

**ARUNAI ENGINEERING COLLEGE**

(AUTONOMOUS)
TIRUVANNAMALAI
REGULATIONS 2024

**CHOICE BASED CREDIT SYSTEM****B.TECH. CHEMICAL ENGINEERING****CURRICULUM AND SYLLABI FOR I TO VIII SEMESTERS****SEMESTER I**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	IP24101	Induction Programme	-	-	-	-		0
THEORY								
2	HS24101	Professional English-I	HSMC	3	0	0	3	3
3	MA24101	Matrices and Calculus	BSC	3	1	0	4	4
4	PH24101	Engineering Physics	BSC	3	0	0	3	3
5	CY24101	Engineering Chemistry	BSC	3	0	0	3	3
6	GE24101	Problem Solving and Python Programming	ESC	3	0	0	3	3
7	GE24102	Heritage of Tamils/ தமிழர்மரபு	HSMC	1	0	0	1	1
PRACTICALS								
8	GE24111	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9	BS24111	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10	GE24112	English Laboratory (\$)	EEC	0	0	2	2	1
TOTAL				16	1	10	27	22

§ Skill Based Course

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS24201	Professional English - II	HSMC	2	0	0	2	2
2	MA24201	Statistics and Numerical Methods	BSC	3	1	0	4	4
3	PH24206	Physics of Materials	BSC	3	0	0	3	3
4	BE24204	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5	GE24201	Engineering Graphics	ESC	2	0	4	6	4
6	CH24201	Introduction to Chemical	PCC	3	0	0	3	3

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		Engineering						
7	GE24202	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	1	0	0	1	1
8		NCC Credit Course Level 1#	-	2	0	0	2	2
PRACTICALS								
8	GE24211	Engineering Practices Laboratory	ESC	0	0	4	4	2
9	BE24211	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
10	GE24212	Communication Laboratory / Foreign Language (\$)	EEC	0	0	4	4	2
TOTAL				17	1	16	30	26

#NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

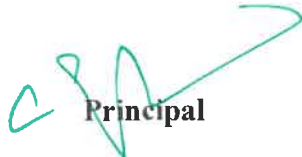
\$ Skill Based Course

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA24304	Transforms and Linear Programming Problems	BSC	3	1	0	4	4
2	CH24301	Fluid Mechanics for Chemical Engineers	PCC	3	0	0	3	3
3	CH24302	Strength of Materials	ESC	3	0	0	3	3
4	CH24303	Mechanical Operations	PCC	3	0	0	3	3
5	CH24304	Chemical Process Calculations	PCC	3	0	0	3	3
6	CY24301	Physical and Organic Chemistry	BSC	3	0	0	3	3
PRACTICALS								
7	CH24311	Fluid Mechanics Lab	PCC	0	0	3	3	1.5
8	CH24312	Mechanical Operations Lab	PCC	0	0	3	3	1.5
9	GE24903	Professional Development ^s	EEC	0	0	2	2	1
TOTAL				18	1	8	27	23

\$ Skill Based Course


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SEMESTER IV

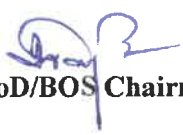
S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA24401	Probability and Statistics	BSC	3	1	0	4	4
2	CH24401	Chemical Engineering Thermodynamics-I	PCC	3	0	0	3	3
3	CH24402	Heat Transfer	PCC	3	0	0	3	3
4	CH24403	Chemical Technology	PCC	3	0	0	3	3
5	CH24404	Mass Transfer-I	PCC	3	0	0	3	3
6	GE24451	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
PRACTICALS								
7	CH24411	Technical Analysis Lab	PCC	0	0	3	3	1.5
8	CH24412	Heat Transfer Lab	PCC	0	0	3	3	1.5
9	CH24513	Industrial Training/Internship I*	EEC	-	-	-	-	0
TOTAL				17	1	6	24	21

*Two weeks industrial training/internship carries one credit. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester.

SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CH24501	Chemical Engineering Thermodynamics-II	PCC	3	0	0	3	3
2.	CH24502	Mass Transfer-II	PCC	3	0	0	3	3
3.		Professional Elective-I	PEC	3	0	0	3	3
4		Professional Elective-II	PEC	3	0	0	3	3
5.		Professional Elective-III	PEC	3	0	0	3	3
6.		Professional Elective-IV	PEC	3	0	0	3	3
PRACTICALS								
7.	CH24511	Computational Chemical Engineering Laboratory	PCC	0	0	3	3	1.5
8.	CH24512	Mass Transfer Lab	PCC	0	0	3	3	1.5
9.	CH24513	Industrial Training/ Internship-I*	EEC	-	-	-	-	1
TOTAL				21	0	6	27	22

*Two weeks industrial training/internship carries one credit. Industrial training/Internship during IV Semester Summer Vacation will be evaluated in V semester


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SEMESTER VI

SEMESTER VI								
S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CH24601	Chemical Reaction Engineering-I	PCC	3	0	0	3	3
2.	CH24602	Process Dynamics and Control	PCC	3	0	0	3	3
3.		Human Values and Ethics	HSMC	3	0	0	3	2
4.		Professional Elective-V	PEC	3	0	0	3	3
5.		Professional Elective-VI	PEC	3	0	0	3	3
6.		Open Elective-I*	OEC	3	0	0	3	3
7.		Mandatory Course-I&	MC	3	0	0	3	0
PRACTICALS								
7.	CH24611	Process Control Lab	PCC	0	0	3	3	1.5
8.	CH24612	Environmental Engineering Laboratory	PCC	0	0	3	3	1.5
9.	CH24713	Industrial Training / Internship II ^{##}	EEC	-	-	-	-	0
TOTAL				21	0	6	27	20

&Mandatory Course-I (Society) is a Non-credit Course (Student shall select one course from the list given under MC-I)

##Two weeks industrial training/internship carries one credit. Industrial training/Internship during VI Semester Summer Vacation will be evaluated in VII semester

*Open Elective – I shall be chosen from the emerging technologies.

SEMESTER VII/VIII*

SEMESTER VII/VIII								
S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CH24701	Chemical Reaction Engineering-II	PCC	3	0	0	3	3
2.		Management Elective@	HSMC	3	0	0	3	3
3.		Open Elective-II**	OEC	3	0	0	3	3
4.		Open Elective-III***	OEC	3	0	0	3	3
5.		Open Elective-IV***	OEC	3	0	0	3	3
6.		Mandatory Course-II&	MC	3	0	0	3	0
PRACTICALS								
7.	CH24711	Chemical Reaction Engineering Lab	PCC	0	0	3	3	1.5


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8.	CH24712	Process Equipment Design and Drawing	PCC	0	0	3	3	1.5
9.	CH24713	Industrial Training / Internship II ^{##}	EEC	-	-	-	-	1
TOTAL				18	0	3	21	19

[&]Mandatory Course-II (health & well-being) is a Non-credit Course (Student shall select one course from the list given under MC-II)

^{##}Two weeks industrial training/internship carries one credit. Industrial training/Internship during VI Semester Summer Vacation will be evaluated in VII semester.

^{**}Open Elective – II shall be chosen from the industrial processes.

^{**}Open Elective – III & IV shall be chosen from the other domains.

[@] Management Elective shall be chosen from the Management Elective courses

SEMESTER VIII/VII*

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	CH24811	Project Work / Internship [#]		0	0	20	20	10
TOTAL				0	0	20	20	10

[#]15 weeks of continuous Internship in an organization carries 10 credits.

TOTAL CREDITS: 163

B. TECH - CHEMICAL ENGINEERING

S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	4	3	-	-	-	2	3	-	12
2	BSC	12	7	7	6	-	-	-	-	32
3	ESC	5	11	3	-	-	-	-	-	19
4	EEC	1	2	1	-	1	-	1	10	16
5	PCC	-	3	12	15	9	9	6	-	54
6	PEC	-	-	-	-	12	6	-	-	18
7	OEC	-	-	-	-	-	3	9	-	12
8	Non-Credit / (Mandatory)	-	-	-	-	-	✓	✓	-	0
Total		22	26	23	21	22	20	19	10	163

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Vertical I Petroleum Process Technology	Vertical II Energy Engineering	Vertical III Biochemical Engineering	Vertical IV Environmental and Safety Engineering	Vertical V Computational Chemical Engineering	Vertical VI Chemical Plant Design
Petroleum Chemistry and Refining Fundamentals	Bioenergy	Biochemistry	Air Pollution Engineering	Computational Techniques	Chemical Plant Design
Primary Refining Technology	Renewable Energy Resources	Bioprocess Technology	Waste Water Treatment	Optimization of Chemical Processes	Plant Layout
Secondary Refining Technology	Pinch Technology	Fermentation and Bioprocessing	Solid waste Management	Process Modeling and Simulation	Design Safety
Refinery Advancements and Environmental Regulations	Hydrogen And Fuel Cell Technology	Bio separation and Downstream Processing	Environmental Impact Assessment	Transport Phenomena	Material Selection
Petroleum Equipment Design	Power Plant Engineering	Enzyme Immobilisation Technology	Process Safety Management	Chemical Process Flow sheeting	Statutory Requirements and Customer Care
Petrochemical Technology	Non- Renewable Energy Sources	Bioreactor Design	Risk and HAZOP Analysis	Computational Fluid Dynamics	Process Plant Utilities


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PROFESSIONAL ELECTIVE COURSESS

VERTICAL I PETROLEUM PROCESS TECHNOLOGY								
S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CH24901	Petroleum Chemistry and Refining Fundamentals	PEC	3	0	0	3	3
2.	CH24902	Primary Refining Technology	PEC	3	0	0	3	3
3.	CH24903	Secondary Refining Technology	PEC	3	0	0	3	3
4.	CH24904	Refinery Advancements and Environmental Regulations	PEC	3	0	0	3	3
5.	CH24905	Petroleum Equipment Design	PEC	3	0	0	3	3
6.	CH24906	Petrochemical Technology	PEC	3	0	0	3	3
VERTICAL II ENERGY ENGINEERING								
7.	CH24907	Bioenergy	PEC	3	0	0	3	3
8.	CH24908	Renewable Energy Resources	PEC	3	0	0	3	3
9.	CH24909	Pinch Technology	PEC	3	0	0	3	3
10.	CH24910	Hydrogen And Fuel Cell Technology	PEC	3	0	0	3	3
11.	CH24911	Power Plant Engineering	PEC	3	0	0	3	3
12.	CH24912	Non- Renewable Energy Sources	PEC	3	0	0	3	3
VERTICAL III BIOCHEMICAL ENGINEERING								
13.	CH24913	Biochemistry	PEC	3	0	0	3	3
14.	CH24914	Bioprocess Technology	PEC	3	0	0	3	3
15.	CH24915	Fermentation and Bioprocessing	PEC	3	0	0	3	3
16.	CH24916	Bio separation and Downstream Processing	PEC	3	0	0	3	3
17.	CH24917	Enzyme Immobilisation Technology	PEC	3	0	0	3	3
18.	CH24918	Bioreactor Design	PEC	3	0	0	3	3
VERTICAL IV ENVIRONMENTAL AND SAFETY ENGINEERING								
19.	CH24919	Air Pollution Engineering	PEC	3	0	0	3	3
20.	CH24920	Waste Water Treatment	PEC	3	0	0	3	3
21.	CH24921	Solid waste Management	PEC	3	0	0	3	3
22.	CH24922	Environmental Impact Assessment	PEC	3	0	0	3	3


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23.	CH24923	Process Safety Management	PEC	3	0	0	3	3
24.	CH24924	Risk and HAZOP Analysis	PEC	3	0	0	3	3
VERTICAL V COMPUTATIONAL CHEMICAL ENGINEERING								
25.	CH24925	Computational Techniques	PEC	3	0	0	3	3
26.	CH24926	Optimization of Chemical Processes	PEC	3	0	0	3	3
27.	CH24927	Process Modeling and Simulation	PEC	3	0	0	3	3
28.	CH24928	Transport Phenomena	PEC	3	0	0	3	3
29.	CH24929	Chemical Process Flow sheeting	PEC	3	0	0	3	3
30.	CH24930	Computational Fluid Dynamics	PEC	3	0	0	3	3
VERTICAL VI CHEMICAL PLANT DESIGN								
31.	CH24931	Chemical Plant Design	PEC	3	0	0	3	3
32.	CH24932	Plant Layout	PEC	3	0	0	3	3
33.	CH24933	Design Safety	PEC	3	0	0	3	3
34.	CH24934	Material Selection	PEC	3	0	0	3	3
35.	CH24935	Statutory Requirements and Customer Care	PEC	3	0	0	3	3
36.	CH24936	Process Plant Utilities	PEC	3	0	0	3	3

