NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi

for

B.Tech., Chemical Engineering [R22]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year (2022-23) onwards)

AUGUST 2022

INSTITUTE VISION AND MISSION	
VISION	• To be an Institute of excellence providing quality Engineering, Technology and Management education to meet the ever changing needs of the society.
MISSION	• To provide quality education to produce ethical and competent professionals with social Responsibility • To excel in the thrust areas of Engineering, Technology and Entrepreneurship by solving real- world problems. • To create a learner centric environment and improve continually to meet the changing global needs.

B.TECH. - CHEMICAL ENGINEERING	
VISION	• To produce globally competent engineers in chemical engineering and allied disciplines to meet the growing needs of the society.
MISSION	• To develop skilled and employable graduates to meet the challenges in emerging fields of Engineering and Technology. • To prepare the students for prosperous career in Engineering and Entrepreneurship by inculcating the leadership qualities with professional and ethical responsibilities for the benefit of the society • To provide learner centric environment by imparting quality education to cater the needs of the society
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	The graduates of Chemical Engineering will be **PEO1: Core Competency:** A successful professional with core competency and inter-disciplinary skills to satisfy the Industrial needs. **PEO2: Research, Innovation and Entrepreneurship:** Capable of identifying technological requirements for the society and providing innovative ideas for real time problems. **PEO3: Ethics, Human values and Life-long learning:** Able to demonstrate ethical practices and managerial skills through continuous learning.
PROGRAMME SPECIFIC OUTCOMES (PSO)	The students of Chemical Engineering will be able to **PSO 1:** Identify, formulate and analyze the problems of chemical engineering systems and product development. **PSO 2:** Implement appropriate engineering tools for modeling, simulation, analysis and optimization of chemical processes.

PROGRAM OUTCOMES:

At the end of this programme the students will be able to

a-i	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	PO1	Apply fundamental concept gained from mathematics, science & chemical engineering courses.
b	Problem Analysis	PO2	Design and conduct experiments, as well as to analyze and interpret data.
c	Design and Development of Solutions	PO3	Design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, safety, manufacturability and sustainability.
d	Investigation of Complex Problems	PO4	Apply research methods like design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e	Modern Tool Usage	PO5	Apply modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f	The Engineer and Society	PO6	Infer societal, health, safety, legal & cultural issues and consequent responsibilities relevant to the professional engineering practice.
g	Environment and Sustainability	PO7	Understand the impact of engineering solutions in societal and environmental contexts, and demonstrate the need for sustainable development.
h	Ethics	PO8	Apply ethical principles and commit to professional ethics and responsibilities of the engineering practice.
i	Individual and Team Work.	PO9	Function effectively as an individual / team in diverse and multi-disciplinary environments.
j	Communication	PO10	Communicate effectively through reports, presentations and discussions within both the engineering domain and the community at large.
k	Project Management and Finance	PO11	Demonstrate knowledge and understanding of engineering, management, principles, finance and apply these to manage projects in multidisciplinary environments.
l	Lifelong Learning	PO12	Acknowledge the need for learning and engage in life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Educational Objectives and the Outcomes is given in the following table

Program Educational Objectives (PEOs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	2	3	3	2	2	1	1	2	1
2	3	3	3	3	2	3	3	2	2	2	2	1
3	3	1	2	1	1	2	3	3	2	1	1	3

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

Program Specific Outcomes (PSOs)	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	2	2	1	2	3	2	3	-	-	-
2	3	2	1	2	3	2	2	2	2	-	1	1

Contribution 1: Reasonable 2: Significant 3: Strong

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE - 638 052

REGULATIONS - 2022(R22) CHOICE BASED CREDIT SYSTEM (CBCS)

B.TECH - CHEMICAL ENGINEERING

CURRICULAM: I to VIII SEMESTER SYLLABUS: I to IV SEMESTER

SEMESTER: I									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	22MAN01	Induction Programme	MC	-	-	-	-	-	-
THEORY									
2	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
3	22MYB01	Calculus and Linear Algebra*	BSC	-	4	3	1	0	4
4	22CYB03	Chemistry	BSC	-	3	3	0	0	3
5	22EEC01	Basic Electrical and Electronics Engineering	ESC	-	3	3	0	0	3
6	22MEC01	Engineering Graphics	ESC	-	4	2	0	2	3
7	22GYA01	தமிழர் மரபு / Heritage of Tamils*	HSMC	-	1	1	0	0	1
PRACTICALS									
8	22CYP01	Chemistry Laboratory*	BSC	-	2	0	0	2	1
9	22GEP01	Engineering Practices Laboratory	ESC	-	4	0	0	4	2
MANDATORY NON-CREDIT COURSES									
10	22MAN02	Soft/Analytical Skills - I	MC	-	3	1	0	2	0
11	22MAN03	Yoga - I*	MC	-	1	0	0	1	0
				TOTAL	**29**	**13**	**1**	**15**	**20**

*Ratified by Eleventh Academic Council

SEMESTER: II									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22EYA02	Professional Communication-II	HSMC	-	4	2	0	2	3
2	22MYB02	Partial Differential Equations And Transforms Techniques*	BSC	-	4	3	1	0	4
3	22PYB02	Advanced Material and Nano Technology	BSC	-	3	3	0	0	3
4	22CYB06	Environmental Science & Sustainability*	BSC	-	3	3	0	0	3
5	22CSC01	Problem Solving and C Programming*	ESC	-	3	3	0	0	3
6	22CHC01	Fundamentals of Chemical Engineering*	PCC	-	3	3	0	0	3
7	22GYA02	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology*	HSMC	-	1	1	0	0	1
PRACTICALS									
8	22PYP01	Physics laboratory*	BSC	-	2	0	0	2	1
9	22CSP01	Problem Solving and C Programming Laboratory*	ESC	-	4	0	0	4	2
MANDATORY NON-CREDIT COURSES									
10	22MAN04	Soft / Analytical Skills - II	MC	-	3	1	0	2	0
11	22MAN05	Yoga - II*	MC	-	1	0	0	1	0
				TOTAL	**31**	**19**	**1**	**11**	**23**

*Ratified by Eleventh Academic Council

SEMESTER: III									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4
2	22MEC08	Basics of Mechanical Engineering	ESC	-	3	3	0	0	3
3	22CHC02	Chemical Engineering Fluid mechanics	PCC	22CHC01	3	3	0	0	3
4	22CHC03	Chemical Process Calculation	PCC	22CHC01	3	3	0	0	3
5	22CHC04	Unit Processes for Chemical Engineers	PCC	-	3	3	0	0	3
6	22CHC05	Mechanical Operations	PCC	22CHC01	3	3	0	0	3
PRACTICALS									
7	22CHP01	Fluid Mechanics Laboratory	PCC	22CHC02	4	0	0	4	2
8	22CHP02	Chemical Analysis Laboratory	PCC	-	4	0	0	4	2
MANDATORY NON-CREDIT COURSES									
9	22MAN07	Soft / Analytical Skills - III	MC	-	5	3	0	2	0
10	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
				TOTAL	**33**	**22**	**1**	**10**	**23**

