearson Education, New Delhi, 2012

3. MillerT.G. Jr., ¯EnvironmentalScience‖,Tenth Edition,Wadsworth PublishingCo.,.

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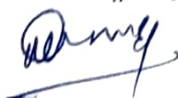
1. https://nptel.ac.in/courses/122103039/38
2. https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909
3. https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm
4. www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
5. nptel.ac.in/courses/120108004/module7/lecture8.pdf

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

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

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20MA206	Mathematics– II for Chemical Sciences (Common to Petrochemical Technology and Textile Technology)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

Course Objectives
The course is intended to
1. Gain the knowledge of evaluating multiple integrals.
2. Acquaint the concepts of vector calculus needed in Chemical engineering field.
3. Study the rigorous and analytic approach to analyze the conformal mapping.
4. Learn the concept of complex integration to evaluate definite integrals.
5. Introduce Laplace transform techniques to solve ordinary differential equations.

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

CO.No.	Course Outcome	Bloom's Level
CO1.	Interpret double and triple integrals.	Understand
CO2.	Apply the basics of vector calculus comprising of gradient, line Surface, volume integrals and the classical theorems.	Apply
CO3.	Explain the concepts of analytic functions and its properties and apply it in conformal mapping.	Understand
CO4.	Demonstrate the singularities and its corresponding residues for the given function.	Understand
CO5.	Identify Laplace transform, Inverse Laplace transform and solve the linear differential equations by Laplace transform techniques.	Apply

Course Contents:
Unit – I Multiple Integrals 12
Double integration – Change of order of integration – Area as a double integral – Change of variables in double integrals (Polar coordinates) - Triple integration in cartesian coordinates – Volume of solids.

Unit – II Vector Calculus 12
Gradient, Divergence and Curl -Directional derivative -Irrotational and solenoidal vector fields – Vector integration -Green's, Gauss divergence and Stokes' theorem - Verification and applications in evaluating line, surface and volume integrals.

Unit – III Complex Differentiation and Conformal mapping 12
Functions of a complex variable -Analytic functions -Statement of Cauchy -Riemann equations – Harmonic functions-Harmonic conjugate -Construction of analytic functions -Conformal mapping : w= z+c, cz, 1/z and Bilinear transformation.

Unit – IV Complex Integration 12
Cauchy's Integral theorem (statement only) - Cauchy's integral formula - Taylor's and Laurent's series - Classification of singularities - Cauchy's residue theorem - Contour integration - Circular and semi-circular contours.

Unit – V Laplace Transforms 12
Laplace transforms -Transform of elementary functions -Properties -Transform of periodic functions - Inverse Laplace transforms -Statement and applications of Convolution theorem -Initial and Final value theorems – Method of solving second order ODE with constant coefficients by using Laplace transforms technique.

Total: 60 Periods

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

CHAIRMAN - BOARD OF STUDIES

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt Ltd., 10th Edition, 2015.
2. Bali N.P, Manish Goyal, "A text book of Engineering Mathematics", , Laxmi Publications (P) LTD, 6th edition 2015.

Reference Books:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 1st edition, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Limited, 10th Edition, 2018.

Additional References:

1. https://nptel.ac.in/courses/111/105/111105122
2. https://nptel.ac.in/courses/111/106/111106139

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

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

Formative assessment

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

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination
	IAE 1 (7.5)	IAE 2 (7.5)	IAE 3 (10)	(60)
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

CHAIRMAN - BOARD OF STUDIES

20PC201		Industrial Chemical Technology	L	T	P	C
Nature of Course	Professional Core		3	0	0	3
Pre requisites	Nil					

Course Objectives

The course is intended to

1. Impart knowledge on various aspects of production engineering and make the student understand the practical methods of production in a chemical factor.
2. Provide an idea about the general principles of chemical processes.
3. Grasp the various Industrial Technologies in identifying thechemical compounds.
4. Understand the overall view of tbe chemical engineering subjects.

Course Outcomes

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

Sl.No.	Course Outcome	Bloom's Level
CO1	Understanding the chemical processes of Sulfur & Sulfuric Acid.	Understand
CO2	Knowledge on various fertilizer industry	Understand
CO3	Accomplish the knowledge of pulp, paper and starch industries	Understand
CO4	Infer the role of petroleum and petrochemicals in chemical industries	Understand
CO5	Evaluate the chemical and physical composition of fuel and industrial gases	Apply

Course contents:

UNITI   SULFUR, SULFURIC ACID AND CEMENT   9
Sulfur: Raw materials Sources – Mining and production of Sulfur – Sulfuric acid – Methods of production of Sulfuric acid – Contact process – Chamber process. Cement – properties of Cement – Methods of production – Overall factors for Cement industry

UNITII   FERTILIZER INDUSTRY   9
Major Components of Fertilizer industries – Nitrogen industries, ammonia, nitric acid, urea – Phosphorus industries – Phosphorus, Phosphoric acid, Super Phosphate – Potassium chloride, Potassium Sulphate.

UNIT III   PULP, PAPER, SUGAR AND STARCH INDUSTRIES   9
Pulp – Methods of production – Comparison of pulping processes– Paper – types of paper products, Raw materials, Methods of production – Sugar – Methods of production – by products of the Sugar industry – Starch – Methods of production, Starch derivations.

UNIT IV   PETROLEUM AND PETRO CHEMICAL INDUSTRIES   9
Petroleum – Chemical Composition, Classification of crude petroleum – Petroleum Refinery products – Petroleum Conversion processes – Pyrolysis and Cracking – Reforming Polymerization- isomerization - Alkylation - petrochemicals - methanol- chloro methanol, Acetylene - ethylene- Isopropanol - Acrylonitrile - Butadiane - Chemicals from Aromatics - Benzene, Toluene and Xylene.

UNITV   FUEL AND INDUSTRIAL GASES   9
Production of Fuel Gases:Producer gas, Water gas, Coke oven gas - Natural gas:Liquefied natural gas - Production of Industrial gases: Carbon dioxide- hydrogen -, nitrogen and oxygen.

Total: 45 Periods

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

CHAIRMAN - BOARD OF STUDIES

TEXT BOOKS:

1. Dryden, C.E, Outlines of Chemical technology, II Ed., Affiliate East West press, 2003.
2. 2. Moulin, J.A., M. Makkee, and Diepen, A.V., Chemical Process Technology, Wiley, 2001.

REFERENCES:

1. Austin, G.T., Shreve's "Chemical Process Industries", 5th ed., McGraw-Hill, 1998.
2. 2. SrikumarKoyikkal, "Chemical Process Technology and Simulation", PHI Learning Ltd.

Web References:

1. https://nptel.ac.in/
2. https://coursera.com/

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

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Understand	Quiz / Presentation/Tutorial	5	
Understand	Assignment / Video presentation	5	15
	Attendance	5	

Summative Assessment			
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	IAE 1 (7.5)	IAE 2 (7.5)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse				
Evaluate				
Create				

Passed in Board of studies Meeting on 01.10.2021   *Approved in Academic Council Meeting on 06.10.2021*

CHAIRMAN - BOARD OF STUDIES

20ENE02	ADVANCED COMMUNICATIVE ENGLISH	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basics of Communicative English				

Course Objectives

The course is intended to
1. Demonstrate satisfactory control over complex structures and mechanics inEnglish.
2. Develop fluency and accuracy in oralcommunication.
3. Communicate effectively and actively in social interactions.
4. Read English at inspectional level.
5. Face interviews withconfidence.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Apply knowledge of English grammar for effective communication	Remember
CO2	Make use of common English phrases and vocabulary strength.	Understand
CO3	Build self-confidence and enhance professionalism	Apply
CO4	Implement listening, reading and writing skills in real - life situations	Apply
CO5	Speak fluently in English with proper pronunciation, intonation, tone and accent.	Understand

Course Contents

Unit – I Grammarand usage
6
Active voice and passive voice - Prefixes and suffixes - Compound words - Clauses - If conditionals - Idioms & Phrases - Right forms of verbs - Modal Auxiliaries - Spotting errors.

Unit – IILexical competence
6
Technical Vocabulary - Expressions - Frequency - Cause and effect - Words often Miss-spelled - Syntax and structure - Homophones and Homonyms- Verbal analogy - idioms and phrases.

Unit - III Conversationaletiquette
6
Processes description - Tone and accent in speech - Role-play (Job-Interview) - Presentationskills - Mechanics of presentation - Telephone etiquette - Group Discussion strategy - Formal & Informal subjective and objective introduction - Body Language - Mock Interview.

Unit – IV Listening readingandwriting
6
Listen to Scientific / Technical talks and gap filling - Listening to TED/INK Talks - Reading - "Water: TheElixirofLife"byC.V.Raman."Progress"bySt.JohnErvine-InstructionsandRecommendations - Letter writing formal - Job application- Report writing - Introspective report - Creative writing - Essays and Paragraphs.