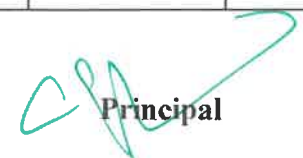

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MANDATORY COURSES

MANDATORY COURSE I (SOCIETY)								
S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX24101	Introduction to women and gender studies	MC	3	0	0	3	0
2.	MX24102	Elements of literature	MC	3	0	0	3	0
3.	MX24103	Disaster risk reduction and management	MC	3	0	0	3	0
4.	MX24104	History of science and technology in India	MC	3	0	0	3	0
5.	MX24105	State, nation building and politics in India	MC	3	0	0	3	0
6.	MX24106	Political and economic thought for a humane society	MC	3	0	0	3	0
7.	MX24107	Understanding Society & Culture through Literature	MC	3	0	0	3	0
8.	MX24108	Work Ethics & Social Responsibility	MC	3	0	0	3	0
9.	MX24109	Technology & Society	MC	3	0	0	3	0
10.	MX24110	Social Innovation & Entrepreneurship	MC	3	0	0	3	0
11.	MX24111	Education & Social Change	MC	3	0	0	3	0
MANDATORY COURSE II (HEALTH AND WELL BEING)								
S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX24201	Industrial Safety	MC	3	0	0	3	0
2.	MX24202	Well Being with Traditional Practices - Yoga, Ayurveda and siddha	MC	3	0	0	3	0
3.	MX24203	Application of Psychology in Everyday Life	MC	3	0	0	3	0
4.	MX24204	Stress Management & Well Being	MC	3	0	0	3	0
5.	MX24205	Health & Well Being in Education	MC	3	0	0	3	0
6.	MX24206	Physical fitness & Mental Resilience	MC	3	0	0	3	0


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7.	MX24207	Food, Nutrition and Health	MC	3	0	0	3	0
8.	MX24208	Life style diseases	MC	3	0	0	3	0

MANAGEMENT ELECTIVES

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GE24M01	Principles of management	HSMC	3	0	0	3	3
2.	GE24M02	Total quality management	HSMC	3	0	0	3	3
3.	GE24M03	Engineering economics and financial accounting	HSMC	3	0	0	3	3
4.	GE24M04	Human resource management	HSMC	3	0	0	3	3
5.	GE24M05	Knowledge management	HSMC	3	0	0	3	3
6.	GE24M06	Industrial management	HSMC	3	0	0	3	3
7.	GE24M07	Foundations of entrepreneurship	HSMC	3	0	0	3	3


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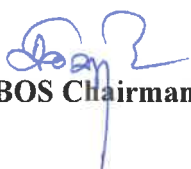
OPEN ELECTIVE COURSES

OPEN ELECTIVE I - EMERGING TECHNOLOGIES								
S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS2401	Artificial Intelligence and Machine Learning fundamentals	OEC	2	0	2	4	3
2.	OCS2402	Data science fundamentals	OEC	2	0	2	4	3
3.	OCS2403	Augmented Reality/ Virtual Reality	OEC	2	0	2	4	3
4.	OCS2404	IOT and its applications	OEC	2	0	2	4	3
5.	OCS2405	Deep Learning Techniques	OEC	2	0	2	4	3
6.	OEC2401	Introduction to ASIC design	OEC	2	0	2	4	3
OPEN ELECTIVE II – INDUSTRIAL PROCESSES								
1.	OME2401	Applied design thinking	OEC	3	0	0	3	3
2.	OME2402	Introduction to industrial automation systems	OEC	3	0	0	3	3
3.	OME2403	Industrial Management	OEC	3	0	0	3	3
4.	OME2404	Quality Engineering	OEC	3	0	0	3	3
5.	OME2405	Sustainable Manufacturing	OEC	3	0	0	3	3
6.	OME2406	Industrial design and rapid prototyping techniques	OEC	3	0	0	3	3
7.	OEE2401	Industrial IOT and industry 4.0	OEC	3	0	0	3	3
8.	OEC2402	Robotics and Industrial Automation	OEC	3	0	0	3	3
OPEN ELECTIVE III & IV – OTHER DOMAINS								
1.	OAG2401	Urban agriculture	OEC	3	0	0	3	3
2.	OAG2402	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3
3.	OBT2401	Basics of Biomolecules	OEC	3	0	0	3	3
4.	OBT2402	Basics of Microbial Technology	OEC	3	0	0	3	3
5.	OBT2403	Biotechnology for Waste Management	OEC	3	0	0	3	3
6.	OBT2404	Food Processing Technology	OEC	3	0	0	3	3


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7.	OEC2403	VLSI Design	OEC	3	0	0	3	3
8.	OEC2404	Remote Sensing Concepts	OEC	3	0	0	3	3
9.	OEC2405	Drone technologies	OEC	3	0	0	3	3
10.	OEE2402	Basics of Electric Vehicle Technology	OEC	3	0	0	3	3
11.	OEE2403	Introduction To Control Systems	OEC	3	0	0	3	3
12.	OEE2404	Integrated energy planning for sustainable development	OEC	3	0	0	3	3
13.	OHS2401	Nano technology	OEC	3	0	0	3	3
14.	OHS2402	Operations research	OEC	3	0	0	3	3
15.	OME2407	Additive Manufacturing	OEC	3	0	0	3	3


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Subject Code	Subject Name	Category	L	T	P	C
IP24101	Induction Programme		0	0	0	0

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

“ Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

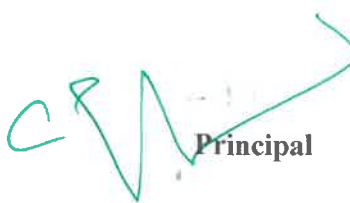
(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.


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(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

Guide to Induction program from AICTE


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Subject Code	Subject Name	Category	L	T	P	C
HS24101	PROFESSIONAL ENGLISH I	HSMC	3	0	0	3
Course Objectives:						
To improve the communicative competence of learners						
To learn to use basic grammatic structures in suitable contexts						
To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text						
To help learners use language effectively in professional contexts						
To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.						

UNIT – I	INTRODUCTION TO EFFECTIVE COMMUNICATION	1
What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?		
UNIT – I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	8
Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).		
UNIT – II	NARRATION AND SUMMATION	9
Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.		
UNIT – III	DESCRIPTION OF A PROCESS / PRODUCT	9
Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).		
UNIT – IV	CLASSIFICATION AND RECOMMENDATIONS	9
Reading – Newspaper articles; Journal reports –and Non-Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non-verbal (chart , graph etc, to verbal mode). Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.		
UNIT – V	EXPRESSION	9
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.		
		Total Contact Hours: 45


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Course Outcomes:	Upon completion of the course students should be able to:
CO1	At the end of the course, learners will be able
CO2	To use appropriate words in a professional context
CO3	To gain understanding of basic grammatical structures and use them in right context.
CO4	To read and interpret information presented in tables, charts and other graphic forms
CO5	To write definitions, descriptions, narrations and essays on various topics

Textbooks:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Jeevani, Department of English, Anna University. 24

Reference books/other materials/web resources:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO2	1	1	1	1	1	3	3	1	3	-	3	-	-	-
CO3	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO4	2	3	2	3	2	3	3	2	3	3	3	-	-	-
CO5	2	3	3	3	-	3	3	2	3	-	3	-	-	-
Average:	1.6	2.2	1.8	2.2	1.5	3	3	1.6	3	3	3	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
MA24101	MATRICES AND CALCULUS	BSC	3	1	0	4
Course Objectives:						
To develop the use of matrix algebra techniques that is needed by engineers for practical applications.						
To familiarize the students with differential calculus.						
To familiarize the student with functions of several variables. This is needed in many branches of engineering.						
To make the students understand various techniques of integration.						
To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications						

UNIT – I	MATRICES	9+3
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.		
UNIT – II	DIFFERENTIAL CALCULUS	9+3
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.		
UNIT – III	FUNCTIONS OF SEVERAL VARIABLES	9+3
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.		
UNIT – IV	DESCRIPTION OF A PROCESS / PRODUCT	9+3
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.		
UNIT – V	MULTIPLE INTEGRALS	9+3
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.		
		Total Contact Hours :60
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	Use the matrix algebra methods for solving practical problems.	
CO2	Apply differential calculus tools in solving various application problems.	
CO3	Able to use differential calculus ideas on several variable functions.	
CO4	Apply different methods of integration in solving practical problems.	
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.	

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Textbooks:	
1.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3.	James Stewart, " Calculus: Early Transcendentals ", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

Reference books/other materials/webresources:	
1.	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2.	Bali. N., Goyal. M. and Watkins. C., " Advanced Engineering Mathematics ", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
3.	Jain . R.K. and Iyengar. S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi, 5th Edition, 2016.
4.	Narayanan. S. and Manicavachagom Pillai. T. K., " Calculus " Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5.	Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6.	Srimantha Pal and Bhunia. S.C, " Engineering Mathematics " Oxford University Press, 2015.
7.	Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus ", 14th Edition, Pearson India, 2018.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	0	0	0	2	0	2	3	-	-	-
Average:	3	3	1	1	0	0	0	2	0	2	3	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
PH24101	ENGINEERING PHYSICS	BSC	3	0	0	3
Course Objectives:						
- To make the students effectively to achieve an understanding of mechanics. - To enable the students to gain knowledge of electromagnetic waves and its applications. - To introduce the basics of oscillations, optics and lasers. - Equipping the students to be successfully understand the importance of quantum physics. - To motivate the students towards the applications of quantum mechanics.						

UNIT – I	MECHANICS	9
Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.		
UNIT – II	ELECTROMAGNETIC WAVES	9
The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.		
UNIT – III	OSCILLATIONS, OPTICS AND LASERS	9
Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.		
UNIT – IV	BASIC QUANTUM MECHANICS	9
Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.		
UNIT – V	APPLIED QUANTUM MECHANICS	9
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.		
		Total Contact Hours :45
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	Understand the importance of mechanics.	
CO2	Express their knowledge in electromagnetic waves.	
CO3	Demonstrate a strong foundational knowledge in oscillations, optics and lasers.	


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CO4	Understand the importance of quantum physics.
CO5	Comprehend and apply quantum mechanical principles towards the formation of energy bands.

Textbooks:

1.	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2.	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ. Press, 2013.
3.	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

Reference books/other materials/web resources:

1.	R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2.	Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3.	K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5.	N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1	-	-	-	-	-	-	-	-
CO2	3	3	2	1	2	1	-	-	-	-	-	-	-	-
CO3	3	3	2	2	2	1	-	-	-	-	1	-	-	-
CO4	3	3	1	1	2	1	-	-	-	-	-	-	-	-
CO5	3	3	1	1	2	1	-	-	-	-	-	-	-	-
Average:	3	3	1.6	1.2	1.8	1	-	-	-	-	1	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
CY24101	ENGINEERING CHEMISTRY	BSC	3	0	0	3
Course Objectives:						
To inculcate sound understanding of water quality parameters and water treatment techniques.						
To impart knowledge on the basic principles and preparatory methods of nanomaterials.						
To introduce the basic concepts and applications of phase rule and composites.						
To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.						
To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.						

UNIT – I	WATER AND ITS TREATMENT	9
Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.		
UNIT – II	NANOCHEMISTRY	9
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.		
UNIT – III	PHASE RULE AND COMPOSITES	9
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.		
UNIT – IV	FUELS AND COMBUSTION	9
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon foot print.		
UNIT – V	ENERGY SOURCES AND STORAGE DEVICES	9
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-		


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battery; Electric vehicles; working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

		Total Contact Hours: 45
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.	
CO2	To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.	
CO3	To apply the knowledge of phase rule and composites for material selection requirements.	
CO4	To recommend suitable fuels for engineering processes and applications.	
CO5	To recognize different forms of energy resources and apply them for suitable applications in energy sectors.	

Textbooks:

1.	P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2.	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3.	S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

Reference books/other materials/web resources:

1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2.	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4.	Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	-	-	-	-	1	-	-	-
CO2	2	-	-	1	-	2	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	1	-	-	1	-	-	-	-	-	-	-	-
CO5	3	1	2	1	-	2	-	-	-	-	2	-	-	-
Average:	2.8	1.3	1.6	1	-	1.5	-	-	-	-	1.5	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
GE24101	PROBLEM SOLVING AND PYTHON PROGRAMMING	ESC	3	0	0	3
Course Objectives:						
• To understand the basics of algorithmic problem solving.						
• To learn to solve problems using Python conditionals and loops.						
• To define Python functions and use function calls to solve problems.						
• To use Python data structures - lists, tuples, dictionaries to represent complex data.						
• To do input/output with files in Python.						

UNIT – I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9
Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.		
UNIT – II	DATA TYPES, EXPRESSIONS, STATEMENTS	9
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.		
UNIT – III	CONTROL FLOW, FUNCTIONS, STRINGS	9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		
UNIT – IV	LISTS, TUPLES, DICTIONARIES	9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.		
UNIT – V	FILES, MODULES, PACKAGES	9
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).		
		Total Contact Hours: 45
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	Develop algorithmic solutions to simple computational problems.	
CO2	Develop and execute simple Python programs.	
CO3	Write simple Python programs using conditionals and looping for solving problems.	
CO4	Decompose a Python program into functions.	
CO5	Represent compound data using Python lists, tuples, dictionaries etc.	