SEMESTER: IV									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CHC06	Chemical Reaction Engineering	PCC	-	3	2	1	0	3
2	22CHC07	Process Heat Transfer	PCC	22CHC01	3	2	1	0	3
3	22CHC08	Chemical Engineering Thermodynamics	PCC	-	3	3	0	0	3
4	22CHC09	Mass Transfer I	PCC	22CHC01	3	2	1	0	3
5	22CHC10	Instrumental Methods of Analysis	PCC	-	3	3	0	0	3
6	22CHC11	Chemical Process Industries	PCC	22CHC01	3	3	0	0	3
PRACTICALS									
7	22CHP03	Heat Transfer laboratory	PCC	22CHC07	4	0	0	4	2
8	22CHP04	Mechanical Operation Laboratory	PCC	22CHC05	4	0	0	4	2
MANDATORY NON-CREDIT COURSES									
9	22MAN08	Soft/Analytical Skills - IV	MC	-	5	3	0	2	0
10	22GED01	Personality and Character Development	EEC	-	1	0	0	1	0
				TOTAL	**31**	**18**	**3**	**11**	**22**

SEMESTER: V									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CHC12	Mass Transfer II	PCC	22CHC01	3	2	1	0	3
2	22CHC13	Process Engineering Economics	PCC	-	3	2	1	0	3
3	22CHC14	Process Dynamics and Control	PCC	-	3	2	1	0	3
4	E1	Elective	PEC	-	3	3	0	0	3
5	E2	Elective	PEC	-	3	3	0	0	3
6	E3	Elective	PEC/OEC	-	3	3	0	0	3
PRACTICALS									
7	22CHP05	Chemical Reaction Engineering Laboratory	PCC	22CHC06	4	0	0	4	2
8	22CHP06	Mass Transfer Laboratory	PCC	22CHC12	4	0	0	4	2
MANDATORY NON-CREDIT COURSES									
9	22MAN10	Soft/Analytical Skills - V	MC	-	3	1	0	2	0
10	22MAN11	Certification Course - I	MC	-	1	0	0	1	0
				TOTAL	**30**	**16**	**3**	**11**	**22**

SEMESTER: VI									
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CHC15	Transport Phenomena	PCC	-	3	2	1	0	3
2	22CHC16	Process Modeling and Simulation	PCC	-	3	2	1	0	3
3	E4	Elective	PEC	-	3	3	0	0	3
4	E5	Elective	PEC	-	3	3	0	0	3
5	E6	Elective	OEC	-	3	3	0	0	3
6	E7	Elective	PEC/OEC	-	3	3	0	0	3
PRACTICALS									
7	22CHP07	Process Control Laboratory	PCC	22CHC14	4	0	0	4	2
8	22CHP08	Process Modeling and Simulation Laboratory	PCC	22CHC16	4	0	0	4	2
MANDATORY NON-CREDIT COURSES									
9	22MAN12	Soft/Analytical Skills - VI	MC	-	3	1	0	2	0
10	22MAN13	Certification Course - II	MC	-	1	0	0	1	0
				TOTAL	**30**	**17**	**2**	**11**	**22**

SEMESTER: VII									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22GEA01	Human Values and Ethics	HSMC	-	2	2	0	0	2
2	EM1	Elective (Management)	HSMC	-	3	3	0	0	3
3	E8	Elective	PEC	-	3	3	0	0	3
4	E9	Elective	PEC	-	3	3	0	0	3
5	E10	Elective	OEC	-	3	3	0	0	3
PRACTICALS									
6	22CHP09	Process Computation laboratory	PCC	-	4	0	0	4	2
7	22CHP10	Chemical Equipment Design laboratory	PCC	-	4	0	0	4	2
8	22GED02	Industrial Training / Internships*	EEC	-	2	0	0	2	1
				TOTAL	**24**	**14**	**0**	**9**	**19**

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

SEMESTER: VIII									
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICALS									
1	22CHD01	Project Work	EEC		20	0	0	20	10
				TOTAL	20	0	0	20	10

(A) HSMC, MC, BSC, ESC and PCC Courses										
Humanities, Social Science and Management Courses (HSMC)				**AICTE Credit Distribution Norm :12**						
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**	**P.S**
1	22EYA01	Professional Communication – I	HSMC	-	4	2	0	2	3	1
2	22GYA01	Heritage Of Tamils (தமிழர் மரபு)	HSMC	-	1	1	0	0	1	1
3	22EYA02	Professional Communication-II	HSMC	-	4	2	0	2	3	2
4	22GYA02	Tamils and Technology	HSMC	-	1	1	0	0	1	2
5	22GEA02	Human Values and Ethics	HSMC		2	2	0	0	2	7
6	E M1	Elective (Management)	HSMC		3	3	0	0	3	7

Mandatory Courses (MC)										
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**	**P.S**
1	22MAN01	Induction Programme	MC	-	0	0	0	0	0	1
2	22MAN02	Soft/Analytical Skills – I	MC	-	3	1	0	2	0	1
3	22MAN03	Yoga – I	MC	-	1	0	0	1	0	1
4	22MAN04	Soft / Analytical Skills - II	MC	-	3	1	0	2	0	2
5	22MAN05	Yoga - II	MC	-	1	0	0	1	0	2
6	22MAN07	Soft / Analytical Skills - III	MC	-	1	1	0	0	0	3
7	22MAN09	Constitutions of India	MC	-	5	3	0	2	0	3
8	22MAN08	Soft/Analytical Skills - IV	MC	-	0	0	0	1	0	4
9	22MAN10	Soft/Analytical Skills - V	MC		3	1	0	2	0	5
10	22MAN11	Certification Course - I	MC		1	0	0	1	0	5
11	22MAN12	Soft/Analytical Skills - VI	MC		3	1	0	2	0	6
12	22MAN13	Certification Course - II	MC		1	0	0	1	0	6

Basic Science Courses (BSC)				AICTE Credit Distribution Norm :25						
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	22MYB01	Calculus and Linear Algebra	BSC	-	3	3	1	0	4	1
2	22CYB03	Chemistry	BSC	-	3	3	0	0	3	1
3	22CYP01	Chemistry Laboratory	BSC	-	2	0	0	2	1	1
4	22MYB02	Partial Differential Equations And Transforms Techniques	BSC	-	4	3	1	0	4	2
5	22PYB02	Advanced Material and Nano Technology	BSC	-	3	3	0	0	3	2
6	22CYB07	Environmental Science & Sustainability	BSC	-	3	3	0	0	3	2
7	22PYP01	Physics laboratory	BSC	-	2	0	0	2	1	2
8	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4	3

Engineering Science Courses (ESC)				AICTE Credit Distribution Norm:24						
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	22EEC01	Basic Electrical and Electronics Engineering	ESC	-	3	3	0	0	3	1
2	22MEC01	Engineering Graphics	ESC	-	3	2	0	2	3	1
3	22GEP01	Engineering Practices Laboratory	ESC	-	4	0	0	4	2	1
4	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3	2
5	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2	2
6	22MEC08	Basics of Mechanical Engineering	ESC	-	3	3	0	0	3	2