Unit –V Phonetics
6
Production and classification of speech sound - International Phonetic Alphabet and transcriptions - Phonological rules - way and Place of articulation - Vowels, consonants and diphthongs. Specific characteristics feature of vowel sounds.

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Role-play - Processes Description	2	Remember
2	Listening to TED/INK Talks and gap filling	4	Understand
3	Group Discussion	3	Understand
4	Articulation with pronunciation practice	3	Apply
5	Reading - Longer texts and Technical Articles (Skimming & Scanning).	4	Apply
6	Presentation skills - Mechanics of presentation	5	Understand
7	Individual presentation on given topics	5	Remember
8	Telephone etiquette	5	Understand
9	Instructions and Recommendations	5	Remember
10	Writing - General Essays.	4	Apply
11	Report writing technique- write up	4	Remember
12	Introspective report - Personal analysis	4	Understand
13	Model Job Interviews	3	Understand
14	Job Interviews(Role play)	3	Apply
15	Body Language	3	Understand

Total: 30 Periods

Text Books

1. Board of Editers, "Using English - A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2nd Edition,2017.

2. Rizvi, Ashraf.M, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5th Edition,2007.

3. Hewings. M, "Advanced English Grammar", Cambridge University Press, Chennai, 3rd Edition, 2000.

Reference Books:

1. Dhanavel S. P., "English and Soft Skills", Orient BlackSwan Private Limited, Hyderabad, 1stEdition,2010.

2. RamanM&SangeethaSharma,"TechnicalCommunication",OxfordUniversityPress,USA,10th Edition,2007.

3. Norman Whitby, Business Benchmark - "Pre-Intermediate to Intermediate, Students Book", Cambridge University Press, 1st Edition,2006.

4. John CunnisonCatford, "A Practical Introduction to Phonetics",Clarendon Press, Jamaica, 2nd Edition,2001.

Web reference:

1. https://www.coursera.org/lecture/tesol-speaking/video-2-listening-strategies-for-learners-AeBL?utm_source=mobile&utm_medium=page_share&utm_content=vlp&utm_campaign=top_button

2. blob:https://www.youtube.com/73f7256d-d302-4563-bed5-9e84c94a26ac

Software used: Globareana

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

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

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

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

Passed in Board of studies Meeting on 01 10 2021   Approved in Academic Council Meeting on 06.10 2021

CHAIRMAN - BOARD OF STUDIES

20PH204	Physics for Chemical Sciences (Common to Textile and Petrochemical Technology)	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Physics				

Course Objectives:

The course is intended to

1. Impart knowledge of properties of matter like elasticity and its applications
2. Provide knowledge of optics, especially laser and their applications in fiber optics.
3. Understand the thermal properties of materials and their applications.
4. Learn the dielectric and magnetic properties of materials
5. Expose to new engineering materials like metallic glasses, shape memory alloys, Ceramics and Composites

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Demonstrate the Young's modulus and rigidity modulus of the materials.	Understand
CO2	Compare the working of lasers and propagation of light through optical fibers and its applications	Understand
CO3	Demonstrate the thermal conductivity of good and bad Conductors.	Understand
CO4	Summarize about the various dielectric and magnetic materials.	Understand
CO5	Explain the properties and applications of new engineering materials like shape memory alloys, metallic glasses composites etc..	Understand

Course Contents:

UNIT I   Properties of Matter   9
Elasticity - Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength - torsional stress and deformations - twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment - cantilever - uniform and non-uniform bending - I-shaped girders - stress due to bending in beams.

UNIT II   Laser and Fiber Optics   9
Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) - Semiconductor lasers: homojunction and heterojunction - Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index, mode) – optical fiber communication system- fiber optic endoscope.

UNIT III   Thermal Physics   9
Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications : heat exchangers in refrigerators, ovens and solar water heaters.

UNIT IV   Dielectric and Magnetic Materials   9
Dielectric materials - Electronic, Ionic, Orientational and space charge polarization - dielectric loss - classification of insulating materials and their applications- Ferroelectric materials - Introduction to magnetic materials - Domain theory of ferromagnetism, Soft and Hard magnetic materials - Anti-ferromagnetic materials – Ferrites.

UNIT V   New Engineering Materials   9
Metallic glasses - preparation, properties and applications - Shape memory alloys - Types, characteristics and applications - Ceramics: types and applications - Nanomaterials - preparation

- physical vapour deposition method, properties and applications.

Total : 45 Periods

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Determination of rigidity modulus - Torsion pendulum.	CO1	Apply
2	Determination of Young's modulus by non-uniform bending method.	CO1	Apply
3	Determination of velocity of sound and compressibility of liquid - Ultrasonic interferometer.	CO1	Apply
4	Determination of Coefficient of viscosity of liquid.	CO1	Apply
5	Determination of acceptance angle in an optical fiber.	CO2	Apply
6	Determination of wavelength and particle size using Laser.	CO2	Apply
7	Determination of thermal conductivity of a bad conductor by Lee's Disc method.	CO3	Apply

Total 30 Periods

TEXT BOOKS:

1. Bhattacharya, D.K and Poonam, T, "Engineering Physics", Oxford University Press, 2nd edition, 2015.
2. M.N. Avadhanulu, M.N. & Kshirsagar PG. "A Text book of Engineering Physics", S.Chand and company, Ltd., New Delhi, 10th edition, 2014.
3. William D Callister Jr. and David G Rethwisch., "Materials Science and Engineering", John Wiley & Sons, Inc, 9th Edition, 2019.

REFERENCES:

1. David Halliday. Robert Resnick. and Jearl Walker., "Principles of Physics", Wiley, 10th Edition, 2014.
2. Raymond A Serway. and John W Jewett., "Physics for Scientists and Engineers", Cengage Learning, 9th Edition, 2019.
3. Raghavan V., "Materials Science and Engineering, A First course", PHI Learning, 5th Edition, 2015.

Web References:
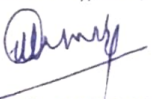
1. https://theconstructor.org/concrete/expansion-joint-concrete/25161/
2. https://nptel.ac.in/courses/115/107/115107095/
3. https://www.youtube.com/watch?v=9bhG0hkKjcA
4. https://theconstructor.org/concrete/expansion-joint-concrete/25161/
5. http://pioneer.netserv.chula.ac.th/~ksongpho/308/B.pdf

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

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

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CHAIRMAN - BOARD OF STUDIES

| Bloom's Level | Summative assessment Continuous Assessment | | | | | Final Examination (Theory) [50 marks] |
| | Theory Marks | | | | Practical | |
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	10	10	10		-	20
Understand	35	35	35		40	70
Apply	5	5	5		60	10
Analyse	-	-	-		-	-
Evaluate	-	-	-		-	-
Create	-	-	-		-	-

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

CHAIRMAN - BOARD OF STUDIES

20CS201	PROBLEM SOLVING USING PYTHON	L	T	P	C
		3	0	2	4

Nature of Course	Engineering Sciences
Pre requisites	Mathematical and Logical Knowledge

Course Objectives

The course is intended
1. To think logically, write algorithm, and draw flow-charts forproblems.
2. To read and write simple Pythonprograms.
3. To develop Python programs with conditionals andloops.
4. To define Python functions and callthem.
5. To use Python data structures – lists, tuples, dictionaries andfiles.

Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Develop algorithmic solutions to simple computational problems and read, write, execute by simple python programs.	Apply
CO2	Structure simple python programs for solving problems.	Understand
CO3	Administer the role of control statements and functions involving the idea of modularity.	Apply
CO4	Represent compound data using python strings and lists.	Apply
CO5	Read and write data from/to files in python Programs.	Understand

Course Contents:

UNITI   Basics of Computers &ProblemSolving   9

ComputerBasics-Components-Computerorganization-ComputerSoftware-Typesofsoftware-Software Development steps -Need for logical analysis and thinking- Algorithms - Flowchart - Numbersystem.

UNIT II Introduction ofPython Programming   9

Introduction-PythonInterpreter-Interactiveandscriptmode-Valuesandtypes,variables,operators, expressions, statements, precedence of operators, Multiple assignments, comments, Input and OutputStatements.

UNIT III Control statementsand Functions   9

Conditional (if), alternative (if-else), chained conditional (if-elif-else)-Iteration-while, for, break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.
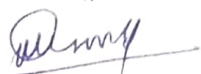
UNIT IV Stringsand Lists   9

Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions-list processing-list comprehension, searching and sorting.

UNIT V Tuples, Dictionariesand Files   9

Tuples- Tuple assignment, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Files and Exception-Text files, reading and writing files, format Operator, Exception handling.