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Textbooks:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/web resources:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. <https://www.python.org/>
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	2	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	2	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
Average:	2	3	3	3	2	-	-	-	-	2	2	3	3	-



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Subject Code	Subject Name	Category	L	T	P	C
GE24102	தமிழர்மரபு	HSMC	1	0	0	1

அலகு I	மொழி மற்றும் இலக்கியம்	3
இந்திய மொழிக்குடும்பங்கள் - திராவிடமொழிகள் - தமிழ் ஒரு செம்மொழி -தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச்சார்பற்றதன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் திருக்குறளில் மேலாண்மைக் கருத்துக்கள் தமிழ்க்காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு		
அலகு II	மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை	3
நடுகல் முதல் நவீன சிற்பங்கள் வரை ஐம்பொன்சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் தேர்செய்யும் கலை சுடுமண்சிற்பங்கள் நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.		
அலகு III	நாட்டுப்புறக்கலைகள்மற்றும்வீரவிளையாட்டுகள்	3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம். தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.		
அலகு IV	தமிழர்களின் திணைக் கோட்பாடுகள்	3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்க கால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி		
அலகு V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3
இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு புத்தகங்களின் அச்ச வரலாறு. கல்வெட்டுகள், கையெழுத்துப்படிக்கைகள்-தமிழ்ப் புத்தகங்களின் அச்சவரலாறு		
		Total Contact Hours :15


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Text-Cum-Reference Books	
1.	தமிழகவரலாறுமக்களும்பண்பாடும்கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2.	கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3.	கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4.	பொருறை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.


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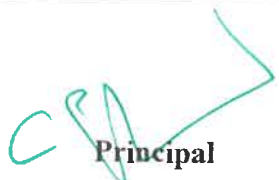

Principal

Subject Code	Subject Name	Category	L	T	P	C
GE24102	HERITAGE OF TAMILS	HSMC	1	0	0	1

UNIT – I	LANGUAGE AND LITERATURE	3
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		
UNIT – II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
UNIT – III	FOLK AND MARTIAL ARTS	3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT – IV	THINAI CONCEPT OF TAMILS	3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT – V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		
		Total Contact Hours :15

Text-Cum-Reference Books	
1.	தமிழகவரலாறுமக்களும்பண்பாடும்கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2.	கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3.	கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4.	பொருதை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)


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


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Subject Code	Subject Name	Category	L	T	P	C
GE24111	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	ESC	0	0	4	2
Course Objectives:						
- To understand the problem solving approaches. - To learn the basic programming constructs in Python. - To practice various computing strategies for Python-based solutions to real world problems. - To use Python data structures - lists, tuples, dictionaries. - To do input/output with files in Python.						

EXPERIMENTS:						
Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here. 1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.) 2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points). 3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern) 4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples) 5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries) 6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape) 7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters) 8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy) 9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word) 10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation) 11. Exploring Pygame tool. 12. Developing a game activity using Pygame like bouncing ball, car race etc.						
						Total Contact Hours: 45
Course Outcomes:	Upon completion of the course students should be able to:					
CO1	Develop algorithmic solutions to simple computational problems					
CO2	Develop and execute simple Python programs.					
CO3	Implement programs in Python using conditionals and loops for solving problems.					
CO4	Deploy functions to decompose a Python program.					
CO5	Process compound data using Python data structures.					


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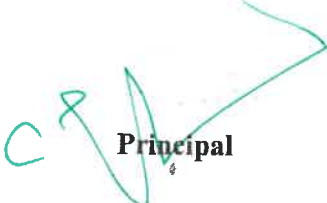
CO6	Utilize Python packages in developing software applications.
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Textbooks:	
1.	Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	https://www.python.org/
6.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	3	2	3	3	-
CO2	3	3	3	3	3	-	-	-	-	3	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	2	-	3	-	-
CO4	3	2	-	2	2	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	1	-	2	-	-
CO6	2	-	-	-	2	-	-	-	-	-	1	2	-	-
Average:	2	3	3	3	2	-	-	-	-	2	2	3	3	-

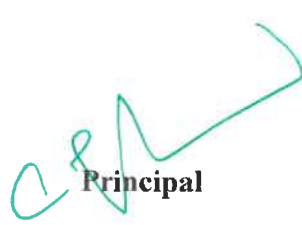

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Subject Code	Subject Name	Category	L	T	P	C
BS24111	PHYSICS AND CHEMISTRY LABORATORY	BSC	0	0	4	2
PHYSICS LABORATORY: (Any Seven Experiments)						
Course Objectives:						
To learn the proper use of various kinds of physics laboratory equipment.						
To learn how data can be collected, presented and interpreted in a clear and concise manner.						
To learn problem solving skills related to physics principles and interpretation of experimental data.						
To determine error in experimental measurements and techniques used to minimize such error.						
To make the student as an active participant in each part of all lab exercises.						

LIST OF EXPERIMENTS	
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects. 2. Simple harmonic oscillations of cantilever. 3. Non-uniform bending - Determination of Young's modulus 4. Uniform bending – Determination of Young's modulus 5. Laser- Determination of the wave length of the laser using grating 6. Air wedge - Determination of thickness of a thin sheet/wire 7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser. 8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids. 9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids 10. Post office box -Determination of Band gap of a semiconductor. 11. Photoelectric effect 12. Michelson Interferometer. 13. Melde's string experiment 14. Experiment with lattice dynamics kit.	
Total Contact Hours :30	
Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the functioning of various physics laboratory equipment.
CO2	Use graphical models to analyze laboratory data.
CO3	Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4	Access, process and analyze scientific information.
CO5	Solve problems individually and collaboratively.


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CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	3	2	3	1	1	-	-	-	-	-	-	-	-	-
C02	3	3	2	1	1	-	-	-	-	-	-	-	-	-
C03	3	2	3	1	1	-	-	-	-	-	-	-	-	-
C04	3	3	2	1	1	-	-	-	-	-	-	-	-	-
C05	3	2	3	1	1	3	-	-	-	-	-	-	-	-
Average:	3	2.4	2.6	1	1	3	-	-	-	-	-	-	-	-


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CHEMISTRY LABORATORY: (Any seven experiments)	
Course Objectives:	
•	To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
•	To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
•	To demonstrate the analysis of metals and alloys.
•	To demonstrate the synthesis of nanoparticles

LIST OF EXPERIMENTS	
1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard 2. Determination of types and amount of alkalinity in water sample. - Split the first experiment into two 3. Determination of total, temporary & permanent hardness of water by EDTA method. 4. Determination of DO content of water sample by Winkler's method. 5. Determination of chloride content of water sample by Argentometric method. 6. Estimation of copper content of the given solution by Iodometry. 7. Estimation of TDS of a water sample by gravimetry. 8. Determination of strength of given hydrochloric acid using pH meter. 9. Determination of strength of acids in a mixture of acids using conductivity meter. 10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration) 11. Estimation of iron content of the given solution using potentiometer. 12. Estimation of sodium /potassium present in water using flame photometer. 13. Preparation of nanoparticles ($\text{TiO}_2/\text{ZnO}/\text{CuO}$) by Sol-Gel method. 14. Estimation of Nickel in steel 15. Proximate analysis of Coal	
Total Contact Hours :30	
Course Outcomes:	Upon completion of the course students should be able to:
CO1	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2	To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3	To analyse and determine the composition of alloys.
CO4	To learn simple method of synthesis of nanoparticles
CO5	To quantitatively analyze the impurities in solution by electroanalytical techniques

Textbooks:	
1.	J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).


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CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	1	-	-	2	-	-	-	-	2	-	-	-
CO2	3	1	2	-	-	1	-	-	-	-	1	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	2	-	-	-	-	-	-	-	-
CO5	2	1	2	-	1	2	-	-	-	-	1	-	-	-
Average:	2.6	1.3	1.6	1	1	1.4	-	-	-	-	1.3	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
GE24112	English Laboratory	EEC	0	0	2	1
Course Objectives:						
To improve the communicative competence of learners						
To help learners use language effectively in academic /work contexts						
To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.						
To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.						
To use language efficiently in expressing their opinions via various media.						

UNIT – I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions(filling out a bank application for example).		
UNIT – II	NARRATION AND SUMMATION	6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings-engaging in small talk- describing requirements and abilities.		
UNIT – III	DESCRIPTION OF A PROCESS / PRODUCT	6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.		
UNIT – IV	CLASSIFICATION AND RECOMMENDATIONS	6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-		
UNIT – V	CLASSIFICATION AND RECOMMENDATIONS	6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions-understanding a website-describing processes		
		Total Contact Hours :30
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	To listen to and comprehend general as well as complex academic texts information	
CO2	To listen to and understand different points of view in a discussion	
CO3	To speak fluently and accurately in formal and informal communicative contexts	
CO4	To describe products and processes and explain their uses and purposes clearly and accurately	
CO5	To express their opinions effectively in both formal and informal discussions	


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CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	1	3	3	3	3	3	3	3	-	-
CO5	3	3	3	3	1	3	3	3	3	3	3	3	-	-
Average:	3	3	3	3	1	3	3	3	3	3	3	3	-	-


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SEMESTER II

Subject Code	Subject Name	Category	L	T	P	C
HS24201	PROFESSIONAL ENGLISH - II	HSMC	2	0	0	2
Course Objectives:						
- To engage learners in meaningful language activities to improve their reading and writing skills - To learn various reading strategies and apply in comprehending documents in professional context. - To help learners understand the purpose, audience, contexts of different types of writing - To develop analytical thinking skills for problem solving in communicative contexts - To demonstrate an understanding of job applications and interviews for internship and placements						

UNIT – I	MAKING COMPARISONS	6
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases		
UNIT – II	EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING	6
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds		
UNIT – III	PROBLEM SOLVING	6
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences		
UNIT – IV	REPORTING OF EVENTS AND RESEARCH	6
Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions		
UNIT – V	THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY	6
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.		
		Total Contact Hours :30
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	To compare and contrast products and ideas in technical texts.	
CO2	To identify and report cause and effects in events, industrial processes through technical texts	
CO3	To analyse problems in order to arrive at feasible solutions and communicate them in the written format.	
CO4	To present their ideas and opinions in a planned and logical manner	
CO5	To draft effective resumes in the context of job search.	

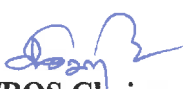

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Textbooks:	
1.	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2.	English for Science & Technology Cambridge University Press 2021.
3.	Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University

Reference books/other materials/webresources:	
1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3.	Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4.	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5.	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO2	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO4	3	3	3	3	2	3	3	2	3	3	3	-	-	-
CO5	-	-	-	-	-	-	-	3	3	3	3	-	-	-
Average:	3	3	3	3	2.75	3	3	2.2	3	3	3	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
MA24201	STATISTICS AND NUMERICAL METHODS	BSC	3	1	0	4
Course Objectives:						
This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology						
To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.						
To introduce the basic concepts of solving algebraic and transcendental equations.						
To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.						
To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.						

UNIT – I	TESTING OF HYPOTHESIS	9+3
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.		
UNIT – II	DESIGN OF EXPERIMENTS	9+3
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 22 factorial design.		
UNIT – III	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9+3
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.		
UNIT – IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	9+3
Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.		
UNIT – V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	9+3
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.		
		Total Contact Hours :60
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.	
CO2	Apply the basic concepts of classifications of design of experiments in the field of agriculture.	


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CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

Textbooks:

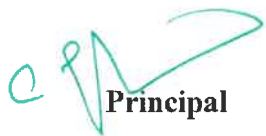
1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference books/other materials/web resources:

1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
5.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	2	0	2	3	-	-	-
Average:	3	3	1	1	1	0	0	2	0	2	3	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
PH24206	PHYSICS OF MATERIALS	BSC	3	0	0	3
Course Objectives:						
To make the students to understand the basics of phase diagrams and various materials preparation techniques						
To equip the students to have a knowledge on different types of electron theory, basics of quantum mechanics and about superconductors						
To introduce the physics of semiconducting materials and applications of semiconductors in device fabrication						
To familiarize the students with the theory and applications of magnetic and dielectric materials						
To provide the students a sound platform towards learning about advanced materials and their applications.						