Professional Core Courses (PCC)				AICTE Credit Distribution Norm :48						
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	22CHC01	Fundamentals of Chemical Engineering	PCC	-	3	3	0	0	3	1
2	22CHC02	Chemical Engineering Fluid mechanics	PCC	22CHC01	3	3	0	0	3	3
3	22CHC03	Chemical Process Calculation	PCC	22CHC01	3	3	0	0	3	3
4	22CHC04	Unit Processes for Chemical Engineers	PCC	-	3	3	0	0	3	3
5	22CHC05	Mechanical Operations	PCC	22CHC01	3	3	0	0	3	3
6	22CHP01	Fluid Mechanics Laboratory	PCC	22CHC02	4	0	0	4	2	3
7	22CHP02	Chemical Analysis Laboratory	PCC	-	4	0	0	4	2	3
8	22CHC06	Chemical Reaction Engineering	PCC	-	3	2	1	0	3	4
9	22CHC07	Process Heat Transfer	PCC	22CHC01	3	2	1	0	3	4
10	22CHC08	Chemical Engineering Thermodynamics	PCC	-	3	3	0	0	3	4
11	22CHC09	Mass Transfer I	PCC	22CHC01	3	2	1	0	3	4
12	22CHC10	Instrumental Methods of Analysis	PCC	-	3	3	0	0	3	4
13	22CHC11	Chemical Process Industries	PCC	22CHC01	3	3	0	0	3	4
14	22CHP03	Heat Transfer laboratory	PCC	22CHC07	4	0	0	4	2	4
15	22CHP04	Mechanical Operation Laboratory	PCC	22CHC05	4	0	0	4	2	4
16	22CHC12	Mass Transfer II	PCC		3	2	1	0	3	5
17	22CHC13	Process Engineering Economics	PCC		3	2	1	0	3	5
18	22CHC14	Process Dynamics and Control	PCC		3	2	1	0	3	5
19	22CHP05	Chemical Reaction Engineering Laboratory	PCC	22CHC06	4	0	0	4	2	5
20	22CHP06	Mass Transfer Laboratory	PCC	22CHC12	4	0	0	4	2	5
21	22CHC15	Transport Phenomena	PCC		3	2	1	0	3	6

22	22CHC16	Process Modeling and Simulation	PCC		3	3	0	0	3	6
23	22CHP07	Process Control Laboratory	PCC	22CHC14	4	0	0	4	2	6
24	22CHP08	Process Modeling and Simulation Laboratory	PCC	22CHC16	4	0	0	4	2	6
25	22CHP09	Process Computation laboratory	PCC		4	0	0	4	2	7
26	22CHP10	Chemical Equipment Design laboratory	PCC		4	0	0	4	2	7

Employability Enhancement Courses (EEC)				**AICTE Credit Distribution Norm :15**						
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**	**P.S**
1	22GED01	Personality and Character Development	EEC	-	5	3	0	2	0	4
2	22GED02	Industrial training/ Internships II**	EEC	-	2	0	0	2	1	7
3	22CHD01	Project Work	EEC		20	0	0	20	10	8

SUMMARY

B.TECH. CHEMICAL ENGINEERING										
S. No	**SUBJECT AREA**	**CREDITS AS PER SEMESTER**								**TOTAL CREDITS**	**Percentage (%)**
		I	II	III	IV	V	VI	VII	VIII		
1	HSMC	4	4					5		13	8.1
2	BSC	8	11	4						23	14.3
3	ESC	8	5	3						16	10
4	PCC		3	16	22	13	10	4		68	42.2
5	PEC					6	6	6		18	11.2
6	OEC					3	6	3		12	7.4
7	EEC							1	10	11	6.8
	TOTAL	20	23	23	22	22	22	19	10	161	100
	Non Credit/ Mandatory	3	2	2	2	2	2				

22EYA01 - PROFESSIONAL COMMUNICATION - I (*Common to All Branches*)					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To build essential English skills to address the challenges of communication in today's work environment	1.1	The students will be able to apply knowledge of communication and language processes occur in various work environment		
2.0	To comprehend the various dimensions of communication by employing LSRW skills	2.1	The students will be able to involve in diverse discourse forms utilizing LSRW skills		
3.0	To deploy students in contextual initiatives by assisting them in developing communication abilities	3.1	The students will be able to participate actively in communication activities that enhance their creative skill		
4.0	To facilitate students in comprehending the intent, target audience and environments of various forms of communication	4.1	The students will be able to associate with the target audience and contexts using varied types of communication		
5.0	To enhance coherence, cohesion, and proficiency in both verbal and nonverbal communication in the workplace environment	5.1	The students will be able to convey the idea distinctly both in verbal and non verbal communication in work culture		

UNIT I –INTRODUCTORY SKILLS	**(6+6)**
Grammar – Parts of Speech – Verb (Auxiliaries – Primary & Modal, Main Verb) -**Listening** – Listening to Short Conversations or Monologues - Listening to Experiences – Listening to Descriptions- **Speaking** – Introducing Oneself – Exchanging Personal information - Talking about food and culture - **Reading**– Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting - **Writing** - Seeking Permission for Industrial Visit & In-plant Training	
UNIT II – LANGUAGE ACUMEN	**(6+6)**
Grammar – Word Formation – Tenses (Present Tense) – Synonyms & Antonyms - **Listening** – Listening to Announcements – Listening to Interviews - Listening and Note-taking - **Speaking** – Talking about Holidays & Vacations – Narrating Unforgettable Anecdotes - **Reading** – Skimming – Scanning (Short Texts and Longer Passages) – Critical Reading - **Writing** – Instruction – Process Description	
UNIT III – COMMUNICATION ROOTERS	**(6+6)**
Grammar– Cause and Effect – Tenses (Past Tense) – Discourse Markers - **Listening** – Listening to Telephonic Conversations – Listening to Podcasts - **Speaking** – Talking about neoteric Technologies – Eliciting information to fill a form - **Reading** –Book Reading(Motivational) - Practising Speed Reading (reading newspaper reports & biographies) - **Writing** – Checklist – Circular, Agenda & Minutes of the Meeting	

UNIT IV – DISCOURSE FORTE	(6+6)
Grammar – Tenses (Future Tense) –Yes/No & WH type questions – Negatives - **Listening** – Listening to TED/ Ink talks -**Speaking** – Participating in Short Conversations - **Reading** – Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - **Writing** - E-Mail Writing	
UNIT V – LINGUISTIC COMPETENCIES	**(6+6)**
Grammar – Articles – Homophones & Homonyms – Single line Definition – Phrasal Verb - **Listening** – Intensive listening to fill in the gapped text - **Speaking** –Expressing opinions through Situations & Role play- **Reading** – Cloze Texts - **Writing** – Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. Grammar
2. Listening Skills
3. Speaking Skills
4. Reading Skills
5. Writing Skills

TOTAL (L:30 , P:30) = 60 PERIODS

TEXT BOOK:

1. Shoba, K N, Deepa Mary Francis, "English for Engineers and Technologists", Volume 1, 3rd Edition, Orient BlackSwan Pvt.Ltd, Telangana, 2022.