TOTAL : 45 Periods

CHAIRMAN - BOARD OF STUDIES

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Write a algorithm & draw flowchart for simple computational problems	CO1	Understand
2	Write a program to perform different arithmetic operations on numbers in python.	CO2	Understand
3	Write a python program to implement the various control structures	CO3	Apply
4	Write a python program for computational problems using recursive function.	CO3	Apply
5	Demonstrate use of list for data validation.	CO4	Apply
6	Develop a python program to explore string functions	CO4	Analyze
7	Implement linear search and binary search.	CO4	Apply
8	Develop a python program to implement sorting methods	CO4	Analyze
9	Develop python programs to perform operations on dictionaries.	CO5	Analyze
10	Write a python program to read and write into a file	CO5	Apply

TOTAL: 30 Periods

Text Books

1. ReemaThareja, "Problem Solving and Programming with Python", Oxford University Press,2018
2. Dr. R. NageswaraRao, "Core Python Programming", Dreamtech Press, 2017Edition
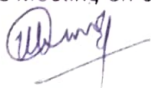
Reference Books:

1. Ashok NamdevKamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018.
2. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,2015
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition,2013
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning,2012

Cos	\multicolumn{12}{c}{Pos}											\multicolumn{3}{c}{PSOs}		

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

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	1	1										3	1	
CO3	3	2	2										3	1	
CO4	3	1	2										3	1	
CO5	3		2										3	1	
	3	\multicolumn{2}{c}{High}		2		\multicolumn{3}{c}{Medium}			1	Low		
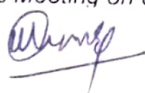
Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

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Bloom's Level	Summative assessment					End Semester Examination (Theory) [50 marks]
	Continuous Assessment					
	Theory Marks				Practical	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	10	10	10			20
Understand	20	20	20		30	50
Apply	20	20	20		50	30
Analyse	-	-	-		20	-
Evaluate	-	-	-		-	-
Create	-	-	-		-	-

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

CHAIRMAN - BOARD OF STUDIES

20PC202	CHEMICAL ANALYSIS LABORATORY	L	T	P	C
Nature of Course	Professional Core	0	0	4	2
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Learn basic principles involved in analysis of petrochemical products
2. Provide an advanced understanding of the importance and analysis of flue gas
3. Learn the basic principles of analytical techniques.
4. Acquire a specialized knowledge and understanding in Aromatic content determination.
5. Understand the concept of bioremediation & biodegradation process.

Course Outcomes

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

S.No.	Course Outcome	Bloom's Level
CO1	Implement the Organic Reaction Mechanism	Understand
CO2	Interpret the properties of Carbohydrates	Understand
CO3	Summarize the Aromatic and sulphur content determination	Understand
CO4	Identify the nature of petrochemicals	Understand
CO5	Apply their knowledge in chemical industries	Apply

LIST OF EXPERIMENTS

S.No	Name of the Experiment	CO Mapping	RBT
1.	Sulphur content determination	2	Analyze
2.	Flue gas Analysis using Orsat Apparatus	2	Evaluate
3.	Aromatic Content determination	3	Analyze
4.	Determination of Lead, Acid content	3	Evaluate
5.	Total acidity determination	2	Analyze
6.	Determination of Salt content	2	Evaluate
7.	Refractive index of petrochemicals	2	Evaluate
8.	Determination of moisture content using KF Titrator	3	Analyze
9.	Dynamic viscosity measurement	2	Evaluate
10.	Calorific value of fuels	2	Analyze

Total : 30 Periods

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

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

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

Summative assessment based on Continuous and Final Examination

Bloom's Level	Rubric based Continuous Assessment [50 marks]	Final Examination [50 marks]
Remember	10	10
Understand	50	50
Apply	30	30
Analyze	10	10
Evaluate	-	-
Create	-	-

Passed in Board of studies Meeting on 01.10.2021   Approved in Academic Council Meeting on 06.10.2021

CHAIRMAN - BOARD OF STUDIES

20MC201	ENVIRONMENTAL SCIENCES	L	T	P	C
		2	0	0	0

Nature of Course	Mandatory Non Credit
Pre requisites	Nil

Course Objectives

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

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Describe the ecosystem and environment	Understand
CO2	Understand the ecological balance and preservation of bio diversity	Understand
CO3	Demonstrate various types of pollution in order to control pollution	Apply
CO4	Classify the energy sources for the conservation of non conventional energy sources	Understand
CO5	Identify the nature and management of e-waste and solid waste	Apply

Course Contents

Unit-I   Ecosystem   6

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

Unit-II   Biodiversity   6

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

Unit-III   Environmental Pollution   6

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

Unit-IV   Non-Conventional Energy Resources   6

Introduction. Types. Solar Energy. Wind Energy and Geo Thermal Energy.

Unit-V   Environmental Management   6

Sustainable Development.Role of Information technology in Environment and Human. HIV and AIDS causes and control measures. Green chemistry. Definition and Principles

Activity Component

S.No	Name of the Experiment	CO Mapping	RBT
1	Field study of simple eco system pond river and hill slopes	CO1	Understand
2	Case study regarding environmental management	CO5	Apply

Total: 30 periods

Passed in Board of studies Meeting on 01 10 2021   Approved in Academic Council Meeting on 06 10 2021

CHAIRMAN - BOARD OF STUDIES

Text Books

1. AnubhaKaushik and C.P. Kaushik, "Environmental Science and Engineering, New Age International Publishers, New Delhi, 2nd Edition,2015.
2. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. Reprint Edition,2010.

Reference Books

1. Santosh Kumar Garg and RajeshwariGarg "Ecological and Environmental Studies", Khanna Publishers, NaiSarak, Delhi, 2nd Edition,2014.

2. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2nd Edition,2012.

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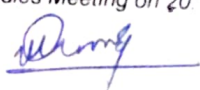
1. https://nptel.ac.in/courses/122103039/38
2. https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909
3. https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm
4. www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
5. nptel.ac.in/courses/120108004/module7/lecture8.pdf

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

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

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

Passed in Board of studies Meeting on 20.10.2020   Approved in Academic Council Meeting on 06.11.2020

CHAIRMAN - BOARD OF STUDIES

20MA304   PROBABILITY AND STATISTICS
(Petro Chemical Technology)

Nature of Course	Basic Sciences
Pre requisites	Mathematics- I , II for Chemical Sciences

Course Objectives

The course is intended to

1. Introduce the basic concepts of Random variables.
2. Acquire the concepts of random variables essential to the subsequent and digital communication
3. Acquaint with the knowledge of testing of hypothesis for small and large samples.
4. Familiarize with the basic concept or types of design of experiments used in the field of engineering
5. Study the concepts or types of classifications and statistical quality control

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the concepts of a random variables and theoretical Distributions	Understand
CO2	Examine the functions of multiple random variable	Apply
CO3	Interpret the testing of hypothesis for small and large samples	Understand
CO4	Apply the concepts of classifications of design of experiments in the field of engineering	Apply
CO5	Illustrate the sampling distribution and statistical techniques	Understand

Course Contents:

UNIT - I - Probability and Random Variables   12
Axiom of Probability Baye's theorem(Statement Only) Random Variables – Discrete and Continuous random variables – Moment Generating Functions – Binomial distribution. Poisson distribution. Geometric distribution Uniform distribution, Exponential distribution and Normal distribution.

UNIT - II - Two – Dimensional random variables   12
Joint distributions – Marginal distributions– Covariance – Correlation and Linear Regression – Transformation of random variables – Central limit theorem (Statement Only)

UNIT - III - Testing of Hypothesis   12
Sampling distributions – - Estimation of parameters – - Statistical hypothesis – - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) -Goodness of fit

UNIT – IV - Design of Experiments   12
One way and Two way classifications – Completely Randomized design – Randomized block design – Latin square design – 2^2 factorial design.
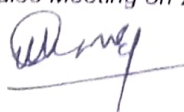
UNIT - V - Statistical Quality Control   12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling

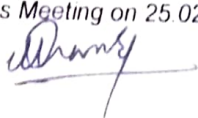Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03 2022

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Bloom's Category	Summative Assessment			
	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Bloom's Level	Summative Assessment					Final Examination (Theory) (50)
	Continuous Assessment					
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PC305	Reservoir Engineering	L	T	P	C
		3	0	0	3
Nature of course	Professional Core (PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. To understand about Reservoir Engineering concept
2. To know the characteristics behavior of crude oil and gas.
3. Analysis about the various test conduct on sample core.
4. Design of fluid flow and through porous medium
5. To calculate the volume and estimate the reserves during drive mechanism.

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Identify the nature of Hydrocarbon Reservoir and its affective exploitation	Remember
CO 2	Facilitate the effective estimations of hydrocarbons with high degree of confidence using the effective maps and statistical procedure.	Apply
CO 3	Understand the Risk analysis and its correlations with Resource Management	Apply
CO 4	To contribute the development of software and application of existing software in the area of Reservoir Engineering.	Apply
CO 5	Understand the drive mechanism used in reservoir Engineering.	Understand

Course Contents

Unit – I   Introduction

12

Introduction to reservoir engineering, characteristics of crude oil and natural gas, classification of crude and it physicochemical properties, calculation of hydrocarbon volumes, fluid pressure regimes, volumetric gas reservoir engineering.

Unit – II   Reservoir Rock Properties

12

Porosity and permeability determination, Combination of permeability in parallel & series beds, Porosity permeability relationship, Fluid saturation determination and significance, Effective and relative permeability, Wettability, capillary pressure characteristics, measurement and uses. Coring and Core analysis.