UNIT – I	PREPARATION OF MATERIALS	9
Phases - phase rule – binary systems – tie line – lever rule – phase diagram – invariant reactions - nucleation – homogeneous and heterogeneous nucleation – free energy of formation of a critical nucleus – Thin films – preparation: PVD, CVD method – Nanomaterials Preparation: wet chemical, solvothermal, sol-gel method.		
UNIT – II	ELECTRICAL PROPERTIES OF MATERIALS	9
Classical free electron theory - expression for electrical conductivity – thermal conductivity, - Wiedemann-Franz law - Quantum free electron theory – tunneling - degenerate states – Fermi-Dirac statistics – density of energy states – electron in periodic potential – electron effective mass – concept of hole. Superconducting phenomena, properties of superconductors – Meissner effect and isotope effect. Type I and Type II superconductors, High T _c superconductors – Magnetic levitation and SQUIDS.		
UNIT – III	SEMICONDUCTING PROPERTIES MATERIALS	9
Elemental Semiconductors - Compound semiconductors - Origin of band gap in solids (qualitative) - carrier concentration in metals - carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Hall effect – determination of Hall coefficient – LED - Solar cells.		
UNIT – IV	DIELECTRIC AND MAGNETIC MATERIALS	9
Dielectric, Paraelectric and ferroelectric materials - Electronic, Ionic, Orientational and space charge polarization – Internal field and deduction of Clausius Mosotti equation – dielectric loss – different types of dielectric breakdown – classification of insulating materials and their applications - Ferroelectric materials - Introduction to magnetic materials - Domain theory of ferromagnetism, Hysteresis, Soft and Hard magnetic materials – Anti-ferromagnetic materials – Ferrites, Giant Magneto Resistance materials.		
UNIT – V	NEW MATERIALS AND APPLICATIONS	9
Ceramics – types and applications – Composites: classification, role of matrix and reinforcement – processing of fibre reinforced plastics and fibre reinforced metals – Metallic glasses – Shape memory alloys – Copper, Nickel and Titanium based alloys – grapheme and its properties – Relaxor ferroelectrics - Biomaterials – hydroxyapatite – PMMA – Silicone - Sensors: Chemical Sensors - Bio-sensors – Polymer semiconductors – Photoconducting polymers.		
		Total Contact Hours :45


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Course Outcomes:	Upon completion of the course students should be able to:
CO1	acquire knowledge of phase diagram, and thin film and nanomaterial preparation techniques
CO2	familiarize with conducting materials, basic quantum mechanics, and properties and applications of superconductors.
CO3	gain knowledge on semiconducting materials based on energy level diagrams, its types, temperature effect. Also, fabrication methods for semiconductor devices will be understood.
CO4	realize with theories and applications of dielectric and ferromagnetic materials
CO5	familiarize with ceramics, composites, metallic glasses, shape memory alloys, biomaterials and their important applications.

Textbooks:	
1.	W.D.Callitser and D.G.Rethwish. Materials Science and Engineering. John Wiley & Sons, 2014.
2.	V.Raghavan. Materials Science and Engineering: A First Course. PHI Learning, 2015.
3.	M.F.Ashby, P.J.Ferreira and D.L.Schodek. Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers, 2011.

Reference books/other materials/webresources:	
1.	J.F.Shackelford. Introduction to Materials Science for Engineers. Pearson, 2015.
2.	D.R. Askeland and W.J.Wright. Essentials of Materials Science and Engineering, Cengage Learning, 2013.
3.	Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
4.	Jean P.Mercier, G.Zambelli and W.Kurz, Introduction to Materials Science, Elsevier, 2002.
5.	Yaser Dahman, Nanotechnology and Functional Materials for Engineers, Elsevier, 2017.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	1	1	-	-	-	1	-	-	-
CO2	3	3	2	-	-	1	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	2	-	-	-	-	1	-	-	-
CO4	3	2	-	1	2	2	-	-	-	-	1	-	-	-
CO5	3	-	2	-	2	2	-	-	-	-	1	-	-	-
Average:	3	2.25	2	1.66	2	1.6	1	-	-	-	1	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
BE24204	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	ESC	3	0	0	3

Course Objectives:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers

UNIT – I	ELECTRICAL CIRCUITS	9
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply – star and delta connection – power in three-phase systems		
UNIT – II	MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS	9
Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems. Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid		
UNIT – III	ELECTRICAL MACHINES	9
Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.		
UNIT – IV	ANALOG ELECTRONICS	9
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters, harmonics		
UNIT – V	SENSORS AND TRANSDUCERS	9
Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors, Strain gauge, LVDT, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.		
		Total Contact Hours :45
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	Compute the electric circuit parameters for simple problems	
CO2	Explain the concepts of domestic wiring and protective devices	
CO3	Explain the working principle and applications of electrical machines	

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CO4	Analyze the characteristics of analog electronic devices
CO5	Explain the types and operating principles of sensors and transducers

Textbooks:

1.	D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2.	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3.	S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4.	James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley, 2018

Reference books/other materials/webresources:

1.	John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2.	Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3.	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017
4.	Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition., Cengage India, 2019.
5.	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO4	2	1	1	-	-	-	1	-	-	-	-	-	-	-
CO5	2	1	1	-	-	-	1	-	-	-	-	-	-	-
Average:	2	1	1	-	-	-	1	-	-	-	-	-	-	-

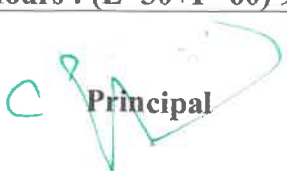

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Subject Code	Subject Name	Category	L	T	P	C
GE24201	ENGINEERING GRAPHICS	ESC	2	0	4	4
Course Objectives: The main learning objective of this course is to prepare the students for:						
• Drawing engineering curves.						
• Drawing freehand sketch of simple objects.						
• Drawing orthographic projection of solids and section of solids.						
• Drawing development of solids						
• Drawing isometric and perspective projections of simple solids.						

	CONCEPTS AND CONVENTIONS (Not for Examination)	
	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	6+12
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.		
UNIT – II	PROJECTION OF POINTS, LINES AND PLANE SURFACE	6+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 and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		
UNIT – III	PROJECTION OF SOLIDS AND FREEHAND SKETCHING	6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)		
UNIT – IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	6+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)		
UNIT – V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	6+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 - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software(Not for examination)		
Total Contact Hours : (L=30+P=60) 90		


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Course Outcomes:	
CO1	Use BIS conventions and specifications for engineering drawing.
CO2	Construct the conic curves, involutes and cycloid.
CO3	Solve practical problems involving projection of lines.
CO4	Draw the orthographic, isometric and perspective projections of simple solids.
CO5	Draw the development of simple solids.

Textbooks:

1.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2.	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3.	Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

Reference books/other materials/webresources:

1.	Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edit ion, 2019.
2.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3.	Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4.	Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:

1.	IS10711 — 2001: Technical products Documentation — Size and layout of drawing sheets.
2.	IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3.	IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4.	IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5.	IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	3	-	2	2	2	-
CO5	3	1	2	-	2	-	-	-	3	-	2	2	2	-
Average:	3	1	2	-	2	-	-	-	3	-	2	2	2	-


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Subject Code	Subject Name	Category	L	T	P	C
CH24201	INTRODUCTION TO CHEMICAL ENGINEERING	PCC	3	0	0	3
Course Objectives:						
To acquaint the students with the fundamentals of Chemical Engineering and to build their perspective in a wholesome manner						

UNIT – I	INTRODUCTION	9
Chemical Engineering in day to life with examples, Origin and growth of chemical Engineers in chemical process industries, unit operations and unit processes concepts, scaling up or down, units and dimensions, application of mathematics in chemical Engg, recent developments in chemical process industries		
UNIT – II	INTRODUCTION TO MATERIAL AND ENERGY BALANCES	9
Basic concepts of material and energy balances, energy and mass transport, and kinetics of chemical reactions. Introduction to heat and mass transfer. Process flow sheeting and symbols.		
UNIT – III	FLUID FLOW	9
Nature of fluid, Viscosity, Flow field, Conservation of mass and energy. Frictional losses, pumping of fluids. Dimensional Analysis and Correlations.		
UNIT – IV	CHEMICAL ENGINEERING COMPUTER SOFTWARE TOOLS AND APPLICATIONS	9
Introduction to Process Engineering Design Software (HYSYS and PRO II) , Computations Using Microsoft Excel, Computer-Aided Design & Drafting, Piping and Equipment Design Software		
UNIT – V	CAREER DIVERSITIES IN CHEMICAL ENGINEERING	9
Career Development Leading to Specialization, Chemical Engineering Job Titles/Options, Chemical and Process Engineers, Commissioning Engineer, Process Control/Automation Engineer, Process Safety Engineer, Research & Development Engineer Pharmaceutical Engineer/Pharmaceutical Process Engineer, Pipeline Engineer Chemical Manufacturing Engineer, Environment Engineer.		
		Total Contact Hours :45
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	Correlate day to day like with the principles of chemical Engineering.	
CO2	Assess the mass and energy involved in any chemical plant.	
CO3	Have an insight into areas where Chemical Engineering plays a major role.	
CO4	Carry out modelling and simulation using software tools.	
CO5	Identify their right future.	
CO6	Gain confidence and outline about the programme as a whole.	

Textbooks:	
1.	Anderson, L.B., Wenzel, L.A., "Introduction to Chemical Engineering", McGraw-Hill Book Company, Inc., New York (1961).
2.	Pushpavanam, S., "Introduction to Chemical Engineering", PHI Learning Pvt.Ltd.(2012).
3.	Ghosal, S.K., Sanyal, S.K., Datta, S., "Introduction to Chemical Engineering", Tata McGraw-Hill Publishing Company Ltd., New Delhi(1997).


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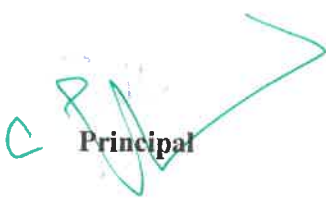

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Reference books/other materials/webresources:

1. Rao, M.G., Sittig, M., "Dryden's Outlines of Chemical Technology", East-West Press (1997).
2. Perry, R.H., Green, D.W., "Perry's Chemical Engineers' Handbook", McGraw-Hill Book Company (2008).

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	1	2	-	-
CO2	3	2	3	1	-	-	-	-	-	-	1	2	2	-
CO3	3	2	3	1	-	-	-	-	-	1	-	2	2	-
CO4	3	2	3	1	1	1	1	-	-	1	1	2	2	-
CO5	3	2	3	1	-	-	-	-	-	-	1	2	2	-
CO6	3	2	3	-	-	-	-	-	-	-	-	2	2	-
Average:	3	2	3	1	1	1	1	-	-	1	1	2	2	-


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Subject Code	Subject Name	Category	L	T	P	C
GE24202	தமிழரும்தொழில்நுட்பமும்	HSMC	1	0	0	1

அலகு I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	3
சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள்		
அலகு II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.		
அலகு III	உற்பத்தித் தொழில் நுட்பம்	3
கப்பல் கட்டும் கலை உலோகவியல் இரும்புத் தொழிற்சாலை இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் -தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்	3
அணை, ஏரி, குளங்கள், மதகு சோழர்காலக் குழுழித் தூம்பின் முக்கியத்துவம் கால்நடை பராமரிப்பு கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு -அறிவுசார் சமூகம்.		
அலகு V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	3
அறிவியல் தமிழின் வளர்ச்சி -கணித் தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் தமிழ்மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்		
		Total Contact Hours :15

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Text-Cum-Reference Books	
1.	தமிழகவரலாறுமக்களும்பண்பாடும்கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2.	கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3.	கீழடி வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம்(தொல்லியல்துறை வெளியீடு)
4.	பொருறை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.


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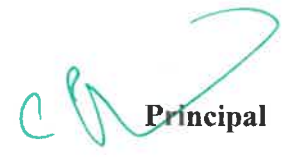

Principal

Subject Code	Subject Name	Category	L	T	P	C
GE24202	TAMILS AND TECHNOLOGY	HSMC	1	0	0	1

UNIT – I	WEAVING AND CERAMIC TECHNOLOGY	3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
UNIT – II	DESIGN AND CONSTRUCTION TECHNOLOGY	3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.		
UNIT – III	MANUFACTURING TECHNOLOGY	3
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.		
UNIT – IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3
Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
UNIT – V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		
		Total Contact Hours :15

Text-Cum-Reference Books	
1.	தமிழகவரலாறுமக்களும்பண்பாடும்கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2.	கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3.	கீழடி வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம்(தொல்லியல்துறைவெளியீடு)
4.	பொருறை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு)
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)


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


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Subject Code	Subject Name	Category	L	T	P	C
NX3251	(NAVAL WING) NCC Credit Course Level - I	NCC	2	0	0	2

NCC GENERAL		6
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		4
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
PERSONALITY DEVELOPMENT		7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
		Total Contact Hours : 30


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Subject Code	Subject Name	Category	L	T	P	C
NX3251	(AIR FORCE WING) NCC Credit Course Level - I	NCC	2	0	0	2

NCC GENERAL		6
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		4
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
PERSONALITY DEVELOPMENT		7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhansi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
		Total Contact Hours : 30


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Subject Code	Subject Name	Category	L	T	P	C
NX3251	(ARMY WING) NCC Credit Course Level - I	NCC	2	0	0	2

NCC GENERAL		6
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		4
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
PERSONALITY DEVELOPMENT		7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
		Total Contact Hours : 30

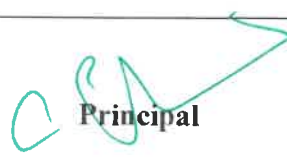

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Principal

Subject Code	Subject Name	Category	L	T	P	C
GE24211	ENGINEERING PRACTICES LABORATORY	ESC	0	0	4	2
Course Objectives:						
Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.						
Wiring various electrical joints in common household electrical wire work.						
Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.						
Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.						