REFERENCES:

1. Koneru, Aruna, "English Language Skills", Tata McGraw Hill Education (India) Private Limited, Chennai, 2006.
2. Hewings M, "Advanced English Grammar", Cambridge University Press, Chennai, 2000.
3. Jack C Richards, Jonathan Hull and Susan Proctor, "Interchange", Cambridge University Press, New Delhi, 2015 (Reprint 2021).

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

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	3	3	-	2	1	-
2	-	-	-	-	-	-	-	-	3	3	-	2	1	-
3	-	-	-	-	-	-	-	-	3	3	-	2	1	-
4	-	-	-	-	-	-	-	-	3	3	-	2	1	-
5	-	-	-	-	-	-	-	-	3	3	-	2	1	-
CO (W.A)	-	-	-	-	-	-	-	-	**3**	**3**	-	**2**	**1**	-

22MYB01 - CALCULUS AND LINEAR ALGEBRA *(Common to All Branches)*			
L	**T**	**P**	**C**
3	**1**	**0**	**4**

PRE REQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes	
1.0	To develop the use of matrix algebra techniques needed by engineers for practical applications.	**1.1**	The students will be able to apply the concept of orthogonal reduction to diagonalise a given matrix.
2.0	To use the techniques, skills and engineering tools necessary for engineering practice, with geometric concepts.	**2.1**	The students will be able to identify the geometric aspects of plane, straight line and sphere.
3.0	To improve the ability of the students in solving geometrical applications of differential calculus problems.	**3.1**	The students will be able to evaluate the radius of curvature, circle of curvature and centre of curvature for a given curve.
4.0	To learn the important role of mathematical concepts in engineering applications with the functions of several variables.	**4.1**	The students will be able to calculate the maxima and minima for a given function with several variables by finding the stationary points.
5.0	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.	**5.1**	The students will be able to evaluate the area and volume by double and triple integrals.

UNIT I - MATRICES	**(6+3)**
Characteristic Equation - Eigen values and Eigen vectors of a matrix - Cayley Hamilton Theorem (excluding proof) and its applications - Quadratic form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II – ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(6+3)**
Equation of plane – Angle between two planes – Equation of straight lines - Coplanar lines –Equation of sphere – Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(6+3)**
Curvature – Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(6+3)**
Partial derivatives - Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V -MULTIPLE INTEGRALS	**(6+3)**
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral- Triple integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL (L:30+T:15) :45 PERIODS	

LIST OF PROGRAMS USING MATLAB (Assignment/Online Test**)**:

1. Introduction to MATLAB
2. Matrix operations – Addition, Multiplication, Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

1. Dr.B.S.Grewal, Higher Engineering mathematics, 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig , Advanced Engineering mathematics , 9th Edition , JOHN Wiley & sons ,2013
3. Veerarajan.T, Engineering Mathematics of semester I & II, Third Edition, Tata McGraw Hill. ,2016

REFERENCES:

1. N.P.Bali, Manish Goyal, A Text book of Engineering Mathematics -Sem-II", 6th Edition, Laxmi Publications, 2014.
2. Kandasamy.P, Thilagavathy.K, Gunavathy .K, Engineering Mathematics for first year, 9th Rev.Ed, S.Chand & Co Ltd, 2013.
3. Glyn James, Advanced Engineering Mathematics , 7th Edition, Wiley India, 2007

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	1	-	-	-	1	-	2	2	2	1
2	3	2	2	-	1	1	-	-	1	-	-	2	2	-
3	3	2	2	-	1	-	-	-	-	-	-	2	2	-
4	3	2	2	1	1	-	-	-	1	-	-	2	2	-
5	3	2	2	1	1	-	-	-	1	-	1	2	2	1
CO (W.A)	3	2	2	1	1	1	-	-	1	-	2	2	2	1

*Ratified by Eleventh Academic Council

22CYB03 CHEMISTRY *(For CHEMICAL Branch Only)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To make the students conversant with water treatment, boiler feed water techniques	**1.1**	Students will be able to identify the various water treatment techniques for domestic and industrial purpose.		
2.0	To endow with the nature of bonding, Vanderwaals force and Engineering materials.	**2.1**	Students will be able to pertain the basic principles of chemistry at the atomic and molecular level.		
3.0	To elucidate the mechanism of corrosion and their control measures.	**3.1**	Students will be able to explore the type of corrosion and depict the methods of corrosion control.		
4.0	To recognize the basic concepts of electrochemistry and understand electrochemical processes.	**4.1**	Students will be able to evaluate fundamentals of electrochemistry, electrodes, cells and electrode potentials.		
5.0	To impart knowledge on the basic principles and preparatory methods of nanomaterials.	**5.1**	Students will be able to identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.		

UNIT I – WATER TECHNOLOGY	**(9)**
Hardness – types – estimation by EDTA method. Water quality parameter – BOD and COD. Domestic water treatment – disinfection methods (chlorination, ozonation and UV treatment) – Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) – Internal conditioning (carbonate, phosphate and calgon) – External conditioning – demineralization process – desalination – reverse osmosis method.	
UNIT II – CHEMICAL BONDING AND ENGINEERING MATERIALS	**(9)**
Chemical bond – Types of bonds - Covalent bond – Hydrogen fluoride, Methane (overview only) - Ionic bond – Sodium Chloride, Magnesium Oxide (overview only) - Coordinate bond – Hydrogen Peroxide, Ozone (overview only) - Hydrogen Bond – Types of hydrogen bond (overview only). Engineering Materials : Synthesis of Abrasives – Properties of Refractories – Properties of Lubricants	
UNIT III – SCIENCE OF CORROSION	**(9)**
Corrosion – types - chemical corrosion - pilling bedworth rule - electrochemical corrosion – mechanism - galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors.	

UNIT IV – ELECTROCHEMISTRY AND FUEL CELLS	(9)
Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode -calomel electrode - potentiometric titrations (redox) - conductometric titrations (acid-base).- Fuel cell – hydrogen and oxygen fuel cell – microbial fuel cell – polymer electrolyte membrane fuel cell	
UNIT V – ANALYTICAL TECHNIQUES AND NANOCHEMISTRY	**(9)**
Colorimetry – principle - estimation of iron by colorimetry – UV- Visible spectroscopy – principle – instrumentation (Block diagram only) - IR spectroscopy - principle –instrumentation (Block diagram only) - Atomic absorption spectroscopy – principle – estimation of nickel by atomic absorption spectroscopy - Nanomaterials – synthesis (laser ablation, and chemical vapour deposition method) - applications of nanomaterials.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr.Ravikrishnan, A," Engineering Chemistry I & Engineering Chemistry II , Sri Krishna Hitech Publishing chem.. Co. Pvt Ltd., 13th ed., Chennai , 2020.
2. S.S. Dara," A Text book of Engineering Chemistry", S.Chand & Co.Ltd. New Delhi, 2019.