Unit – III   Reservoir Fluids

12

Phase behavior of hydrocarbon system, ideal & non ideal system, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.

Unit – IV   Flow of Fluids through Porous Media

12

Darcy's law, Single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations, derivation of the basic radial flow equation, condition of solution.
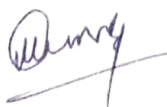
Unit – V   Reservoir Drive mechanisms

12

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on
09.03 2022

CHAIRMAN - BOARD OF STUDIES

Unit – V ntroduction to New Materials

Biomaterials - Implantable Materials ,Temporary and Permanent Implants ,Bio-degradable Materials
Nanomaterials-Hybrid nanomaterials,Metallic glasses ,Shape memory alloys, grapheneand its
properties , Chemical Sensors - Bio-sensors ,conducting, semiconducting and photo responsive
polymers

Total : 45 Periods

Text Books

1. V.Raghavan, "Materials Science and Engineering: A first course", V Edition, Prentice Hall of India , 2004Text Book detail 02
2. Smith, W.F., Hashemi, J. & Prakash. R. "Materials Science and Engineering". Tata Mcgraw Hill Education Pvt. Ltd., 2014
3. Balasubramaniam, R. "Callister's Materials Science and Engineering". Wiley India Pvt.Ltd. 2014.

Reference Books

1. W.F.Hosford, "Material Science", Cambridge Univ. Press, New York, 2006.
2. C.Srinivasan, "Science of Engineering Materials", John Wiley, New York, 1987.
3. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010

Additional / Web References

1. NPTEL LINK :https://nptel.ac.in/courses/113/102/113102080/
2. COURSERA LINK: .\ .\Fundamentals of Materials Science _ Coursera_files
3. MIT COURSE WORK: .\ .\Materials Science and Engineering _ MIT OpenCourseWare _ Free Online Course Materials.html

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

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

Formative assessment

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

Summative Assessment		
Internal Assessment Examinations		

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PC302	MATERIALS TECHNOLOGY FOR CHEMICAL ENGINEERS	L	T	P	C
		3	0	0	3

Nature of course	ENGINEERING SCIENCES (ES)
Pre requisites	Applied Physics

Course Objectives

The course is intended to

1. Provide students with a strong foundation in materials science
2. Emphasis on the fundamental scientific and engineering principles of material structures
3. Implementation of processing and performance of all classes of materials used in engineering systems
4. Explain the qualities and quantifications of mechanical, thermal, electrical, magnetic properties
5. Enrich the fundamentals of advancement of new materials

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Acquaint with properties and selection of materials	Understanding
CO 2	Understand the basics of metallurgical science	Applying
CO 3	Apply the various heat treatment and testing procedure for steels and nonferrous alloys	Applying
CO 4	Know the various types of non-metallic materials	Understanding
CO 5	Learn the novelty of new materials	Understanding

Course Contents

Unit – I   Introduction to materials   9

Classification of Engineering Materials ,structure of materials,Single crystals – polycrystalline - Non crystalline solids - Imperfection in solids – Vacancies – Interstitials point, line, surface and volume defects , selection of materials, functional properties of materials.

Unit – II   METALLURGICAL AND PHYSICAL PROPERTIES OF MATERIALS   9

Invariantreactions, eutectic, eutectoid and peritectic system,Mechanical properties - tension test, hardness test , Conductivity of materials(metals, ceramics, polymers), Introduction to magnetic materials - Soft and Hard magnetic materials, Anti-ferromagnetic materials ,Ferrites, magnetoresistance materials

Unit – III   Ferrous and Non-Ferrous Alloys   9

Classification of steel, Fe-C phase diagram, heat treatment, TTT curves, tool steels, stainless steel cast iron. Copper and its alloys -brass, bronze, copper –nickel, Aluminium and its alloys, titanium and its alloys,Magnesium and its Alloys

Unit – IV   Polymers ,Ceramicsand Composites   9

Engineering Ceramics –Properties and applications of Alumina $(Al2O3)$ - Silicon Carbide (SiC) - Silicon Nitride $(Si3N4)$ - Partially Stabilized Zirconia (PSZ) and Sialon , Polymers – classification, reaction, types, mechanisms, mechanical, thermal, electrical and chemical behavior Rubber silicones, fluorocarbons, Composites -FRP, particulates, and laminates

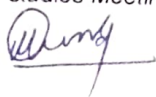Passed in Board of studies Meeting on 25 02 2022   Approved in Academic Council Meeting on 09 03 2022

CHAIRMAN - BOARD OF STUDIES

B. Tech. Petrochemical Technology (R - 2020)

Bloom's Category	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Final Examination (60)
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Bloom's Level	Summative Assessment						
	Continuous Assessment						Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PC303	CHEMICAL PROCESS CALCULATIONS	L	T	P	C
		3	0	0	4
Nature of course	PROFESSIONAL CORE (PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to
1. Understand the concept of degree of freedom
2. Impact knowledge in the mass and energy balances
3. Understand fundamentals of units and stoichiometric equations
4. Understand fundamentals of ideal gas behavior
5. Understand fundamentals of phase equilibra

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	determine the characteristics of degree of freedom for all gas components	Applying (K3)
CO 2	determine the mathematical methodologies for the computation of Mass and energy balances	Applying (K3)
CO 3	examine the fundamentals of units and stoichiometric equations	Applying (K3)
CO 4	categorize Ideal gas behavior and determine the Ideal gas constants	Applying (K3)
CO 5	analyze the working fundamentals of phase equilibra	Applying (K3)

Course Contents

Unit – I   Basic Chemical Calculations   12

Units and Dimensions

Basic and derived units – Use of model units in calculations – Methods of expression – Compositions of mixture and solutions.

Gas Calculations

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

Unit – II   Material Balance   12

Stoichiometric principles – Application of material balance to unit operations like distillation – Evaporation, crystallization, drying etc., – Material balance with chemical reaction – Limiting and excess reactants – Recycle – Bypass and purging – Unsteady state material balances

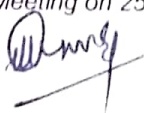**Unit – III   Humidity & Saturation**   12

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

Unit – IV   Fuels & Combustion   12

Determination of composition by Orsat analysis of products of combustion of solid, liquid and gas fuels – Calculation of excess air from Orsat technique, problems on sulphur and sulphur burning compounds – Theoretical flame temperature

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

Unit – V   **Agitation and Mixing**

Significance of agitation and mixing, equipment for agitation, types of impellers, power requirement for mixing of Newtonian liquids, Mixers for powders and pastes, mixing index

Total : 45 Periods

Text Books

1. Swain A K , Patra H and Roy G K , "Mechanical Operations", 1st Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, 2017
2. McCabe, W L , Smith, J C , and Harriot, P , "Unit Operations in Chemical Engineering" 7th
3. K A GAVHANE "UNIT OPERATIONS-I 25TH Edition, Nirali prakashan, PUNE 2015

Reference Books

1. Coulson J M and Richardson J F , "Chemical Engineering", 5th Edition, Butterworth-Heinemann Ltd , United States of America, 2002
2. Foust, A S , Wenzel, L A , Clump, C W , Naus, L , and Anderson, L B , "Principles of Unit Operations", 2nd Edn., John Wiley & Sons, 1994 Christie J Geankoplis, Transport processes and unit operations

Additional / Web References

1. NPTEL LINK https://nptel.ac.in/courses/103/107/103107123/
2. SWAYAM PORTAL https://www.classcentral.com/course/swayam-mechanical-operations-10092
3. IIT GUWAHATI https://freevideolectures.com/course/4106/nptel-mechanical-unit-operations

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

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)
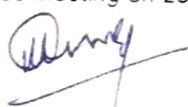
Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PC304	MECHANICAL OPERATIONS	L	T	P	C
		3	0	0	3
Nature of course	PROFESSIONAL CORE (PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the handling and operation of solids
2. Impact knowledge in the field of particle size reduction
3. Understand solid-liquid, liquid-liquid, gas-solid and solid-solid
4. Understand particulate solid characterization
5. Work with the detail construction and working of equipment's used for mechanical operations

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	determine the characteristics of solids, size analysis and demonstrate the transportation and storage of solids	Applying (K3)
CO 2	categorize the size reduction equipment and estimate the power consumption and effectiveness of the screen	Applying (K3)
CO 3	examine the separation equipment for solid-solid, solid-liquid and solid-gas system and design of thickener	Applying (K3)
CO 4	categorize various filters and determine the rate of filtration	Applying (K3)
CO 5	analyze the working of various types of impellers, mixers and determine the power consumption for mixing and agitation	Applying (K3)

Course Contents

Unit – I   Properties and Handling of Particulate Solids   9

Particle characterization, agglomeration and segregation, Methods of handling, transportation and storage of bulk solids

Unit – II   Size Reduction   9

Laws and mechanism of size reduction; types of crushing equipment; industrial screens and screen effectiveness