GROUP – A (CIVIL & ELECTRICAL)		
PART I	CIVIL ENGINEERING PRACTICES	15
PLUMBING WORK: a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household. b) Preparing plumbing line sketches. c) Laying pipe connection to the suction side of a pump d) Laying pipe connection to the delivery side of a pump. e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances. WOOD WORK: a) Sawing, b) Planing and c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint. Wood Work Study: a) Studying joints in door panels and wooden furniture b) Studying common industrial trusses using models.		
PART II	ELECTRICAL ENGINEERING PRACTICES	15
a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket b) Staircase wiring c) Fluorescent Lamp wiring with introduction to CFL and LED types. d) Energy meter wiring and related calculations/ calibration e) Study of Iron Box wiring and assembly f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac) g) Study of emergency lamp wiring/Water heater		
GROUP – B (MECHANICAL AND ELECTRONICS)		
PART III	MECHANICAL ENGINEERING PRACTICES	15
WELDING WORK: a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. b) Practicing gas welding.		


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BASIC MACHINING WORK:

- a) (simple)Turning.
- b) (simple)Drilling.
- c) (simple)Tapping.

ASSEMBLY WORK:

- a) Assembling a centrifugal pump.
- b) Assembling a household mixer.
- c) Assembling an airconditioner.

SHEET METAL WORK:

- a) Making of a square tray

FOUNDRY WORK:

- a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES**15****SOLDERING WORK:**

- a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

- a) Study an elements of smart phone..
- b) Assembly and dismantle of LED TV.
- c) Assembly and dismantle of computer/ laptop

Total Contact Hours :60

Course Outcomes:	Upon completion of this course, the students will be able to:
CO1	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
CO2	Wire various electrical joints in common household electrical wire work.
CO3	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
CO4	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	-	-	-	-	2	2	1	1
CO2	3	2	-	-	1	1	-	-	-	-	2	2	1	1
CO3	3	2	-	-	1	1	-	-	-	-	2	2	1	1
Average:	3	2	-	-	1	1	-	-	-	-	2	2	1	1



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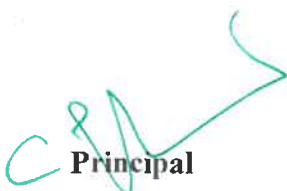
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Subject Code	Subject Name	Category	L	T	P	C
BE24211	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY	ESC	0	0	4	2
Course Objectives:						
To train the students in conducting load tests electrical machines						
To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers						
To train the students to measure three phase power and displacement						

LIST OF EXPERIMENTS	
1. Verification of ohms and Kirchhoff's Laws. 2. Three Phase Power Measurement 3. Load test on DC Shunt Motor. 4. Load test on Self Excited DC Generator 5. Load test on Single phase Transformer 6. Load Test on Induction Motor 7. Characteristics of PN and Zener Diodes 8. Characteristics of BJT, SCR and MOSFET 9. Design and analysis of Half wave and Full Wave rectifiers 10. Measurement of displacement of LVDT	
Total Contact Hours :60	
Course Outcomes:	Upon completion of this course, the students will be able to:
CO1	Use experimental methods to verify the Ohm's law and Kirchhoff's Law and to measure three phase power
CO2	Analyze experimentally the load characteristics of electrical machines
CO3	Analyze the characteristics of basic electronic devices
CO4	Use LVDT to measure displacement

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
CO2	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
CO3	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
CO4	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-
Average:	2	3	1	2	-	-	1.5	2	-	-	-	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
GE24212	COMMUNICATION LABORATORY / FOREIGN LANGUAGE	EEC	0	0	4	2
Course Objectives:						
To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.						
To analyse concepts and problems and make effective presentations explaining them clearly and precisely.						
To be able to communicate effectively through formal and informal writing.						
To be able to use appropriate language structures to write emails, reports and essays						
To give instructions and recommendations that are clear and relevant to the context						

UNIT – I		12
Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life-discussing past events-Writing: writing emails (formal& semi-formal).		
UNIT – II		12
Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.		
UNIT – III		12
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios-talking about purchasing-discussing advantages and disadvantages- making comparisons-discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.		
UNIT – IV		12
Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.		
UNIT – V		12
Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing: job application (Cover letter + Curriculum vitae)-writing recommendations.		
Total Contact Hours :60		
Course Outcomes:	At the end of the course, learners will be able	
CO1	Speak effectively in group discussions held in a formal/semi formal contexts	
CO2	Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions	
CO3	Write emails, letters and effective job applications.	
CO4	Write critical reports to convey data and information with clarity and precision	
CO5	Give appropriate instructions and recommendations for safe execution of tasks	

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CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	2	3	3	3	1	3	3	3	3	3	3	-	-	-
C02	2	3	3	3	1	3	3	3	3	3	3	-	-	-
C03	2	2	3	3	1	3	3	3	3	3	3	-	-	-
C04	3	3	3	3	3	3	3	3	3	3	3	-	-	-
C05	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Average:	2.4	2.8	3	3	1.8	3	3	3	3	3	3	-	-	-


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SEMESTER III

Subject Code	Subject Name	Category	L	T	P	C
MA24304	TRANSFORMS AND LINEAR PROGRAMMING PROBLEMS	BSC	3	1	0	4

Course Objectives:

- To acquaint the student with Fourier transform techniques used in wide variety of situations
- To acquaint the student with Laplace Transform techniques used in various situations
- To acquaint the student with Z-transform techniques used in discrete-time signal processing, control systems.
- To apply quantitative techniques in modelling.
- To solving business related problems.

UNIT – I	FOURIER TRANSFORMS	9+3
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.		
UNIT – II	LAPLACE TRANSFORMS	9+3
Introduction to Laplace transforms – Sufficient conditions for existence - Properties of the Laplace transform - Transforms of derivatives and derivatives of transforms - Shifting theorems - Change of scale property – Periodic function - Convolution theorem - Inverse Laplace transforms – Solution of first and second order ordinary differential equations.		
UNIT – III	Z - TRANSFORMS	9+3
Z-transforms - Elementary properties– Inverse Z - transform using partial fraction, convolution theorem – Formation of Difference equations, Solution of difference equations using Z – transform.		
UNIT – IV	LINEAR PROGRAMMING PROBLEMS	9+3
Linear Programming formulation, Solution by Graphical method - Simplex methods – Big-M method.		
UNIT – V	TRANSPORTATION AND ASSIGNMENT PROBLEMS	9+3
Transportation Models – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI. Assignment Problems– Balanced and Unbalanced Problems-Hungarian Method.		
		Total Contact Hours :60
Course Outcomes:	Upon completion of the course students should be able to:	
CO1	Use the effective mathematical tools for the solutions of Fourier transform techniques.	
CO2	Use the effective mathematical tools for the solutions of Laplace transform techniques.	
CO3	Use the effective mathematical tools for solutions of PDE by using Z transform techniques for discrete time systems.	
CO4	Understand the Linear programming in product mix decisions.	
CO5	Apply the Transportation and assignment in logistics and job allocation scenarios	

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Textbooks:	
1.	Johnson. R.A., Miller. I. and Freund. J.E., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9 th Edition, 2016.
2.	John E. Freund, "Mathematical Statistics", Prentice Hall, 5 th Edition, 1992.
3.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4 th Edition, 2007
4.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44 th Edition, 2018
5.	N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.

Reference books/other materials/webresources:	
1.	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12 th Edition, 2020
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8 th Edition, 2014.
3.	Walpole.R.E., Myers.R.H., Myers.S.L. and Ye.K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9 th Edition, 2010.
4.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10 th Edition, New Delhi, 2016.

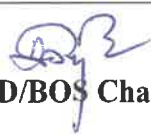
CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO3	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO4	3	3	3	2	2	-	-	-	1	-	1	-	-	-
CO5	3	3	3	2	2	-	-	-	1	-	1	-	-	-
Average:	3	3	2.4	2	1.4	-	-	-	1	-	1	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
CH24301	FLUID MECHANICS FOR CHEMICAL ENGINEERS	PCC	3	0	0	3
Course Objectives:						
To enable the students to acquire a sound knowledge on fluid properties, fluid statics, dynamic characteristics of fluid flow for through pipes and porous medium, flow measurement and fluid machineries						

UNIT – I		9
Methods of analysis and description - fluid as a continuum – Velocity and stress field - Newtonian and non-Newtonian fluids – Classification of fluid motion		
UNIT – II		9
Fluid statics – basic equation - equilibrium of fluid element – pressure variation in a static fluid - application to manometer – Differential analysis of fluid motion – continuity, equation of motions, Bernoulli equation and Navier- Stokes equation.		
UNIT – III		9
The principle of dimensional homogeneity – dimensional analysis, Rayleigh method and the Pi-theorem - non-dimensional action of the basic equations - similitude - relationship between dimensional analysis and similitude - use of dimensional analysis for scale up studies		
UNIT – IV		9
Reynolds number regimes, internal flow - flow through pipes – pressure drop under laminar and turbulent flow conditions – major and minor losses; Line sizing; External flows - boundary layer concepts, boundary layer thickness under laminar and turbulent flow conditions- Flow over a sphere – friction and pressure drag - flow through fixed and fluidized beds.		
UNIT – V		9
Flow measurement - Constant and variable head meters; Velocity measurement techniques; Types, characteristics and sizing of valves; Classification, performance characteristics and sizing of pumps, compressors and fans		
		Total Contact Hours : 45
Course Outcomes:	On completion of the course, the students would be able to	
CO1	Understand the fundamental properties of fluids, stress-strain relationship in fluids, and its characteristics under static conditions and establish force balance in static systems.	
CO2	Apply Bernoulli principle, Navier - Stokes equation and compute pressure variation in static fluid.	
CO3	Use of dimensional analysis to derive relationships among process or system variables. Further they would develop dimensionless groups that help in scale-up studies.	
CO4	Understand the different types of flow conditions in fixed bed and fluidized beds.	
CO5	Describe function of flow metering devices, apply Bernoulli equation to determine the performance of flow-metering devices and also analyze the performance aspects of fluid machinery such as pumps, compressors and valves.	
Textbooks:		
1.	Noel de Nevers, “Fluid Mechanics for Chemical Engineers “, Third Edition, McGraw-Hill, (2017).	


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2.	McCabe W.L, Smith, J C and Harriot. P “Unit operations in Chemical Engineering”, McGraw Hill, VII Edition, 2017
3.	Munson, B. R., Young, D.F., Okiishi, T.H. “Fundamentals of Fluid Mechanics”, 9th Edition“, John Wiley, 2021

Reference books/other materials/webresources:

1.	White, F.M., “Fluid Mechanics “, IV Edition, McGraw-Hill Inc., 1999.
2.	James O Wilkes and Stacy G Bike, “Fluid Mechanics for Chemical Engineers’ Prentice Hall PTR (International series in Chemical Engineering) (1999)

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	1	2	-	3	1	-
CO2	-	3	-	-	-	-	-	-	-	-	-	3	2	-
CO3	-	3	3	3	2	-	-	-	3	1	2	-	-	2
CO4	3	-	3	3	2	-	-	-	-	-	3	3	-	-
CO5	2	3	-	3	-	2	1	-	-	-	-	-	2	2
Average:	3	3	3	3	2	2	1	-	2	1	3	3	2	2


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Subject Code	Subject Name	Category	L	T	P	C
CH24302	STRENGTH OF MATERIALS	ESC	3	0	0	3
Course Objectives:						
- To introduce the equilibrium of rigid bodies, vector methods and free body diagram. - To study and understand the distributed forces, surface, loading on beam and intensity - To understand the concepts of stress, strain, principal stresses and principal planes. - To determine stresses and deformation in circular shafts and helical spring due to torsion. - To study the stresses and deformations induced in thin and thick shells.						

UNIT – I	EQUILIBRIUM OF RIGID BODIES	9
Vectors and scalars - Resultant of two forces which are parallel - Resultant of two forces which are not parallel - Resolution of single force into components – Theorem of Varignon - Graphical method of determining the resultant of a system of coplanar forces – Principle of triangle of forces – Lami's theorem.		
UNIT – II	DISTRIBUTED FORCES	9
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a ThreeDimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area.		
UNIT – III	STRESS, STRAIN AND DEFORMATION OF SOLIDS	9
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simple and compound bars – Thermal stresses – Elastic constants - Volumetric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.		
UNIT – IV	TORSION	9
Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.		
UNIT – V	THIN CYLINDERS, SPHERES AND THICK CYLINDERS	9
Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Thick cylinders - Lamé's theory.		
		Total Contact Hours : 45
Course Outcomes:	On completion of the course, the students would be able to	
CO1	Analyse the rigid body in equilibrium	
CO2	Evaluate the properties of distributed force	
CO3	Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.	
CO4	Apply basic equation of torsion in designing of shafts and helical springs	
CO5	Analyze thin and thick shells for applied pressures.	