REFERENCES: *Web link https://www.elprocus.com/microbial-fuel-cell/*

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Vol I &II, Dhanpat Rai Pub, Co,New Delhi 15th ed.,2018.
2. B.Sivasankar, "Engineering Chemistry" , Tata McGraw- Hill Pub.Co.Ltd.,New Delhi,2018

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	-	-	-	1	2	-	1	-	-	2	2	-
2	3	1	2	-	-	1	2	-	1	-	-	2	-	1
3	3	-	-	-	-	-	-	-	1	-	-	2	2	-
4	3	1	2	-	-	2	2	-	1	-	-	2	-	1
5	3	2		-	-	2		-	1	-	-	2	-	-
CO **(W.A)**	3	1	2	-	-	2	2	-	1	-	-	2	2	1

22EEC01-BASIC ELECTRICAL AND ELECTRONICS ENGINEERING *(Common to AGRI, CHEM and CIVIL Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To impart knowledge on the concepts of circuit elements, circuit laws and measuring instruments	**1.1**	The student will be able to interpret Fundamental principles, laws, and their practical applications by analytical instruments.		
2.0	To Gain information on the basic principles of DC electrical machines and their performance.	**2.1**	The student will be able to identify DC electrical components and explore the characteristics of DC electrical machines.		
3.0	To Gain information on the basic principles of AC electrical machines and their performance	**3.1**	The student will be able to identify AC electrical components and explore the characteristics of AC electrical machines.		
4.0	To Identify basic theoretical principles behind the working of modern electronic gadgets..	**4.1**	The student will be able to identify & apply schematic symbols and understand the working principles of electronic devices & instruments.		
5.0	To Demonstrate digital electronic circuits and assemble simple devices.	**5.1**	The student will be able to design analog& digital circuits using basic concepts to solve problems.		

UNIT I - ELECTRICAL CIRCUITS & MEASURMENTS	**(9)**
Introduction to DC circuits-Ohm's Law – Kirchhoff's Laws – Resistive circuits-Resistors in Series and parallel - Introduction to AC circuits – Power and Power factor -Classification of measuring instruments – Dynamometer type wattmeter- Induction type energy meter	
UNIT II - DC MACHINES	**(9)**
DC Generator: Construction, Types, Principle of operation, EMF equation, Characteristics. DC Motor : Principle of operation, , Types, Torque equation, Characteristics and Applications.	
UNIT III - AC MACHINES	**(9)**
Single phase induction motor: Construction, Types, working principle- Three phase induction motor: Construction, Types, Torque – Slip Characteristics- Synchronous motor : Construction, working principle.	
UNIT IV - SEMICONDUCTOR DEVICES AND ITS APPLICATIONS	**(9)**
Introduction - Characteristics of PN junction diode and Zener diode – Half wave rectifier – Bipolar junction transistor: CB, CE, CC configurations and characteristics.	
UNIT V -DIGITAL SYSTEMS	**(9)**
Number System – Binary, Decimal, Octal, Hexadecimal – Binary arithmetic– Boolean Algebra –Logic Gates-Applications: Half Adder.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 4th Edition,Third Reprint ,2019.
2. R.Muthusubramaian, S.Salivahanan and K.A.Muraleedharan, "Basic Electrical, Electronics and Computer Engineering", 2nd ed., Tata McGraw Hill publishers, New Delhi, 2012

REFERENCES:

1. Jr., William H. Hayt,Kemmerly, Jack E.Phillips, Jamie D.Durbin, Steven M."Engineering Circuits Analysis," 9th edition., Tata McGraw Hill publishers, New Delhi, 2020
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", 2nd Edition,Pearson India,New delhi,2017.

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	-	2	2	3	2	1	2	1	2	3	3	1
2	3	3	3	2	2	2	3	1	2	-	2	2	3	1
3	3	3	2	2	2	2	2	1	2	-	2	3	3	1
4	3	3	3	-	2	2	1	1	2	-	2	3	3	1
5	3	2	-	2	2	2	2	1	2	1	2	3	3	1
CO (W.A)	**3**	**2.8**	**2.6**	**2**	**2**	**2.2**	**2**	**1**	**2**	**1**	**2**	**2.8**	**3**	**1**

22MEC01 - ENGINEERING GRAPHICS *(Common to AGRI, CHEM, CIVIL and EEE Branches)*					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To Construct various plane curves	**1.1**	Students will be able to construct various plane curves		
2.0	To Construct the concept of projection of points, lines and plane	**2.1**	Students will be able to create the projection of points, lines and planes		
3.0	To Develop the projection of solids	**3.1**	Students will be able to develop projection of solids		
4.0	To Solve problems in sectioning of solids and developing the surfaces	**4.1**	Students will be able to solve problems in sections of solids and development of surfaces		
5.0	To Apply the concepts of orthographic and isometric	**5.1**	Students will be able to apply the concepts of isometric in engineering practice		

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 – scales	
UNIT I - PLANE CURVES	**(6+6)**
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 - theory of projection - principle of multi-view orthographic projection - profile plane and side views - multiple views - representation of three dimensional objects - layout of views.	
UNIT II - PROJECTION OF POINTS, LINES AND PLANES	**(6+6)**
Principal planes - first angle projection - projection of points - projection of straight lines (only first angle projections) inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.	
UNIT III - PROJECTION OF SOLIDS	**(6+6)**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to anyone of the principal plane and perpendicular to another by rotating object method.	
UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	**(6+6)**
Sectioning of solids (prism, cube, pyramid, cylinder and cone) 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 cylinder and cone.	
UNIT V - ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	**(6+6)**
Principles of isometric projection - isometric scale - isometric projections of lines, plane figures, simple solids and truncated solids - prisms, pyramids, cylinders, cones – free hand sketching of orthographic views from isometric views of objects.	
TOTAL (L:30+ P:30) : 60 PERIODS	

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. K.R.Gopalakrishna., "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.
3. K. V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
4. 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.
5. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	-	-	1	-	-	-	2	-	3	-	1
2	3	2	1	-	-	1	-	-	-	2	-	3	-	1
3	3	2	1	-	-	1	-	-	-	2	-	3	-	1
4	3	2	1	-	-	1	-	-	-	2	-	3	-	1
5	3	3	1	-	-	1	-	-	-	2	-	3	-	1
CO (W.A)	**3**	**2.2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**1**

22CYP01 CHEMISTRY LABORATORY *(Common to AGRI, BME, CHEM, CIVIL, ECE, EEE and MECH Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**2**	**1**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To explain the origin of hardness, alkalinity, and chloride and dissolved oxygen in water.	1.1	The students will be able to acquire practical skills in the determination of water quality parameters through volumetric analysis		
2.0	To determine the copper in brass in the given solution.	2.1	The students will be able to evaluate the amount of copper in the given analyze by titration method.		
3.0	Enable the students to acquire knowledge of conductometric titrations and their calculations.	3.1	The students will be able to gain the knowledge about conductance of ions.		
4.0	To perform a potentiometric titration and pH of an acidic solution of known Normality.	4.1	The students will be able to analyze and gain experimental skill about activity of hydrogen ions and measures the voltage.		
5.0	To know about pH of the solution and how to measure pH using pH meter.	5.1	The students will be able to utilize the fundamental laboratory techniques for analyses such as pH of acidic, basic and neutral solution.		