Unit – III   Separation of Particulate Solids   9

Gravity separation: classifier, clarifier, settler; sedimentation and centrifugal separation; flotation, magnetic separators and electrostatic precipitator

Unit – IV   Filtration   9

Filtration theory, classification of filtration process, Selection of filters, Industrial filtration equipment

Text Books:

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics",Tata McGraw Hill, 4th Edition, 2007
2. Oliver.C.Ibe, 'Fundamentals of Applied Probability and Random Processes", Elsevier India,2nd Edition , 2014

Reference Books:

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Lakshmi Publications Pvt Ltd,9th Edition,2014.
2. Ronald E. Walpole, Raymond H. Myers and Sharon L. Myers "Probability And Statistics and for Engineers and scientists ", Pearson India ,9th edition, 2012.
3. Robert V. Hogg Elliot Tanis Dale Zimmermann., "Probability and Statistical Education,2021.   inference "Pearson

Additional References:

1. https://nptel.ac.in/courses/111/102/111102111
2. https://nptel.ac.in/courses/110/107/110107114

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

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

3	High		2	Medium		1	Low	

Formative Assessment

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

Summative Assessment

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

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN · BOARD OF STUDIES

20PC301	Fluid Mechanics for Chemical Engineers	L	T	P	C
		3	2	0	4
Nature of course	PC – Professional Core				
Pre-requisites	Nil				

Course Objectives

The course is anticipated to
1. Depict the students to the fundamentals of fluids and its classification.
2. Facilitate the students to understand and the various equations related to fluid mechanics.
3. Enable the students to understand the concepts of dimensional and non-dimensional analysis and its principles.
4. Formulate the students, understand the concepts of laminar, turbulent flows and boundary layer conditions.
5. Make the students understand the concepts related to flow with respect to Fluid Mechanics.

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Remember the basic concepts and of Fluid Mechanics	Remember
CO 2	Study Kinematics and dynamics of fluids	Apply
CO 3	Learn Dimensional analysis, dimensionless numbers and similitude	Apply
CO 4	Understand the conception of Boundary Layer	Understand
CO 5	Learn concepts related to Flow in Chemical Engineering equipments	Understand

Course Contents

Unit – I   INTRODUCTION TO FLUID MECHANICS   9

Fluid Mechanics in Chemical Engineering - General Concepts of a Fluid - Stresses, Pressure, Velocity, and the Basic Laws - Physical Properties: Density, Viscosity, and Surface Tension – Newtonian and non-Newtonian fluids – Fluid Statics – Basic Equation of Fluid Statics – Pressure – Pressure Measurement – Manometry.

Unit – II   KINEMATICS AND DYNAMICS OF FLUID FLOW   9

Kinematics – Methods of Fluid flow- Liquid and Gas Flow through Pipelines - Types of Fluid Flow – Rate of Flow - Continuity Equation – Velocity & Acceleration – General Conservation Laws – Mass, Energy and Momentum Balances – Moody Chart - Equations of Motion – Euler's Equation of Motion – Bernoulli's Equation – Statement and assumptions – B.E for real fluid – Applications of B.E.

Unit – III   DIMENSIONAL ANALYSIS, MODEL & DIMENSIONLESS NUMBERS   9

Introduction – Derived Quantities- Dimensional Homogeneity – Methods of Dimensional Analysis- Rayleigh's Method – Buckingham's Pi Theorem – Selecting Repeating Variables – Model Analysis – Similitude – Types of Similitude- Types of forces – Dimensionless Numbers – Model Laws.

Unit – IV   BOUNDARY LAYER FLOW   9

Introduction to Boundary Layer- Definitions – Drag force on a Flat plate – Turbulent Boundary Layer on a Flat plate – its analysis – Total drag on a flat plate due to Laminar and Turbulent Boundary Layer – Separation of Boundary Layer.

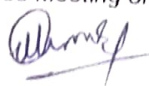### Unit – V   FLOW IN CHEMICAL ENGINEERING EQUIPMENT   9

Introduction - Pumps and Compressors - Pumps in Series and Parallel - Drag Force on Solid Particles in Fluids - Flow Through Packed Beds - Pressure Drop in a Packed Bed Reactor - Filtration - Fluidization - Cyclone Separators – Sedimentation.

Total : 45 Periods

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03 2022

CHAIRMAN - BOARD OF STUDIES

Text Book
1. Munson, B. R., Young, D. F., Okiishi, T. H. "Fundamentals of Fluid Mechanics", 5th Edition", John Wiley, (2006)
2. Noel de Nevers, "Fluid Mechanics for Chemical Engineers", 2nd Edition, McGraw-Hill, (1991).
3. White, F. M., "Fluid Mechanics", IV Edition, McGraw-Hill Inc., (1999)

Reference Book
1. R. K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", 9th Edition (Revised), (2010).
2. James O Wilkes [with contributions], "Fluid Mechanics for Chemical Engineers with Microfluidics, CFD, and COMSOL Multiphysics 5" Prentice Hall, PTR (International series in Chemical Engineering) (2018).
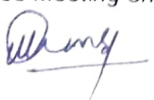
Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

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

Formative assessment

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

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

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Bloom's Level	Summative Assessment					
	Continuous Assessment					Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

Unit – V   Energy Balance

Thermo Physics

Heat capacity of solids, liquids, gases and solutions – Use of mean heat capacity in heat calculations– Problems involving sensible heat and latent heats – Evaluation of enthalpy.

Thermo Chemistry

Standard heat of reaction, heats of formation, combustion, solution, mixing etc., – Calculation of standard heat of reaction – Effect of pressure and temperature on heat of reaction – Energy balance for systems with and without chemical reaction – Unsteady state energy balances

Total : 60 Periods

Text Books

1. Bhatt, B.I. and Vora, S. M., "Stoichiometry", 4th Edition, Tata McGraw Hill PublishersLtd., 2005.
2. K.A GAVHANE ,"Introduction to Process Calculations", Nirali prakashan, PUNE ,2016

Reference Books

1. Venkataramani, V. and Anantharaman, N., "Process calculations", Prentice Hall ofIndia (P) Ltd., 2003.
2. Himmelblau, D., "Basic Principles and Calculations in Chemical Engineering", 6thEdition, Prentice Hall of India (P) Ltd.,2000

Additional / Web References

1. NPTEL LINK: https://nptel.ac.in/courses/103/107/103107123/
2. SWAYAM PORTAL: https://www.classcentral.com/course/swayam-process calculations-11092
3. IIT GUWAHATI:https://freevideolectures.com/course/4106/nptel-unit-operations

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

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

Formative assessment

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

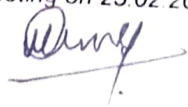Passed in Board of studies Meeting on 25 02 2022   Approved in Academic Council Meeting on 09.03.2022

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Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Summative Assessment

Bloom's Level	Continuous Assessment					Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

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Reservoir Pressure Measurements and Significance-Techniques of pressure measurement. Reservoir drive mechanics and recovery factors. Reserve estimation: resource & reserve concept.

Total : 60 Periods

Text Books

1. Tarek Ahmed, "Reservoir engineering hand book", 5th edition, Gulf publishing house, 2018.
2. Guo,B,Lyons,W.C. and Ghalambor, A., Petroleum production engineering: a computer assisted approach, Gulf professional Publishing, Burlington,3rd edition, 2006.
3. L.P.Dake L Elsevier, "Fundamentals of Reservoir Engineering."Development in Petroleum Science.1980.

Reference Books
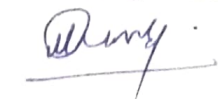
1. Tarek Ahmed,Paul D Mc Kinney,"Advanced reservoir engineering" Gulf publishing house, 2nd edition, 2005.
2. Abdus Satar, James L Butchwater,"Practical enhanced reservoir engineering" Penwell corporation, 2nd edition, 2007.