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Textbooks:	
1.	Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand& company Ltd., New Delhi, 7th edition, 2018.
2.	Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt .Ltd., New Delhi, 2017.
3.	Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

Reference books/other materials/webresources:	
1.	Singh. D.K., "Strength of Materials", Ane Books Pvt Ltd., New Delhi, 2021
2.	Beer. F.P. & Johnston. E.R. "Mechanics of Materials", Tata McGraw Hill, 8th Edition, New Delhi 2019.
3.	Engineering Mechanics - A text book of Applied Mechanics – S.Ramamrutham, Dhanpat Rai publishing company (P) Ltd, Ninth edition, 2016.
4.	Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013
5.	Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	2	3	1	1
CO2	3	2	3	1	2	-	-	-	-	-	2	3	1	2
CO3	3	3	3	3	2	3	3	2	3	1	3	3	2	3
CO4	3	3	3	3	2	3	3	2	3	1	3	3	2	3
CO5	3	3	3	3	2	3	3	2	3	1	3	3	2	3
Average:	3	3	3	2	2	3	3	2	3	1	3	3	2	2


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Subject Code	Subject Name	Category	L	T	P	C
CH24303	MECHANICAL OPERATIONS	PCC	3	0	0	3
Course Objectives:						
To impart knowledge in the field of particle size reduction and also construction and working of equipment's used for mechanical operations.						

UNIT – I	PARTICLE CHARACTERIZATION AND MEASUREMENT	9
General characteristics of solids, different techniques of size analysis- Static - Image analysis and Dynamic analysis - Light scattering techniques, shape factor, surface area determination, estimation of particle size. Advanced particle size analysis techniques. Screening methods and equipment, screen efficiency, ideal and actual screens.		
UNIT – II	PARTICLE SIZE REDUCTION AND SIZE ENLARGEMENT	9
Laws of size reduction, energy relationships in size reduction, methods of size reduction, classification of equipments, crushers, grinders, disintegrators for coarse, intermediate and fine grinding, power requirement, work index; Advanced size reduction techniques - Nano particle fabrication - Top-down approach - Bottom-up approach. Size enlargement - Importance of size enlargement, principle of granulation, briquetting, palletization, and flocculation. Fundamentals of particle generation.		
UNIT – III	PARTICLE SEPARATION (GAS-SOLID AND LIQUID-SOLID SYSTEM)	9
Gravity settling, sedimentation, thickening, elutriation, double cone classifier, rake classifier, bowl classifier. Centrifugal separation - continuous centrifuges, super centrifuges, design of basket centrifuges; industrial dust removing equipment, cyclones and hydro cyclones, electrostatic and magnetic separators, heavy media separations, floatation, jigging		
UNIT – IV	FILTRATION AND FILTRATION EQUIPMENTS	9
Theory of filtration, Batch and continuous filters, Flow through filter cake and filter media, compressible and incompressible filter cakes, filtration equipments - selection, operation and design of filters and optimum cycle of operation, filter aids.		
UNIT – V	MIXING AND PARTICLE HANDLING	9
Mixing and agitation - Mixing of liquids (with or without solids), mixing of powders, selection of suitable mixers, power requirement for mixing. Storage and conveying of solids - Bunkers, silos, bins and hoppers, transportation of solids in bulk, Powder hazards, conveyer selection, different types of conveyers and their performance characteristics.		
		Total Contact Hours : 45
Course Outcomes:	On completion of the course, the students would be able to	
CO1	Understand and determine various properties of particulates	
CO2	Gain Preliminary understanding on Size Reduction and Size Enlargement	
CO3	Understand various separation and purification techniques employed in solid particles	
CO4	Enhance their knowledge on Filtration Process	
CO5	Understand Handling, Storage and Transportation of Solids and Obtain knowledge on various unit operations and their applications	


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Textbooks:

1.	McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.
2.	Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", Tata McGraw Hill, 1997.
3.	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.
4.	Hiroaki Masuda ,KoHigashitani and Hideto Yoshida, Powder Technology Handbook, 3rd Edition.

Reference books/other materials/webresources:

1.	Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. II, 4th Edn., Asian Books Pvt. Ltd., India, 1998.
2.	Christie J. Geankoplis, Transport processes and unit operations.
3.	Sunggyu Lee, Kimberly H. Henthorn, Particle Technology and Applications.
4.	Martin Rhodes, Introduction to Particle Technology, Second Edition.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	1	-	3	3	3	2	3	3	1
CO2	3	2	2	2	2	1	-	1	2	2	2	2	3	1
CO3	3	2	2	3	3	1	2	1	2	3	2	2	3	3
CO4	2	2	2	1	1	1	1	1	1	1	1	2	2	1
CO5	2	2	3	2	1	2	1	1	1	2	2	1	1	3
Average:	3	3	3	3	2	2	1	2	2	3	3	3	3	2


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Subject Code	Subject Name	Category	L	T	P	C
CH24304	CHEMICAL PROCESS CALCULATIONS	PCC	3	0	0	3
Course Objectives:						
To enable the students to acquire knowledge on laws of chemistry and its application to solution of mass and energy balance equations for single and network of units and introduce to process simulators.						

UNIT – I		9
Base and derived Units - Composition of Mixture and solutions - 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		9
Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallisation, drying etc., - Material balance with chemical reaction - Limiting and excess reactants - recycle - bypass and purging - Unsteady state material balances.		
UNIT – III		9
Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying - Humidity chart, dew point.		
UNIT – IV		9
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. 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		
UNIT – V		9
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 - Application of Process simulators in energy and material balance problems.		
		Total Contact Hours: 45
Course Outcomes:	On completion of the course, the students would be able to:	
CO1	Understand the concepts of dimensional consistency and effective application of units and dimensions.	
CO2	Analyze a problem statement and balance the material flowing through single and various operations	
CO3	Understand the gas behavior and its properties	
CO4	Understand general energy balance, simplify and apply to open and closed systems	
CO5	Write material and energy balance for unsteady state how material and energy balances are formulated for equation- and modular based flow sheeting codes	
Textbooks:		
1.	Bhatt, B.L., Vora, S.M., “Stoichiometry “, 4th Edition, Tata McGraw-Hill (2004)	
2.	Himmelblau, D.M., “Basic Principles and Calculations in Chemical Engineering”, EEE Eighth Edition. Prentice Hall Inc., 2012	


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3.	Felder, R. M. and Rousseau, R. W., "Elementary Principles of Chemical Processes", 5th Edn., John Wiley & Sons, New York, 2005.
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Reference books/other materials/web resources:

1.	Hougen O A, Watson K M and Ragatz R A, "Chemical process principles" Part I, CBS publishers, Second edition, 2004.
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CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	2	1	1	1	1	1	2	3	1
CO2	2	3	2	3	3	2	1	1	1	1	1	2	3	1
CO3	2	3	2	3	3	2	1	1	1	1	1	2	3	1
CO4	2	3	2	3	3	2	1	1	1	1	1	2	3	1
CO5	2	3	2	3	3	2	1	1	1	1	1	2	3	1
Average:	2	3	2	3	3	2	1	1	1	1	1	2	3	1


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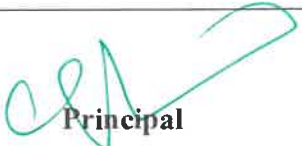

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Subject Code	Subject Name	Category	L	T	P	C
CY24301	PHYSICAL AND ORGANIC CHEMISTRY	BSC	3	0	0	3
Course Objectives:						
- To develop an understanding of the basic concepts of phase rule and its applications. - To acquire knowledge on distribution law and its applications. - To get familiarized with various industrial polymers. - To learn about preparations and uses of synthetic intermediates. - To know the classification, preparation and properties of dyes.						

UNIT – I	PHASE RULE	9
Phase rule - introduction, definition of terms - phase, components and degree of freedom -phase diagram- one component system(water system) - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system-pattinson process- compound formation with congruent melting – Mg- Zn system - vapour pressure curves and its significance.		
UNIT – II	THE DISTRIBUTION LAW	9
Distribution co-efficient - Distribution Law - conditions for the validity of the distribution law - I2-CCl4- H2O system - nature of interaction of the solute with one of the solvents - dissociation - association - applications of distribution law and problems– Extraction process- Single and multiple-solvent extraction - principle and process - batch extraction - continuous extraction.		
UNIT – III	INDUSTRIAL POLYMERS	9
Polymerisation-Methods of polymerisation (bulk polymerisation-solution polymerization suspension polymerisation-emulsion polymerisation)-Preparation, properties and applications of polyethylene, Teflon, PMMA, Polystyrene, epoxy resins, phenol formaldehyde resins and synthetic rubbers.		
UNIT – IV	PREPARATION OF SYNTHETIC INTERMEDIATES	9
Preparations of Benzil from benzyl aldehydes - Furfyl from furfural, Vannilin from catechol through guaiacol, Gramine from indole, N-acetyl-5- bromo indoline from indole, Salol from phenol, Alanine from propionic acid, Heteroauxin from indole - Uses, Reaction and mechanism of acyloin condensation, Baeyer-Villiger reaction, Gabriel's synthesis of phthalimide, Bartoli Indole synthesis.		
UNIT – V	DYE CHEMISTRY	9
Colour and constitutions – Witt's theory and Modern theory of colours. Classification of dyes based on structure and mode of dyeing. Synthesis of some important azo dyes (Methyl orange, Methyl red and Congo red), triphenylmethane dye (Alizarin), phthalein dyes (Phenolphthalein and Fluorescein).		
Total Contact Hours : 45		
Course Outcomes:	On completion of the course, the students would be able to	
CO1	Apply the concept of phase rule in single and multi-component systems.	
CO2	Associate distribution law in extraction processes.	
CO3	Process the polymers by various techniques.	
CO4	Develop a synthetic intermediate for an organic compound at larger scale.	
CO5	Be capable of synthesizing dyes.	

Textbooks:	
1.	B.S.Bhal and Arun Bhal, "A Text Book of Organic Chemistry", 17th Ed., S Chand & Co. New Delhi, 2005.


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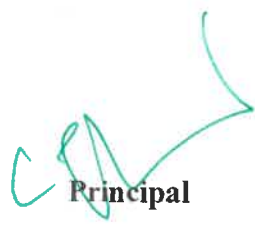
2.	R.T. Morrison and R.N. Boyd "Organic Chemistry" VII Edition Prentice Hall Inc (2010) USA.
3.	Kund and Jain, Physical Chemistry, S. Chand and Company, New delhi (1996).
4.	Gordon M. Barrow, Physical Chemistry, Sixth Edition, Tata McGraw Hill (1998).

Reference books/other materials/webresources:

1.	Peter Atkins, Julia de Paula, Physical Chemistry, 9th Edition, Oxford University Press.
2.	K.S. Tiwari, N.K. Vishnoi and S.N. Malhotra "A text book of Organic Chemistry" fourth Edition, Vikas Publishing House Pvt. Ltd. (2017) New Delhi.
3.	V. A. Shenai, "Chemistry of Dyes and Principles of Dyeing", Sevak Publications, Mumbai, 1995. .

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	1	-	1	1	1	-
CO2	3	3	1	1	-	-	-	-	1	1	1	1	-	-
CO3	3	3	1	1	-	1	-	-	-	-	1	1	1	-
CO4	3	3	3	1	-	1	1	-	1	1	1	1	1	-
CO5	3	3	3	1	-	1	1	-	1	1	1	1	1	-
Average:	3	3	2	1		1	1		1	1	1	1	1	-


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Subject Code	Subject Name	Category	L	T	P	C
CH24311	FLUID MECHANICS LABORATORY	PCC	0	0	3	1.5
Course Objectives:						
To enable the students to learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine pump characteristics.						

LIST OF EXPERIMENTS

1. Viscosity measurement of non-Newtonian fluids
2. Calibration of constant and variable head meters
3. Calibration of weirs and notches
4. Open drum orifice and draining time
5. Flow through straight pipe
6. Flow through annular pipe
7. Flow through helical coil and spiral coil
8. Losses in pipe fittings and valves
9. Characteristic curves of pumps (Centrifugal / Gear / Reciprocating)
10. Pressure drop studies in packed column
11. Hydrodynamics of fluidized bed
12. Drag coefficient of solid particle

Minimum 10 experiments shall be offered

		Total Contact Hours : 45
Course Outcomes:	On completion of the course, the students would be able to	
CO1	Identify and characterize of flow patterns and regimes	
CO2	Calibrate flow measurement devices	
CO3	Correlate the difference between fixed and fluidized bed columns and its application	
CO4	Select pumps for the transportation of fluids based on process conditions/requirements and fluid properties	
CO5	Compare the results of theoretical analytical models to the actual behavior of real fluid flows and draw sustainable conclusions	

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	2	3	3	-
CO2	-	3	3	3	-	-	-	-	-	-	2	3	3	-
CO3	-	3	3	3	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3		2	-	-	-	-	-	2	3	3	3
CO5	3	3	3	3	2	-	-	-	3	2	3	3	3	3
Average:	3	3	3	3	2	2	-	-	3	2	2	3	3	3


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Subject Code	Subject Name	Category	L	T	P	C
CH24312	MECHANICAL OPERATIONS LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- Develop sound practical knowledge on different types of mechanical operations equipments.