LIST OF EXPERIMENTS

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of chloride content of water sample by Argentometric method.
4. Determination of DO content of water sample by Winkler's method.
5. Estimation of copper in brass by EDTA.
6. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Determination of strength of given hydrochloric acid using pH meter.

Total (30 P) = 30 periods

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1		1	1	1					1	1	1	
2	2	1		1		1	2				1	1		
3	2			1		1	2				1	1		
4	2			1	2	1	2				1	1	1	
5	2	2		1		1	2					1		
CO (W.A)	**2**	**1**		**1**	**2**	**1**	**2**				**1**	**1**	**1**	

*Ratified by Eleventh Academic Council

22GEP01 - ENGINEERING PRACTICES LABORATORY (Common to AGRI, BME, CHEM, CIVIL, ECE, EEE and MECH Branches)					
			L	**T**	**P**	**C**
			0	**0**	**4**	**2**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To provide hands on training on various basic engineering practices in Civil Engineering	1.1	The students will be able to make various joints/ connections in civil engineering practices like plumbing and carpentry.		
2.0	To provide hands on training on welding in Mechanical Engineering	2.1	The students will be able to make various shapes using welding processes.		
3.0	To provide hands on training on various basic engineering practices in Mechanical Engineering	3.1	The students will be able to make various shapes using manufacturing processes like machining and sheet metal work.		
4.0	To understand the basic working principle of electric components	4.1	The student will be able to do residential house wiring and measure electric quantities-Voltage, Current and Power in R Circuit		
5.0	To understand the basic working principle of electronic components	5.1	The students will be able to perform the assembling and testing of the PCB based electronic circuits.		

GROUP-A (MECHANICAL AND CIVIL ENGINEERING)	
I - CIVIL ENGINEERING PRACTICE	**(15)**
Buildings: a. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects	
Plumbing: a. Study of tools and operations b. Hands-on-exercise: External thread cutting and joining of pipes	
Carpentry: a. Study of tools and operations b. Hands-on-exercise: "L" joint and "T" joint	
II - MECHANICAL ENGINEERING PRACTICE	**(15)**
Welding: a. Study of arc welding, gas welding tools and equipments b. Arc welding- Butt joints, Lap joints and Tee joints c. Practicing gas welding	
Basic Machining: a. Study of lathe and drilling machine b. Facing and turning c. Drilling and Tapping	

Sheet Metal Work:

a. Study of tools and operations
b. Rectangular tray
c. Cone

GROUP - B (ELECTRICAL AND ELECTRONICS)

I - ELECTRICAL ENGINEERING PRACTICE	**(15)**

a. Residential house wiring using Switches ,fuse, indicator and lamp.
b. Fluorescent lamp wiring
c. Stair Case Wiring
d. Measurement of electrical quantities – Voltage, current ,power in R Circuit
e. Study of Electrical apparatus-Iron box & water heater
f. Study of Electrical Measuring instruments- Megger

II - ELECTRONICS ENGINEERING PRACTICE	**(15)**

a. Study of Electronic components and various use of multi meter.
b. Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.
c. Study of logic gates AND, OR, XOR and NOT.
d. Study of Clock Signal.
e. Soldering practice -Components Devices and Circuits - Using general purpose PCB.
f. Study of Half Wave Rectifier (HWR) and Full Wave Rectifier (FWR).
g. Study of Telephone, FM Radio and Cell Phone.

TOTAL (P: 60) = 60 PERIODS

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

Mapping of COs with POs / PSOs														
	POs												**PSOs**	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	-	-	-	-	1	1	1	-	2	1	-
2	3	3	2	-	-	-	-	1	1	1	-	2	1	-
3	3	2	2	-	-	-	-	1	1	1	-	2	1	-
4	3	2	-	-	-	-	-	1	1	1	-	2	1	-
5	3	2	-	-	-	-	-	1	1	1	-	2	1	-
CO (W.A)	**3**	**2.4**	**2**	-	-	-	-	**1**	**1**	**1**	-	**2**	**1**	-

22MAN01 INDUCTION PROGRAMME *(For Common To All Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**0**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To help the student see the need for developing a holistic perspective of life	**1.1**	Students will be able to analyze the significance of value inputs provided in formal education along with skills and develop a broader perspective about life and education.		
2.0	To sensitize the student about the scope of life – individual, family (inter-personal relationship).society and nature/existence.	**2.1**	Formulate their aspirations and concerns at different levels of living, and the way to fulfill them in a sustainable manner.		
3.0	To strengthen self-reflection.	**3.1**	Evaluate their current state of understanding and living, and model a healthy lifestyle.		
4.0	To develop more confidence and commitment to understand, learn and act accordingly.	**4.1**	Examine the issues of home sickness, interactions with seniors on the campus, peer pressure with better understanding and feel grateful towards parents, teachers and others.		
5.0	To educate student the need of holistic development across all the fields.	**5.1**	Develop more confidence and commitment for value-based living in family, society and nature.		

UNIT I - ASPIRATION AND CONCERNS	**(9)**
Getting to know each other - Individual academic, career - Expectations of family, peers, society, and nation - Fixing one's goals.	
UNIT II - SELF MANAGEMENT AND HEALTH	**(9)**
Self-confidence, peer pressure, time management, anger, stress - Personality development, self-improvement – Health issues – healthy diet – healthy lifestyle – hostel life.	
UNIT III - RELATIONSHIP AND SOCIETY	**(9)**
Home sickness - gratitude towards parents, teachers and others - Ragging and interaction Competition and cooperation - Peer pressure - Participation in society.	
UNIT IV - NATURAL ENVIRONMENT	**(9)**
Participation in nature.	
UNIT V - EDUCATION – HOLISTIC PERSPECTIVE	**(9)**
Review role of education Need for a holistic perspective.	
TOTAL (L:45) : 45 PERIODS	

REFERENCES:
AICTE model curriculum.

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1			2			2	2	3	1	2		3		
2			2			2	2	3	1	2		3		
3			2			2	2	3	1	2		3		
4			2			2	2	3	1	2		3		
5			2			2	2	3	1	2		3		
CO (W.A)			**2**			**2**	**2**	**3**	1	**2**		**3**		

22MAN02 - SOFT/ANALYTICAL SKILLS – I (*Common to All Branches)*					
		L	**T**	**P**	**C**
		1	**0**	**2**	**0**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the basic concepts of grammar and apply them in a structured manner.	**1.1**	The students will be able to intensify their awareness on correct usage of grammar in writing and speaking		
2.0	To evaluate various real-life situations by resorting to an analysis of key issues and factors.	**2.1**	The students will be able to solve the real-time problems for performing job functions easily.		
3.0	To solve mathematical problems and thereby reducing the time taken for performing job functions.	**3.1**	The students will be able to enhance their aptitude round clearing ability in interview process.		