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

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

Formative assessment

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

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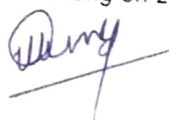
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Bloom's Category	Summative Assessment			
	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Bloom's Level	Summative Assessment					
	Continuous Assessment				Practical's	Final
	Theory					
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	Examination (Theory) (50)
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

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20PC306	FLUID AND SOLID OPERATIONS LABORATORY	L	T	P	C
		0	0	2	1
Nature of course	ENGINEERING SCIENCES (ES)				
Pre requisites	Basic knowledge on fluid mechanics and mechanical operations				

Course Objectives

The course is intended to

1. Learn experimentally to calibrate flow meters
2. Find pressure loss for fluid flows
3. Determine pump characteristics
4. Develop a sound working knowledge on different types of crushing equipments
5. Understand the separation characteristics of different mechanical operation separators

Course Outcomes

On successful completion of the course, students will be able to
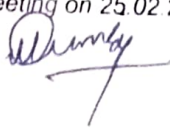
CO. No	Course Outcome	Bloom's Level
CO 1	Use variable area flow meters and variable head flow meters	Evaluating
CO 2	Analyze the flow of fluids through closed conduits, open channels and flow past immersedbodies	Analyzing
CO 3	Select pumps for the transportation of fluids based on process conditions/requirements and fluid properties	Applying
CO 4	Determine work index, average particle size through experiments by crushers, ball mill andconducting sieve analysis	Analyzing
CO 5	Design size separation equipments such as sedimentation, Filters etc.	Analyzing

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Calibration of constant head meters	1	Evaluating
2.	Calibration of variable head meters	1	Evaluating
3.	Open drum orifice and draining time	2	Analyzing
4.	Flow through helical coil and spiral coil	2	Analyzing
5.	Characteristic curves of pumps	3	Applying
6.	Pressure drop studies in packed column	2	Evaluating
7.	Sieve analysis and Effectiveness of screen	5	Analyzing
8.	Batch filtration studies using a Leaf filter	5	Analyzing
9.	Batch filtration studies using a Plate and Frame Filter press	5	Analyzing
10.	Characteristics of batch Sedimentation	5	Analyzing
11.	Reduction ratio in Jaw Crusher	4	Analyzing
12.	Reduction ratio in Ball mill	4	Analyzing

Total : 30 Periods

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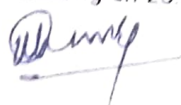
Reference Books

Laboratory Manual

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

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

Formative assessment

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

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

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Text Books:
1. Grewal B S, and Grewal J S, " Numerical methods in engineering and science "Khanna Publishers, 10th Edition,2015.
2. Burden, R L and Faires, J.D, "Numerical Analysis" Cengage Learning, 9th Edition, 2016.

Reference Books:
1. Sankara Rao. K , "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, New Delhi, 3rd Edition,2007.
2. Sastry, S.S., "Introductory Methods of Numerical Analysis", PHI Learning pvt Ltd, 5th Edition, 2015.

Additional References:
1. https://nptel.ac.in/courses/111/107/111107105
2. https://nptel.ac.in/courses/127/106/127106019

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

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

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

Formative assessment

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

Summative Assessment

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

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20PC401	Chemical Engineering Thermodynamics	L	T	P	C
		3	0	0	3
Nature of course	PC – Professional Core				
Pre requisites	Nil				

Course Objectives

The course is intended to
6. Expose the students to the fundamentals of Thermodynamics Laws and its applications.
7. Enable the students to understand the concepts gases and different processes.
8. Facilitate the students to understand the concepts of Energy and its transformation.
9. Make the students understand the concepts of Equilibrium, criteria and its consistencies.
10. Take the students through the concepts like refrigeration, liquefaction, properties of mixtures, entropy and other related equations

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Remember the laws of Thermodynamics	Remember
CO 2	Study PVT behavior of fluids and applications	Apply
CO 3	Learn Thermodynamic property relations and its applications	Apply
CO 4	Understand the Refrigeration and Liquefaction Process	Understand
CO 5	Learn concepts related to Equilibrium and Free energy	Understand

Course Contents

Unit – I   INTRODUCTION   10

Scope and Limitations of Thermodynamics – Definitions and Fundamental Concepts – Energy, Work, Force and Pressure – Equilibrium state and the Phase rule – Temperature and Zeroth Law of Thermodynamics – Reversible and Irreversible process – PVT Behavior – Ideal Gas – Equation of state for Ideal and Real Gas – Compressibility Chart – Principle of Corresponding states – First law of thermodynamics - Second law of thermodynamics.

Unit – II   THERMODYNAMIC LAWS   10

Thermodynamic Cycles – Joule's Experiment – Internal energy – Enthalpy - Application of first Law of Thermodynamics for Flow and non-flow processes – Entropy- The Carnot Principle – Thermodynamic Temperature Scale – Clausius Inequality - Third law of thermodynamics.

Unit – III   REFRIGERATION & LIQUEFACTION   8

Refrigeration: COP – Air-refrigeration - Liquefaction process – Relationships among thermodynamic properties - Maxwell relations - Clapeyron equation - Psychrometric process - Adiabatic saturation – Cooling - Humidification, dehumidification.

Unit – IV   PROPERTIES OF SOLUTIONS   8

Partial molar properties - Ideal and Non-ideal solutions - Selection of standard states - Gibbs-Duhem equation - Activity in Solutions – Activity Coefficients - Property changes of mixing - Excess Properties of mixtures.
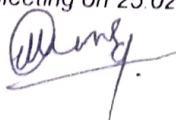
Unit – V   PHASE EQUILIBRIUM AND CHEMICAL REACTION EQUILIBRIUM   9

Thermodynamic consistency of Phase Equilibria - Criteria for Phase Equilibria – Phase Equilibria in Single-component system - Chemical Reaction Equilibria - Criteria for Chemical Reaction Equilibria - Equilibrium constant - Standard free energy change – Choice of Standard State – Feasibility of a reaction.

Total : 45 Periods

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

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Text Book

1. Narayanan, K V. "A Textbook of Chemical Engineering Thermodynamics", 2nd Edition, PHI Learning, Delhi, 2013.

Reference Book

1. Smith, van Ness and Abbott, "Chemical Engineering Thermodynamics", 8th Edition, McGraw Hill, New York, 2005.

Additional / Web References

1. https://nptel.ac.in/courses/103/104/103104151/
2. https://nptel.ac.in/courses/103/103/103103144/

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

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

Formative assessment

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

Summative Assessment

Bloom's Category	\multicolumn{3}{c	}{Internal Assessment Examinations}	Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

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Bloom's Level	Summative Assessment					
	Continuous Assessment					Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze		.				
Evaluate						
Create						

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20PC402	HEAT TRANSFER OPERATIONS	L	T	P	C
		3	2	0	3

Nature of course	PROFESSIONAL CORE (PC)
Pre requisites	Nil

Course Objectives

The course is intended to

1. Understand the concept of Modes of heat transfer
2. Impact knowledge in various heating methodologies in process engineering
3. Understand the fundamentals of heat transfer equipments
4. Understand the Design for heat transfer equipments

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	determine the characteristics of conduction, convection and radiation	Applying (K3)
CO 2	determine the heating methodologies for all unit operations	Applying (K3)
CO 3	categorize the fundamentals of heat transfer equipments	Applying (K3)
CO 4	Examine the design aspects for heat transfer equipments	Applying (K3)

Course Contents

Unit – I   Conduction

12

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

Unit – II   Convection

12

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

Unit – III   Radiation

12

Concept of thermal radiations – Black body concept – Stefan Boltzman's law – Emissive power – Black body radiation – Emissivity – Planck's law – Radiation between black surfaces – Gray surfaces – Radiation shields – Radiation applications – Pipe still heaters
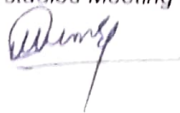
Unit – IV   Heat Exchangers

12

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

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

Total : 60 Periods

Text Books
1. Kumar, D.S., "Heat and Mass Transfer", 5th Edition, S.K. Kataria and Sons, 2000
2. K.A GAVHANE ,"Heat transfer", Nirali prakashan, PUNE ,2017

Reference Books
1. Kern, D.Q., "Process Heat Transfer", Tata McGraw Hill Publishing Co., 1990
2. Hollman, "Heat Transfer", 8th Edition, McGraw Hill, 1997

Additional / Web References
1. NPTEL LINK: https://nptel.ac.in/courses/103/107/103107123/
2. SWAYAM PORTAL: https://www.classcentral.com/course/swayam-heat transfer-12092
3. IIT GUWAHATI:https://freevideolectures.com/course/4106/nptel-unit-operations

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

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

Formative assessment

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

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60

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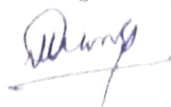
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Analyze			
Evaluate			
Create			

Bloom's Level	Summative Assessment					
	Continuous Assessment					Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

CHAIRMAN - BOARD OF STUDIES

20PC403	PETROLEUM EXPLORATION AND EXPLOITATIONTECHNIQUES	L	T	P	C
		3	2	0	4
Nature of Course	Professional Core (PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Make the students to learn the origin of petroleum.
2. Understand the petroleum exploration methods.
3. Know about various geological structures.
4. Understand importance of drilling fluids.

Course Outcomes

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

CO.No	Course Outcome	Bloom's Level
CO 1	The origin and favorable geological conditions for the formation of petroleum	Understand
CO 2	Understand the modern oil finding techniques and its feasibility for oil production	Applying
CO 3	Analyze the various oil recovery and stimulation methods to optimize oil production.	Analyse
CO 4	Formulate drilling fluid for well drilling and well completion methods	Understand
CO 5	Understand the offshore exploration methods and well completion	Applying

Course Contents

UNIT I   ORIGIN OF PETROLEUM AND SEDIMENTARY ENVIRONMENT   9

Origin of oil – Rock cycle - petroleum occurrence – Source, cap and reservoir rocks - Oil bearing rocks - Migration and accumulation - Continental environment –Transitional environment – Marine environment.