LIST OF EXPERIMENTS

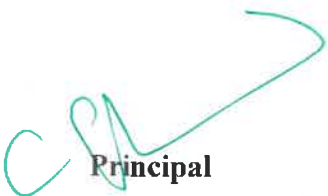
1. Sieve analysis
2. Batch filtration studies using a Leaf filter
3. Batch filtration studies using a Plate and Frame Filter press
4. Characteristics of batch Sedimentation
5. Reduction ratio in Jaw Crusher
6. Reduction ratio in Ball mill
7. Separation characteristics of Cyclone separator
8. Reduction ratio of Roll Crusher
9. Separation characteristics of Elutriator
10. Reduction ratio of Drop weight crusher
11. Size separation using Sub-Sieving

Total Contact Hours: 45

Course Outcomes:	On completion of the course, the students would be able to
CO1	Determine the size analysis in solid- solid separation systems
CO2	Capability to select different solid - fluid separation equipments.
CO3	Evaluate the size reduction and various crushing parameters
CO4	Estimate the separation characteristics
CO5	Understand the technical methods related to unit operations in process plant

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	3	1	3	2	1	2	3	2	1
CO2	3	3	2	2	1	2	2	2	1	2	1	3	3	2
CO3	3	3	2	2	1	2	1	2	1	1	1	3	2	1
CO4	3	2	2	1	1	1	1	2	2	2	2	3	2	1
CO5	3	3	2	3	3	2	3	3	3	2	3	3	3	2
Average:	3	3	2	2	2	2	2	3	2	2	2	3	3	2


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Subject Code	Subject Name	Category	L	T	P	C
GE24903	PROFESSIONAL DEVELOPMENT	EEC	0	0	2	1
Course Objectives: To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.						
To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.						
To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, Interlink, and utilizing many more critical features offered						
To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.						

MS WORD:	10
- Create and format a document - Working with tables - Working with Bullets and Lists - Working with styles, shapes, smart art, charts - Inserting objects, charts and importing objects from other office tools - Creating and Using document templates - Inserting equations, symbols and special characters - Working with Table of contents and References, citations - Insert and review comments - Create bookmarks, hyperlinks, endnotes footnote - Viewing document in different modes - Working with document protection and security - Inspect document for accessibility	
MS EXCEL:	10
- Create worksheets, insert and format data - Work with different types of data: text, currency, date, numeric etc. - Split, validate, consolidate, Convert data - Sort and filter data - Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) - Work with Lookup and reference formulae - Create and Work with different types of charts - Use pivot tables to summarize and analyse data - Perform data analysis using own formulae and functions - Combine data from multiple worksheets using own formulae and built-in functions to generate results	


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• Export data and sheets to other file formats • Working with macros • Protecting data and Securing the workbook	
MS POWERPOINT:	10
• Select slide templates, layout and themes • Formatting slide content and using bullets and numbering • Insert and format images, smart art, tables, charts • Using Slide master, notes and handout master • Working with animation and transitions • Organize and Group slides • Import or create and use media objects: audio, video, animation • Perform slideshow recording and Record narration and create presentable videos	
Total Contact Hours : 45	
Course Outcomes:	On successful completion the students will be able to
CO1	Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
CO2	Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
CO3	Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.


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SEMESTER IV

Subject Code	Subject Name	Category	L	T	P	C
MA24401	PROBABILITY AND STATISTICS	BSC	3	1	0	4
Course Objectives:						
To introduce the basic concepts of probability and random variables.						
To introduce the basic concepts of Special distribution.						
To introduce the basic concepts of two dimensional random variables.						
To acquaint the knowledge of non-parametric test.						
To introduce the basic concepts of classifications of design of experiments. Which plays very important roles in the field of agriculture and statistical quality control.						

UNIT – I	PROBABILITY AND RANDOM VARIABLES	9+3
Axioms of probability - Conditional Probability - Baye's Theorem – One dimensional Discrete and Continuous Random variables - Moments – Moment generating functions		
UNIT – II	SPECIAL DISTRIBUTIONS	9+3
Discrete distributions: Binomial, Poisson, Geometric – Continuous distributions: Uniform, Exponential and Normal distribution.		
UNIT – III	TWO DIMENSIONAL RANDOM VARIABLES	9+3
Two dimensional random variables: Joint distribution - Marginal and Conditional distributions -Covariance – Correlation co-efficient – Regression lines.		
UNIT – IV	NON PARAMETRIC TESTS	9+3
Introduction - The sign test - The Signal - Rank test - Rank sum tests - The U-test - The H-test - Tests based on Runs - Test of randomness - The Kolmogorov Tests.		
UNIT – V	STATISTICAL QUALITY CONTROL	9+3
Control charts for measurements (X and R charts) - Control charts for attributes (p,c,np charts) - Tolerance Limits - Acceptance Sampling.		
		Total Contact Hours :60
Course Outcomes:	On completion of the course, the students would be able to	
CO1	Understand the basic concepts of Probability and Random variables and apply in Engineering applications.	
CO2	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.	
CO3	Apply the concept of Two dimensional random variable in Engineering disciplines	
CO4	Use the concept of non-parametric testing for Non-Normal population.	
CO5	Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control	

Textbooks:	
1.	Johnson. R.A., Miller. I.R and Freund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9 th Edition, 2016.
2.	Milton. J. S. and Arnold.J.C., "Introduction to Probability and Statistics", Tata


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	Mc Graw Hill, 4th Edition, 2007.
3.	John E. Freund, "Mathematical Statistics", Prentice Hall, 5 th Edition, 1992.

Reference books/other materials/webresources:

1.	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12 th Edition, 2020.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8 th Edition, 2014.
3.	Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5 th Edition, Elsevier, 2014.
4.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4 th Edition, 2012.
5.	Walpole.R.E., Myers.R.H., Myers S.L. and Ye.K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9 th Edition, 2010.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	2	-	2	-	-	-
CO2	3	3	-	-	-	-	-	-	2	-	2	-	-	-
CO3	3	3	-	-	-	-	-	-	2	-	2	-	-	-
CO4	3	3	3	2	-	-	-	-	2	-	2	-	-	-
CO5	3	3	2	2	-	-	-	-	2	-	2	-	-	-
Average:	3	3	2.5	2	-	-	-	-	2	-	2	-	-	-

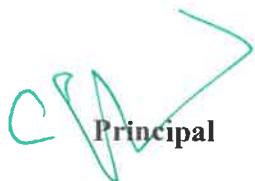

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Subject Code	Subject Name	Category	L	T	P	C
CH24401	CHEMICAL ENGINEERING THERMODYNAMICS-I	PCC	3	0	0	3
Course Objectives: The course is aimed to enable the students to						
Learn PVT behaviour of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.						

UNIT – I	9
Terminologies of thermodynamics, the variables and quantities of thermodynamics, characteristics of systems and processes, energy classifications, point and path functions, energy in transition work and heat. Zeroth law; temperature scales	
UNIT – II	9
The first law of thermodynamics, statements of first law for the flow and non-flow processes. PVT behaviour of fluids; Mathematical representation of PVT behaviour; generalized compressibility factor correlation; generalized equations of state	
UNIT – III	9
Joule's experiment, energy balance for closed systems, mass and energy balance for open systems, Statements of the second law of thermodynamics, heat engine and refrigerator, Carnot cycle and Carnot theorems, thermodynamic temperature scale, entropy and its calculation, second law of thermodynamics for a control volume, Third law of thermodynamics, entropy from a microscopic point of view.	
UNIT – IV	9
Thermodynamic properties – internal energy, enthalpy, Helmholtz free energy, Gibbs free energy; thermodynamic property relations – Maxwell relations – partial derivatives and Jacobian method; residual properties; thermodynamic property tables and diagrams.	
UNIT – V	9
Thermodynamic aspects of compression, expansion processes and duct flow of compressible fluids, steam power plant.	
Total Contact Hours :45	
Course Outcomes:	On the completion of the course students are expected to
CO1	Understand the fundamental concepts of thermodynamics and its related functions
CO2	Relate PVT behaviour of fluids and understand the real gas behavior
CO3	Apply second law and analyse the feasibility of system/devices
CO4	Analyse the thermodynamic property relations and their application to fluid flow
CO5	Develop the significance of thermodynamic potentials and their use in the analysis of processes and formulate thermodynamic formulations and the working of compressors and expanders


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Textbooks:

1.	Smith J.M., VanNess,H.C., &Abbot M.C,," Introduction to Chemical Engineering Thermodynamics",McGraw Hill VII Edition 2009
2.	Kyle B.G.,,"Chemical and Process Thermodynamics", Pearson International third Edition.
3.	Rao Y.V.C.,,"Chemical Engineering Thermodynamics"Universities Press, 2005
4.	Koretsky.,Engineering and Chemical thermodynamics, Wiley,2011

Reference books/other materials/webresources:

1.	Sandler,S.I.,," Chemical and Engineering Thermodynamics",IVEdition,Wiley,2006.
2.	Narayanan K.V,"A Text Book of Chemical Engineering Thermodynamics"Prentice Hall of India Pvt.Ltd,2 nd edition,2013.
3.	Kevin Douglas, Fundamentals of Chemical Engineering Thermodynamics, Timothy Anderson,2015

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	-	2	1	-	3	-	-
CO2	3	2		2	1	-	-	1	1	-	1	-	-	-
CO3	3	3	3	2	-	2	1	3	2	1	1	3	2	2
CO4	2	2	2	2	2	1	2	3	1	2	2	2	3	2
CO5	2	2	1	-	-	1	2	1	1	2	-	-	2	1
Average:	3	3	3	2	2	2	2	2	3	2	2	2	2	2


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Subject Code	Subject Name	Category	L	T	P	C
CH24402	HEAT TRANSFER	PCC	3	0	0	3
Course Objectives: The course is aimed to						
Teach the fundamental concepts of heat transfer viz., conduction, convection, radiation, boiling and condensation and its application to the students						

UNIT – I		9
Importance of heat transfer in Chemical Engineering operations - Modes of heat transfer ; One dimensional steady state heat conduction through plane and composite walls, hollow cylinder and spheres - Thermal conductivity measurement-effect of temperature on thermal conductivity; Heat transfer in extended surfaces; Transient heat conduction		
UNIT – II		11
Concepts of heat transfer by convection - Natural and forced convection, Hydrodynamic and thermal Boundary layers; analogies between transfer of momentum and heat - Reynold's analogy, Prandtl and Colburn analogy. Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate.		
UNIT – III		9
Heat Exchangers – classification and design, overall and individual film coefficients, mean temperature difference, LMTD correction factor for multiple pass exchanger, NTU and efficiency of Heat exchangers		
UNIT – IV		8
Heat transfer to fluids with phase change - heat transfer from condensing vapours, drop wise and film wise condensation, Nusselt equation for vertical and horizontal tubes, condensation of superheated vapours, Heat transfer to boiling liquids - mechanism of boiling, nucleate boiling and film boiling		
UNIT – V		8
Evaporation- single and multiple effect operation, material and Energy balance in evaporators, boiling point elevation, Duhring's rule. Radiation heat transfer - Black body radiation, Emissivity, Stefan - Boltzman law, Plank's law, radiation between surfaces.		
		Total Contact Hours :45
Course Outcomes:	On the completion of the course students are expected to	
CO1	Familiarize the students with the fundamental concepts of Heat Transfer. provide the student with knowledge about heat transfer by conduction in solids for steady state.	
CO2	Understand convective heat transfer and use of heat transfer coefficients for laminar and turbulent flows	
CO3	Students will be able to calculate and use overall heat transfer coefficients in designing heat exchangers	
CO4	The course provides the student with knowledge about heat transfer with phase change (boiling and condensation) and evaporation	
CO5	Students will understand radiative heat transfer including blackbody radiation and Kirchoff's law, and will be able to solve radiative problems apply knowledge of heat transfer to solve thermal engineering problems	


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Textbooks:	
1.	Holman, J. P., 'Heat Transfer', 10th Edn., McGraw Hill, 2010.
2.	Ozisik, M. N., Heat Transfer: A Basic Approach, McGraw-Hill, 1984
3.	Kern, D.Q., "Process Heat Transfer ", McGraw-Hill, 1999.
4.	B.K. Dutta, Heat transfer principles and applications, PHI Learning PVT Ltd, 2016

Reference books/other materials/webresources:	
1.	McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 6th Edn., McGraw-Hill, 2001.
2.	Coulson, J.M. and Richardson, J.F., "Chemical Engineering " Vol. I, 4th Edn., Asian Books Pvt. Ltd., India, 1998

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	-	-	-	-	1	2	2	2
CO2	2	2	3	3	2	1	1	1	1	1	-	1	2	2
CO3	3	2	2	2	2	1	1	1	1	-	1	1	1	1
CO4	2	2	3	2	3	1	-	-	-	-	2	2	1	1
CO5	2	3	3	2	3	1	-	1	-	1	1	2	2	1
Average:	3	2	3	3	2	2	1	1	1	1	1	2	2	2

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Subject Code	Subject Name	Category	L	T	P	C
CH24403	CHEMICAL TECHNOLOGY	PCC	3	0	0	3
Course Objectives: The course is aimed to						
To gain knowledge on various aspects of production engineering and understand the practical methods of production in a chemical factory.						