UNIT I – VERBAL ABILITY	**(5+10)**
Tenses - One word substitution- Articles – Preposition - Conjunction	
UNIT II – BASIC APTITUDE	**(5+10)**
Percentage – Ratio and Proportion – Blood Relations – Analogy	
UNIT III – LOGICAL REASONING	**(5+10)**
Probability – Profit and Loss - Syllogism - Statement Assumptions.	
TOTAL (L:15, P: 30) :45 PERIODS	

REFERENCES:

1. Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand and Company Limited, New Delhi, 2014.
2. Ashish Aggarwal, "Quick Arithmetic", S Chand and Company Limited, New Delhi, 2014.
3. Raymond Murphy, "English grammar in use", Fourth Edition, Cambridge University 2012.

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

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	3	3	-	2	1	-
2	-	3	2	2	-	-	1	-	2	-	-	3	-	1
3	-	3	2	2	-	-	1	-	2	-	-	3	-	1
CO (W.A)	-	**2**	**1.3**	**1.3**	-	-	**0.6**	-	**2.3**	**1**	-	**2.6**	**0.3**	**0.6**

22MAN03 YOGA - I *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**I**	**0**

PRE REQUISITE : NIL

Course Objectives		**Course Outcomes**	
1.0	To make the students understand the importance of sound health and fitness principles as they relate to better health.	**1.1**	Students will able to Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
2.0	To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.	**2.1**	Students will able to Learn breathing exercises and healthy fitness activities
3.0	To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.	**3.1**	Students will able to Identify opportunities for participation in yoga and sports activities
4.0	To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.	**4.1**	Students will able to Develop understanding of health-related fitness components: cardio respiratory endurance, flexibility and body composition.
5.0	To Learn different types of Asanas	**5.1**	Students will able to Improve personal fitness through participation in yogic activities.

UNIT I – INTROUDCTION TO PHYSICAL EDUCATION	**(3)**
Meaning & definition of Physical Education - Aims & Objectives of Physical Education - Changing trends in Physical Education.	
UNIT II – PHYSICAL FITNESS, WELLNESS AND LIFESTYLE	**(3)**
Meaning & Importance of Physical Fitness & Wellness - Components of Physical fitness - Components of Health related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle.	
UNIT III – INTROUDCTION TO YOGA	**(3)**
Meaning & Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas - Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra.	
UNIT IV – YOGA AND LIFE STYLE	**(3)**
Asanas as Preventive measures – Hypertension:Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana – Obesity: Procedure, Beneits & contraindications fr Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana – Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana - Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana – Asthema: Procedure, Benfits & contraindications of for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.	

UNIT V – PHYSICAL EXERCISES AND ASANAS	(3)
Hand Exercises – Leg Exercises – Eye Exercises – Asanas – Sun salutation – Tadasana – Yegapadhasana – Chakrasana – Udkaddasana – Thirikosana – Thandasana – Pjjimothasanam – Ustrasana – Vakrasana – Tolangulasana – Komugasana – Padmasana – Vajrasana – Sukhasana – Siddhasana – Parvatasana – Janushirasana – Mandukasana – Yogamudra – mahamudra.	
TOTAL (P:15) : 15 PERIODS	

TEXT BOOKS/REFERENCES:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga by B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes).

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						2	2	3	2	2		3		
2						2	2	3	2	2		3		
3						2	2	3	2	2		3		
4						2	2	3	2	2		3		
5						2	2	3	2	2		3		
C O (W.A)						2	2	3	2	2		3		

*Ratified by Eleventh Academic Council

22EYA02 - PROFESSIONAL COMMUNICATION - II (*Common to All Branches*)					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : 22EYA01					
Course Objectives		**Course Outcomes**			
1.0	To familiarize the students with the basic structures of English and to train them to use these elements correctly in speaking and writing	**1.1**	Students will be able to frame sentences both in written and spoken forms with accuracy and fluency.		
2.0	To acquire proficiency in LSRW skills on par with the expectations of the industry.	**2.1**	Students will be able to attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.		
3.0	To enable students to adopt strategies for enhancing vocabulary, language and fluency and to deliver professional presentations.	**3.1**	Students will be able to gain essential competency to express one's thoughts orally and in writing in a meaningful way.		
4.0	To communicate effectively in an academic setting using the language skills as tools.	**4.1**	The students will be able to use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.		
5.0	To acquire necessary language skills to follow and comprehend discourse such as lectures, conversations, interviews, and discussions.	**5.1**	Students will be able to perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation		

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UNIT I – LANGUAGE RUDIMENTS	**(6+6)**
Grammar – Active and Passive Voice – Impersonal Passive Voice – Numerical Expressions - **Listening** – Listening for Specific Information and Match / Choose / Fill in the texts - **Speaking** – Describing a Person - Making Plans -**Reading** – Intensive Reading -**Writing** – Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	**(6+6)**
Grammar – Reported Speech – Infinitive and Gerund - **Listening** – Listening to Iconic Speeches and making notes - Listening news / documentaries - **Speaking** –Talking over Phone – Narrating Incidents - **Reading** – Extensive Reading (Motivational Books) - **Writing** – Recommendation	
UNIT III – TECHNICAL CORRESPONDENCE	**(6+6)**
Grammar – If Conditionals – Blended Words - **Listening** – Listening to business conversation on audio and video of Short Films, News, Biographies - **Speaking** – Synchronous communication and Asynchronous communication - Opportunities and threats in using digital platform- **Reading** - Finding key information in a given text - **Writing** –Netiquettes- Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	**(6+6)**
Grammar – Concord – Compound Words - **Listening** – Listening to Roles and Responsibilities in Corporate - Listening to technical videos - **Speaking** – Introduction to Technical Presentation - Story Telling - **Reading** – Reading and Understanding Technical Articles - **Writing** – Report Writing (Accident, Survey and feasibility)	

UNIT V - LANGUAGE BOOSTERS	**(6+6)**
Grammar - Idiomatic Expressions – Relative Clauses – Confusable words - **Listening** – Listening to different kinds of Interviews - Listening to Group Discussion - **Speaking** – Group Discussion - **Reading** – Reading and Interpreting Visual Materials - **Writing** – Analytical Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. Grammar.
2. Listening Skills.
3. Speaking Skills.
4. Reading Skills
5. Writing Skills

TOTAL (L:30 , P:30) = 60 PERIODS

TEXT BOOKS:

1. Sudharshana, N.P and Saveetha.C, "English for Technical Communication", Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

2. Rizvi, M Ashraf, "Effective Technical Communication", Second Edition, McGraw Hill Education India Pvt Ltd, 2017.
3. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds, "A Student's Introduction to English Grammar", Second Edition, Cambridge University Press, New Delhi, 2022

WEB REFERENCE:

4. http://youtu.be/URtdGiutVew

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

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									3	3		2	1	
2									3	3		2	1	
3									3	3		2	1	
4									3	3		2	1	
5									3	3		2	1	
CO (W.A)									**3**	**3**		**2**	**1**	