UNIT II   PETROLEUM EXPLORATION METHODS   9

Geological exploration methods – Geophysical exploration methods – Geochemical methods - survey methods -Prognostication – Classification of drilling locations – Economic analysis – Well programme
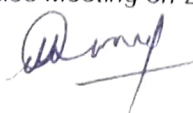
UNIT III   GEOLOGICAL STRUCTURE AND WELLOGGING   9

Types of traps and faults – Core Collection Techniques – Sample logging, Drilling time logging, Mud/Gas/Oil logging – Formation Evaluation Techniques using wire line well logging include – Spontaneous potential logging, Natural Gamma Ray Logging, Caliber Logging, Density Logging, Neutron Porosity logging, Sonic velocity Logging, Electrical Resistance Logging.

Analyze				
Evaluate				
Create				

Bloom's Level	Summative Assessment					
	Continuous Assessment					Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

UNIT IV   DRILLING FLUIDS AND FUNCTIONS

Drilling Fluids: Function, composition, and classification – Packer fluid –Casing packs - Cementing – Various well completion methods – Various stimulation methods.

UNIT V   OFF – SHORE DRILLING TECHNOLOGY   9

Seismic technology – Sniffer survey – Drilling technology – Off-shore rigs – Primary, secondary And enhanced oil recovery techniques and methods – Major well complication and Remedies.

Note: To make the students understand the stages of oil and gas formation, exploration and production

Total : 45 Periods

Text Books

1. Bhagwan Sahay "Petroleum Exploration and Exploitation Practices" Allied Publishers Ltd ,Chennai, 1994.

2. Richard Dawe, "Modern Petroleum Technology", Vol.I, Upstream, 6th Edition, John and Wiley Sons Ltd, 2000.

Reference Books

1. Howard B. Bradley, "Petroleum Engineering Handbook", Society of Petroleum Engineers, 1987.

2. Norman J. Hyne., "Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production", 2nd Edition, Pennwell Books, 2001.

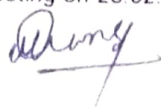3. Shay B., "Wellsite Geological Techniques for Petroleum Exploration" Allied Publishers Ltd ,
1991.

Additional References

1. **NPTEL** - https://nptel.ac.in/courses/114/106/114106042//
2. https://www.youtube.com/watch?v=XCSiqXicp1w

COs	\multicolumn{12}{c	}{Pos}	PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1			2				3	3					3	3
CO 2			2				3	2					2	3
CO 3			2				2	2					3	3
CO 4			2				3	2					2	3
CO 5			2				3	3					3	3

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

3-High	2-Medium	1-Low

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

Formative Assessment

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

Summative Assessment

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

Passed in Board of studies Meeting on 25 02 2022   Approved in Academic Council Meeting on 09 03 2022

CHAIRMAN - BOARD OF STUDIES

20PC404	Natural Gas Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core (PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to

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

Course Outcomes

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

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

Course Contents

UNIT I   INTRODUCTION TO NATURAL GAS ENGINEERING   9

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

UNIT II   OFFSHORE AND ONSHORE PRODUCTION   9

Introduction to offshore oil and gas operations. Offshore Fixed and mobile Units, Offshore Drilling, Difference in drilling from land, from fixed platform, jack up, ships and semi submersibles. Offshore Well Completion, Offshore Production systems. Onshore drilling systems: Onshore drilling-Onshore oil rig, Onshore drilling equipments. Onshore rig structures-hydraulics applied in onshore rigs..
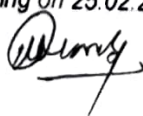
UNIT III   DEHYDRATION AND ACID GAS TREATING   9

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

UNIT IV COMPRESSION AND VOLUMETRIC MEASUREMENT 9

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

UNIT V SEPARATION AND TRANSPORTATION 9

Separation of Gas and Liquids: Principles of Separation, Types of Separators and Factors Affecting Separation. Separator Design: Stage Separation, Flash Calculation and Low-Temperature Separation. Transportation: Pipeline Design Sizing Pipelines Pipeline Wall Thickness Transportation of LNG

Note: Students will able to learn the Gas Compression, Dehydration, Separation of gas and liquids, transportation pipeline design of natural gas processing.

Total : 45 Periods

Text Books

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

Reference Books

1. William C Lyons, Gary C Plisga "Standard Handbook of Petroleum and Natural Gas Engineering" Gulf Professional Publishing, 2nd Edition.
2. Smith, R. V "Practical Natural Gas Engineering", Penwell Publishing Company- 2nd Edition 1990.
3. Dring, M.M "The Natural Gas Industry – A Review of World Resources and Industrial Applications", Butterworth, 1974.
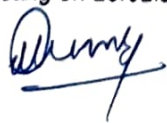
Additional References

1. **NPTEL** - https://nptel.ac.in/courses/103/103/103103140//
2. **NPTEL** - https://youtu.be/mAc4MKilelA
3. **MOOC Courses** - https://www.mooc-list.com/course/natural-gas-coursera

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

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

3-High	2-Medium	1-Low

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

Formative Assessment

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

Summative Assessment

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

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PC405	PETROLEUM PROCESSING I	L	T	P	C
		3	2	0	3
Nature of Course	Professional Core (PC)				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Make the students to learn the primary refining operation of crude oil.
2. Understand testing of petroleum products.
3. Know about various treatment techniques.
4. Illustrate different techniques and value added treatment on crude oil finished products.

Course Outcomes

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

CO.No	Course Outcome	Bloom's Level
CO 1	Acquire knowledge on types of crude and their properties.	Remembering
CO 2	Perform various tests to check the quality of crude oil and its products.	Applying
CO 3	Understand the manufacturing techniques involved in crude oil processing.	Understand
CO 4	Understand the manufacturing techniques involved in lubricating oil and bitumen.	Understand
CO 5	Understand the final treatment techniques required for the finished products.	Understand

Course Contents

UNIT I   GENERAL INTRODUCTION   9

Origin of crude oil, Exploration and production of petroleum, Types of crudes, crude oil composition, Characteristics and classification: Crude oil properties, Indigenous and imported crudes.

UNIT II   TESTING OF PETROLEUM PRODUCTS   9

Testing of crude oil and its commercial Products, Quality control of Petroleum products - IS 1448 Standard, Various Specifications and their Significance. Bharath stage III, IV Norms for fuels. Euro Stage IV, V, VI norms for fuels,
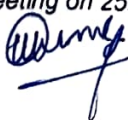
UNIT III   PROCESSING OF CRUDE OIL   9

Pretreatment of crude oil for Refining: Dehydration and desalting of crude oil, Atmospheric distillation and Vacuum distillation. Types of trays, flow pattern in the trays: Reflux types and its significance.

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

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UNIT IV   LUBE DISTILLATE TREATMENT TECHNIQUES   9

Treatment techniques for vacuum distillates with different processes like solvent extraction , Deasphalting, dewaxing, hydrofining, Catalytic dewaxing and clay contact process : Production of Lubricating oils.

UNIT V   BITUMEN AND SULFUR PROCESSING   9

Asphalt manufacture, Air blowing technology, Bitumen Types and their properties, Handling and distribution, Applications. Finishing Process: Acid gas removal and Sulphur removal techniques.

Note: Students will able to learn the manufacturing techniques involved in production of petroleum products and treatment techniques for the finished products.

Total : 45 Periods

Text Books

1. Bhaskara Rao, B.K., "Modern Petroleum Refining Processes", 6th Edition, Oxford and IBH Publishing Company Pvt. Ltd.
2. Ram Prasad, "Petroleum Refining Technology", 1st Edition, Khanna Publishers.

Reference Books

1. James H. Gary and Glenn E. Handwerk., "Petroleum Refining Technology and Economics", 4th Edition, Marcel Dekker Inc., 2001.
2. Nelson, W.L "Petroleum Refinery Engineering", McGraw Hill Publishing Company Limited, 1985.
3. Hobson, G.D., "Modern Petroleum Refining Technology ", 5th Edition, John Wiley Publishers, 1984.