UNIT – I	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.		
UNIT – II	FERTILIZER INDUSTRY	9
Major Components of Fertilizer industries – Nitrogen industries, ammonia, nitric acid, urea – Phosphorus industries, Phosphoric acid, Single Super Phosphate, DAP, MAP and NPK – Potassium chloride, Potassium Sulphate – Liquid Fertilizers – Bio Fertilizers.		
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 and Alkylation – petrochemicals – methanol, chloro methanol, Acetylene and ethylene, Isopropanol, Acrylonitrile, Butadiene – Chemicals from Aromatics - Benzene, Toluene and Xylene.		
UNIT – V	OILS, FATS, SOAPS, DETERGENT, RUBBER AND POLYMER INDUSTRIES	9
Hydrogenation of oils, fatty acids and alcohols, waxes, soaps, synthetic detergents- Polymerisation processes – different types - Natural rubber; Synthetic rubber such as SBR, NBR, CR – Fundamental methods of processing of synthetic Rubbers.		
		Total Contact Hours :45
Course Outcomes:	On the completion of the course students are expected to	
CO1	Understand the importance of Sulfur, Sulfuric Acid and Cement Industries	
CO2	Express Their Knowledge in Fertilizer Industry	
CO3	Demonstrate A Strong Foundational Knowledge in Pulp, Paper, Sugar and Starch Industries	
CO4	Understand The Importance of Petroleum and Petro Chemical Industries	
CO5	Understand The Importance of Oils, Fats, Soaps, Detergent, Rubber and Polymer Industries	

Textbooks:	
1.	Dryden, C.E, Outlines of Chemical technology, II Ed., Affiliate East West press, 2003.
2.	Moulin, J.A., M. Makkee, and Diepen, A.V., Chemical Process Technology, Wiley, Second edition 2013.


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Reference books/other materials/webresources:

1. Austin, G.T., Shreve's "Chemical Process Industries", 5th ed., McGraw-Hill, 2017.
2. Srikumar Koyikkal, "Chemical Process Technology and Simulation", PHI Learning Ltd.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	1	-	-	-	-	1	2	3	2
CO2	2	2	3	3	2	1	1	1	1	1	-	2	2	2
CO3	3	2	2	2	2	1	1	1	1	-	1	1	1	1
CO4	2	3	3	2	3	1	-	-	-	-	2	2	2	2
CO5	2	3	3	2	3	1	-	1	-	1	1	2	2	3
Average:	2	2	3	2	2	1	1	1	1	1	1	2	2	2

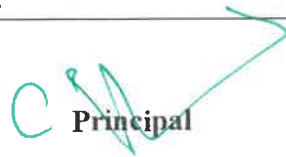

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Subject Code	Subject Name	Category	L	T	P	C
CH24404	MASS TRANSFER-I	PCC	3	0	0	3
Course Objectives: The course is aimed to						
Learn and determine mass transfer rates under laminar and turbulent conditions and apply these concepts in the design of humidification columns, dryers and crystallisers.						

UNIT – I	MOLECULAR DIFFUSION	9+3
Introduction to mass transfer operations. Molecular diffusion in gases, liquids and solids. Diffusivity measurement and prediction; multi-component diffusion.		
UNIT – II	CONVECTIVE TRANSFER AND INTERPHASE MASS TRANSFER	9+3
Eddy diffusion, concept of mass transfer coefficients, theories of mass transfer, different transport analogies, application of correlations for mass transfer coefficients, inter phase mass transfer, relationship between individual and overall mass transfer coefficients. NTU and NTP concepts, Stage-wise and differential contractors.		
UNIT – III	HUMIDIFICATION OPERATIONS	9+3
Humidification – Equilibrium, humidity chart, adiabatic and wet bulb temperatures; humidification operations; theory and design of cooling towers, dehumidifiers and humidifiers using enthalpy transfer unit concept.		
UNIT – IV	DRYING	9+3
Drying – Equilibrium. Classification of dryers, batch drying – Mechanism and time of cross through circulation drying, theoretical estimation of drying rate and time. Continuous dryers – material and energy balance. Advance drying techniques such as freeze drying, microwave drying		
UNIT – V	CRYSTALLIZATION	9+3
Crystal geometry. Equilibrium, yield and purity of products, theory of super saturation, nucleation and crystal growth, classification of crystallizers, design of batch crystallizers and continuous crystallizers.		
		Total Contact Hours :60
Course Outcomes:	On the completion of the course students are expected to	
CO1	Understand the fundamentals, types and mechanism of mass transfer operations	
CO2	Understand the theories of mass transfer and the concept of inter-phase mass transfer	
CO3	Understand the basics of humidification process and its application	
CO4	Understand the concept and mechanism of drying operations	
CO5	Understand the concept of crystallization process and identification of suitable crystallizer and formulate to solve material balances for unit operations such as humidification, drying and crystallization operations	

Textbooks:	
1.	Treybal, R. E., “Mass Transfer Operations”, 3rd Edition, McGraw-Hill, 2017.
2.	Geankoplis, C.J., “Transport Processes and Unit Operations”, 4th Edition, Prentice Hall Inc., New Jersey, 2003.
3.	Narayanan K.V. and Lakshmikutty, B “Mass Transfer – Theory and Applications”, 1st Edition, CBS Publishers & Distributors Pvt Ltd, New Delhi, 2014.

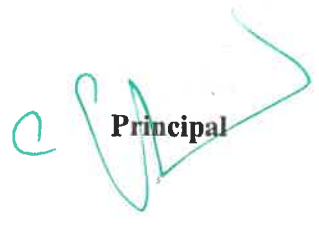

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Reference books/other materials/webresources:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edition., McGraw-Hill, 2005.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I and II, 5th Edition, Asian Books Pvt. Ltd., India, 2002.
3. Seader J.D. and Henley E.J., "Separation Process Principles", 4th Ed., John Wiley, 2016

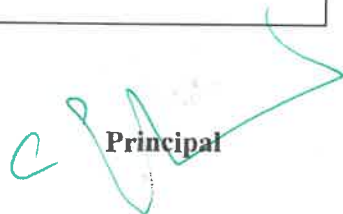
CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	3	1	-	-
CO2	3	3	3	-	-	-	-	-	-	-	3	1	-	-
CO3	3	3	3	-	-	-	-	-	-	-	3	1	-	-
CO4	3	3	3	-	-	1	1	-	-	-	3	1	1	-
CO5	3	3	3	-	-	1	1	-	-	-	3	1	1	-
Average:	3	3	3	-	-	1	1	-	-	-	3	1	1	-


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Subject Code	Subject Name	Category	L	T	P	C
GE24451	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	BSC	2	0	0	2
Course Objectives:						
To study the interrelationship between living organism and environment.						
To finding and implementing scientific, technological, economic and political solutions to environmental problems.						
To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.						
To study the dynamic processes and understand the features of the earth's interior and surface.						
To study the integrated themes and biodiversity, natural resources, pollution control and waste management.						

UNIT – I	ENVIRONMENT AND BIODIVERSITY	6
Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.		
UNIT – II	ENVIRONMENTAL POLLUTION	6
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.		
UNIT – III	NATURAL RESOURCES	6
Forest resources: Use and over-exploitation, deforestation, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. New Renewable Energy Sources: Hydrogen energy, Solar energy, wind energy, Tidal energy, Ocean thermal energy and Geothermal energy. Role of an individual in conservation of natural resources.		
UNIT – IV	SUSTAINABILITY PRACTICES	6
Zero waste and R concept, Circular economy, Material Life cycle assessment, Environmental Impact Assessment, ISO 14000 Series, Green buildings. Water conservation, rain water harvesting. Issues and possible solutions – climate change, global warming. Concept of Carbon Credit and Carbon Footprint. Development and GDP. Environmental management in industry-A, case study.		
UNIT – V	SOCIAL ISSUES AND POPULATION	6
Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies. Urban problems related to energy.		
		Total Contact Hours :30
Course Outcomes:	On the completion of the course students are expected to	


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CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3	To apply knowledge on the conservation of natural resources by keeping the sustainable development as a main goal.
CO4	To identify the importance of Development as a standard of living otherwise that leads to serious environmental disasters.
CO5	To demonstrate the knowledge about human population and its drastic change which will eventually lead to unsustainable development.

Textbooks:

1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
6.	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

Reference books/other materials/web resources:

1.	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
2.	Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3.	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4.	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015
5.	Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient BlackswanPvt. Ltd. 2013.

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	2	-	-	-	-	-
CO3	2	-	-	-	-	2	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	2	-	-	2	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average:	2	-	-	-	-	2	-	-	2	-	-	-	-	-


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Subject Code	Subject Name	Category	L	T	P	C
CH24411	TECHNICAL ANALYSIS LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- To learn basic principles involved in estimation and characterization of industrially important materials.

EXPERIMENTS:

I. Soap Analysis

- Estimation of total fatty acid
- Estimation of percentage alkali content

II. Oil Analysis

- Estimation of free acid
- Determination of Saponification value
- Determination of iodine value

III. Cement Analysis

- Estimation of Silica content
- Estimation of mixed oxide content
- Estimation of calcium oxide content
- Estimation of calcium oxide by rapid method

IV. Coal Analysis

- Estimation of Sulphur present in coal
- Ultimate analysis of coal
- Proximate analysis of coal

V. Analysis of Bleaching Powder

- Estimation of available chlorine

VI. Analysis of Glycerol

- Estimation of purity of glycerol

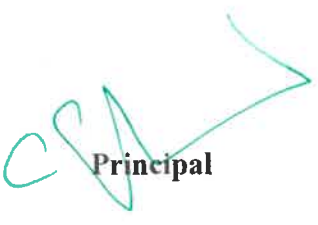
VII. Analysis of fuels

- Flash point
- Fire point
- Cloud point
- Pour point
- Aniline point.

Total Contact Hours :45

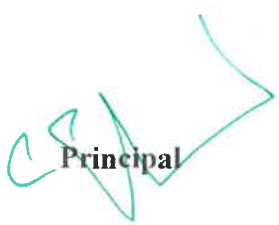
Course Outcomes:	On the completion of the course students are expected to
CO1	Understand the estimation and analysis of Soap.
CO2	Understand the estimation and analysis of Cement Analysis
CO3	Understand the estimation and analysis of Coal Analysis
CO4	Understand the estimation and analysis of Analysis of Glycerol
CO5	Understand the estimation and analysis of Analysis of fuels


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CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	3	3	2	2	2	2	3	2	2	3	3	2	-
CO2	1	2	3	2	2	2	3	3	2	3	3	3	2	1
CO3	1	2	2	-	-	2	2	3	2	2	3	2	2	1
CO4	1	3	3	2	-	-	-	2	2	2	2	2	-	1
CO5	1	3	3	2	3	3	3	2	2	3	3	2	1	2
Average:	1	3	3	3	2	2	3	2	3	2	2	3	3	1


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Subject Code	Subject Name	Category	L	T	P	C
CH24412	HEAT TRANSFER LABORATORY	PCC	0	0	3	1.5
Course Objectives:						
Develop sound practical knowledge for students on different types of heat transfer equipments.						

LIST OF EXPERIMENTS

1. Measurement of Thermal Conductivity of metal rod
2. Performance studies on Cooling Tower
3. Batch drying kinetics using Tray Dryer
4. Heat transfer in Open Pan Evaporator
5. Boiling Heat Transfer
6. Heat Transfer through Packed Bed
7. Heat Transfer in a Double Pipe Heat Exchanger
8. Heat Transfer in a Bare and Finned Tube Heat Exchanger
9. Heat Transfer in a Vertical and Horizontal Condenser
10. Heat Transfer in Helical Coils
11. Heat Transfer in Agitated Vessels
12. Heat transfer studies in Stefan - Boltzmann apparatus

Total Contact Hours :45

Course Outcomes:	On the completion of the course students are expected to
CO1	Apply the concepts of heat transfer and fluid dynamics to the operation of heat transfer equipments.
CO2	Estimate the heat transfer rate and heat transfer co-efficient
CO3	To perform heat transfer operation and to compare observed with predicted performance.
CO4	Evaluate the performance/calculate the parameters in heat transfer equipments.
CO5	Collect and analyse the heat transfer data practically and Conduct experiments to solve complex engineering problems effectively as an individual as well as team work

CO	CO-PO Mapping											CO-PSO Mapping		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	1	2	3	2	2	3	3	-
CO2	3	3	3	2	2	1	1	2	3	2	2	3	3	-
CO3	3	3	3	2	2	1	1	2	3	2	2	3	3	-
CO4	3	3	3	2	2	1	1	2	3	2	2	3	3	-
CO5	3	3	3	3	2	1	1	2	3	2	2	3	3	-
Average:	3	3	3	3	2	1	1	2	3	2	2	3	3	-


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Subject Code	Subject Name	Category	L	T	P	C
CH3513	INDUSTRIAL TRAINING / INTERNSHIP I*	EEC	-	-	-	1

Course Objectives:

To enable the students to

- Get connected with industry/ laboratory/research institute
- Get practical knowledge on production process in the industry and develop skills to solve related problems
- Develop skills to carry out research in the research institutes/laboratories

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.	
	No. of. Weeks: 02
Course Outcomes:	On the completion of the course students are expected to
CO1	Plant layout, machinery, organizational structure and production processes in the firm or research facilities in the laboratory/research institute
CO2	Analysis of industrial / research problems and their solutions
CO3	Documenting of material specifications, machine and process parameters, testing parameters and results
CO4	Preparing of Technical report and presentation


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