Additional References

1. **NPTEL** - https://nptel.ac.in/courses/103/102/103102022//
2. https://www.youtube.com/watch?v=RjZJjneJ5fk

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

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

Formative Assessment

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

Summative Assessment

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

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PC406	DRILLING FLUIDS LABORATORY	L	T	P	C
Nature of course	Professional core (pc)	0	0	2	1
Pre requisites	Apply knowledge and importance of drilling fluids				

Course Objectives

The course is intended to
1. To understand the drilling fluids and functions
2. To apply drilling fluids principle and operation.
3. To evaluate the pH of the drilling fluids
4. To analyses thickness of cement slurry
5. To evaluate the compressive strength of cement slurry

Course Outcomes

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

CO. No	Course Outcome	Bloom's Level
CO 1	Knowledge about the drilling fluids and properties	Understanding
CO 2	Understand basic principle and operation of drilling fluids	Applying
CO 3	Estimation of pH of the drilling fluids	Analyzing
CO 4	Analyze the thickness of cement slurry	Analyzing
CO 5	Evaluate the compressive strength of cement slurry	Understanding

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Determination and measurement of fluid loss of a drilling fluid and mud cake properties of a drilling fluid using atmospheric filter press.	1	Evaluating
2.	Determination and measurement of fluid loss of cement slurry using atmospheric filter press.	2	Analyzing
3.	pH.	2	Applying
4.	Determination of thickening time of cement slurry.	2	Analyzing
5.	Determination of compressive strength of cement slab.	2	Evaluating

Total : 30 Periods

Reference Books
Laboratory Manual

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

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

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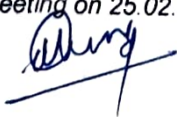
Formative assessment

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

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Summative Assessment

Bloom's Level	Continuous Assessment					Final Examination (Theory) (50)
	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20

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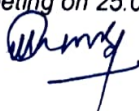
CHAIRMAN - BOARD OF STUDIES

B. Tech. Petrochemical Technology (R - 2020)

Analyze						
Evaluate						
Create						

	Summative Assessment					
	Continuous Assessment					Final Examination (Theory) (50)
Bloom's Level	Theory				Practical's	
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PC1304	Technical Analysis Laboratory	L	T	P	C
		0	0	2	1
Nature of course	BASIC SCIENCES (BS)				
Pre requisites	Basic knowledge on analytical technique				

Course Objectives

The course is intended to

1. Estimation of hardness and chloride content of water to check its suitability for drinking and industrial purpose.
2. Analyze the need, design and perform a set of experiments.
3. To impart basic knowledge related to material selection and the techniques for material analysis.
4. Identify quality of experimental measurements.
5. Express the titrimetric analysis methods.

Course Outcomes

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

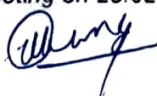| CO. No	Course Outcome	Bloom's Level
CO 1	Determination of parameters like hardness and chloride content in water	Analyzing (K4)
CO 2	To determine the acid value of oils and Fats.	Analyzing (K4)
CO 3	Expain the fundamentals of analytical chemistry and steps of a characteristic analysis.	Applying (K3)
CO 4	Identify quality of experimental measurements.	Analyzing (K4)
CO 5	Express the titrimetric analysis methods.	Analyzing (K4)

Laboratory components

S.No	List of Experiments	CO Mapping	Revised Blooms Taxonomy
1.	Estimation of Acid value(Analysis of Oil)	2	Analyzing (K4)
2.	Estimation of Saponification value(Analysis of Oil)	2	Analyzing (K4)
3.	Estimation of Iodine value(Analysis of Oil)	2	Analyzing (K4)
4.	Estimation of Total fatty matter content (Analysis of Soap)	2	Analyzing (K4)
5.	Estimation of Total alkali content(Analysis of Soap)	3	Applying (K3)
6.	Estimation of Silica content (Analysis of Cement)	4	Analyzing (K4)
7.	Estimation of Mixed oxide content (Analysis of Cement)	5	Analyzing (K4)
8.	Estimation of Calcium oxide content (Analysis of Cement)	5	Analyzing (K4)
9.	Determination of Alkalinity in given water sample by volumetric method	5	Analyzing (K4)
10.	Determination of Total Hardness in the water sample	1	Analyzing (K4)
11.	Estimation of available chlorine in the given bleaching powder	1	Analyzing (K4)
12.	Estimation of Nitrogen by Kjeldahl method	4	Analyzing (K4)
13.	Determination of chemical oxygen demand(COD)	3	Applying (K3)

Total : 30 Periods

Reference Books

Laboratory Manual

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022
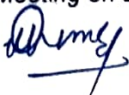
CHAIRMAN - BOARD OF STUDIES

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

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

Formative assessment

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

Summative Assessment

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

Summative Assessment

Bloom's Level	Continuous Assessment				Practical's	Final Examination (Theory) (50)
	Theory					
	IAE – 1 (7.5)	IAE – 2 (7.5)	IAE – 3 (10)	Attendance (5)	Rubric based CIA (20)	
Remember	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20MC401	SOFT SKILLS (Common to All Branches of B.E., / B.Tech.)	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory Course				
Pre requisites	Nil				

Course Objectives

The course is intended to
1 Improve language skills in personal and professional life.
2 Equip students with the vital communication and soft skills to succeed in the highly.
2. Competitive international arena.
3. Focus on the fundamental soft skills and of their practical social and work place usage.
4. Learn to identify and overcome the barriers in interpersonal relationships.
5. Enhance employability skills and ensure career success.

Course Outcomes

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

CO.No.	Course Outcome	Bloom's Level
CO1	Relate the significance and fundamental nature of soft skills.	Remember
CO2	Take part in a wide range of Public speaking and professional group discussions.	Understand
CO3	Plan one's time effectively and productively, especially at work.	Apply
CO4	Make use of leadership skills to manage stress &conflict.	Apply
CO5	Organize presentation effectively and participate in interview with confidence.	Apply

Course Contents

Unit – I Introduction to soft skills and Interpersonal Communication　　　　　　6
An Introduction – Definition and Significance of Soft Skills; Interpersonal communication-types of interpersonal communication.

Unit - II Public Speaking and Oral Communication skills　　　　　　6
Public Speaking: Skills, Methods, Strategies Group Discussion: Importance, Planning, Elements.

Unit – III Time Management and Personality Development　　　　　　6
Time Management – concepts and essentials tips. Personality-development – meaning, SWOT analysis & goal setting- Stress and conflict management.

Unit – IV Leadership skills and Emotional intelligence　　　　　　6
Leadership skills: Concept of Leadership and honing Leadership Skills- Problem-Solving Skills - Group and Ethical Decision-Making. Emotional Intelligence: Strategies to enhance Emotional Intelligence.

Unit-V Interview Skills　　　　　　6
Interviewer - Interviewee perspectives - Self Introduction and Presentation: Types, Content and Essential Tips–before, during and after presentation, Overcoming Nervousness - Mock Interview.

Total: 30 Periods

Passed in Board of studies Meeting on 25.02.2022　　　Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

Text Books
1. Managing Soft Skills for Personality Development—edited by B.N.Ghosh, McGraw Hill India, 2nd Edition, 2018.
2. English and Soft Skills—S.P. Dhanavel, Orient Black swan India, 1st Edition, 2017
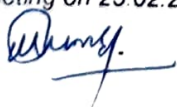
Reference Books:
1. Sutapa Banerjee, Soft Skill Business and Professional Communication Book, 2016
2. PushpLata and Sanjay Kumar, Communication Skills Book, 2nd Edition, 2015

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

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

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PCA01	Energy conservation Technology	L	T	P	C
		1	0	0	1
Nature of course	Energy conservation Techniques				
Pre requisites	NIL				

Course Objectives
The course is intended to
1. To study the various energy conservation technologies
2. To study about energy auditing & energy management

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

CO. No	Course Outcome	Bloom's Level
CO 1	Understand the basics concept of various energy Technologies	Understand
CO 2	Importance of energy auditing and energy management	Apply

Course Contents

Unit -I   Basics of Energy conservation   7

Principle of energy conservation - Energy auditing - Energy management. Energy conservation equipment: Waste heat recovery - Boilers, Recuperators, Regenerators, Heat pipes - Heat pumps - Multiple effect evaporators - Steam traps.

Unit- II   Energy conservation Techhniques   8

Energy conservation techniques in Process Industries: Petroleum and petrochemical industries, sugar and alcohol industries, pulp and paper industries, fertilizer industries, cement plants, Steel plants. Adoption of new technologies: Co-generation fluidized bed combustion, Magneto Hydrodynamic(MHD) power generation, adoption of solar energy devices

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

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

Passed in Board of studies Meeting on 25.02.2022   Approved in Academic Council Meeting on 09.03.2022

CHAIRMAN - BOARD OF STUDIES

20PCA02	Membrane Technology	L	T	P	C
		1	0	0	1

Nature of course	Membrane.systems and separation processes
Pre requisites	NIL

Course Objectives
The course is intended to
1. To give the students the technical background on membrane technology
2. To provide wide level of understanding that will allow them to design, using appropriatecombinations of unit processes and water treatment plant

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

CO. No	Course Outcome	Bloom's Level
CO 1	Make use of principles of membrane systems in separation processes	Understand
CO 2	Ability to design by using appropriate combinations of unit processes	Apply

Course Contents
Unit I – Membrane processing   8
Processing: Phase-inversion process, anisotropic membranes, and isotropic porous membranes.Polymer blends and alloys, dynamic membranes, liquid membranes, biomimetic membranes ion exchange membranes, electro dialysis, bipolar membranes, mosaic membranes.

Unit II – Membrane systems and its applications   7
Membrane systems: Plate and frame, spiral-wound module, hollow fiber modules. MembraneSynthetic Membranes - configuration, morphology, principles of permeation and separation, membrane materials. Applications: Wastewater treatment, bioseparation, biomedical.
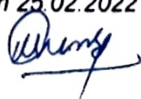
Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

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

3	High		2	Medium		1	Low	

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

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