22MYB02 –PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES *(Common to AGRI,CIVIL.CHE,EEE, MECH Branches)*					
		L	**T**	**P**	**C**
		3	**1**	**0**	**4**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the concept of Fourier series and enhance the problem solving skills.	**1.1**	The students will be able to analysis the Fourier series problem		
2.0	To acquire knowledge of Partial Differential Equations.	**2.1**	The students will be able to know the formation of partial differential equations and types of solutions.		
3.0	To solve different forms of wave and heat equations	**3.1**	The students will be able to apply the partial differential equations to solve boundary value problems.		
4.0	To gain the concept of Fourier transform techniques used in wide variety of situations.	**4.1**	The students will be able to solve the problems using Fourier transforms and convolution theorem technique.		
5.0	To apply the concepts of Laplace transforms & its applications to various problems related to Engineering	**5.1**	The students will be able to simplify calculations in system modeling		

UNIT I – FOURIER SERIES	**(9+3)**
Dirichlet's condition – Fourier series: Half range sine series – Half range cosine series – Parseval's identity for half range series – Root mean square value of a function – Harmonic analysis.	
UNIT II –PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Formulation of partial differential equations by eliminating arbitrary constants and functions – Solution of standard types first order partial differential equations of the type f(p,q)=0,Clairaut's form – Lagrange's linear equations –Linear partial differential equation of second and higher order with constant coefficient of homogeneous types.	
UNIT III –APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Classification of second order quasi linear partial differential equations – Solution of one dimensional wave equation (Zero and non-zero velocity) – One dimensional heat equation (Temperature reduced to zero and non zero boundary conditions) – Steady state solution of two dimensional heat equation(Finite and infinite plate).	
UNIT IV –-FOURIER TRANSFORMS	**(9+3)**
Fourier integral theorem(Statement only) – Fourier transform pair - Sine and Cosine transforms – Properties -Transforms of simple functions – Convolution theorem – Parseval's identity(Excluding proof).	
UNIT V –LAPLACE TRANSFORM	**(9+3)**
Condition for existence - Transforms of Elementary functions –Basic Properties- First & Second Shifting Theorems(Statement only) - Initial and Final value Theorems. Inverse Laplace transforms -Convolution theorem (Excluding proof)- Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.	
TOTAL (L:45+T:15) :60 PERIODS	

TEXT BOOKS:

1. Veerajan.T,"Engineering Mathematics (for semester III), 3rd ed., Tata Mc Graw Hill, New Delhi.
2. Kandasamy.P, Thilagavathy.K, and Gunavathy.K., "Engineering Mathematics; Volume III", S.Chand&Coltd., 2008.
3. GrewalB.S,"Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.

REFERENCES:

1. Goyal Manish and Bali.N.P,"A Text book of Engineering mathematics", 6th ed.,Laxmi Publication (P) Ltd,New Delhi, 2012.
2. Kreyszig, Erwin,"Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.
3. Singaravelu.A,"Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamilnadu.

WEB REFERENCES:

1. https://youtu.be/HCHnXuQ2oME
2. https://www.youtube.com/watch?v=LYsIBqjQTdI&list=PLF6061160B55B0203&index=1
3. https://www.youtube.com/watch?v=9DgiyiRNw1g
4. https://youtu.be/lkAvgVUvYvY
5. https://www.youtube.com/watch?v=8oE1shAX96U&list=PLnVYEpTNGNtVH5YLVJsA2WxWXk6bAps-D&index=1

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1	1					1			2	1	1
2	3	2	1	1					1			2	1	1
3	3	2	1	1					1			2		
4	3	2	1	1					1			2		
5	3	2	1	1					1			2	1	1
CO (W.A)	3	2	1	1					1			2	1	1

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22PYB02 - ADVANCED MATERIALS AND NANO TECHNOLOGY (Common to CIVIL,CHEM & AGRI)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To gain adequate information about the properties of matter.	1.1	Understand the fundamental concepts of properties of matter		
2.0	To obtain the knowledge regarding the basics of thermal physics.	2.1	Acquire knowledge about the basics of thermal physics.		
3.0	To gain knowledge about the synthesis and properties of nanostructures.	3.1	Explore the knowledge of synthesising methods and properties of nanostructures.		
4.0	To expose the concepts of Photonics and fiber optics.	4.1	Get adequate information about Photonics and fiber optics in the field of electrical and communication.		
5.0	To update the recent development in Advanced new engineering materials	5.1	Acquire knowledge about recent developments in Advanced new engineering materials		

UNIT I – PROPERTIES OF MATTER	**(9)**
Elasticity – Hooke's law Stress-strain diagram and its uses – factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple – torsion pendulum: theory and experiment - bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I-shaped girders - stress due to bending in beams.	
UNIT II – THERMAL PHYSICS	**(9)**
Mode of heat transfer-thermal conductivity-Newton's law of cooling –thermal conduction through compound media (bodies in series and parallel) – Thermal conductivity of a good conductor – Forbe's method - Thermal conductivity of bad conductor – Lee's disc – Hazards – Cyclone and flood hazards – Fire hazards and fire protection, fire – proofing of materials, fire safety regulations and firefighting equipment. Prevention and safety measures.	
UNIT III - SYNTHESIS AND PROPERTIES OF NANOSTRUCTURES	**(9)**
Introduction to Nanoscience – Types of nanostructure and properties of Nanomaterials – Synthesis and preparation of Nanomaterials – Nanosensors – Biosensors – Nanoscience and Environment.	
UNIT IV – PHOTONICS AND FIBER OPTICS	**(9)**
Photonics: Population of energy levels – Einstein's A and B coefficients derivation – Resonant cavity – Types of lasers – solid state laser (Neodymium) – gas laser (CO_2) Applications of lasers in science – Engineering – Medicine. **Fibre optics:** Principle, numerical aperture and acceptance angle - Types of optical fibres (Material, refractive index and mode) -Losses in optical fibre - Fibre optic communication Fibre optic sensors (pressure and displacement).	

UNIT V- ADVANCED NEW ENGINEERING MATERIALS	(9)
Ceramics - Types and applications - Composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics - Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications - Shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy and application - Bio material - applications.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS

1. Dattuprasad, Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2019.
2. V.Rajendran, — Engineering Physics, Tata McGraw-Hill. New Delhi.2017.
3. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2018.

REFERENCES

1. Subrahmanyam N, Brijlal, "A Text Book of Optics" S.Chand & Co. Ltd, New Delhi, 2017.
2. Kongbamchandramanisingh, "Basic Physics", PHI, 2018.
3. M.N.Avathanalu, P.G.Kshirsagar "A text book of engineering physics" S.Chand &company Ltd, 2017

WEB LINKS

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf.
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
3. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
4. https://zenodo.org/record/243407#.ZEgPZXZBzIU
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	-	-	-	-	-	1	1	-	2	-	-
2	3	2	3	-	-	-	-	-	1	1	-	1	-	1
3	3	2	3	-	-	-	-	-	1	1	-	1	-	-
4	2	2	2	-	-	-	-	-	-	-	-	1	-	-
5	2	1	2	-	-	-	-	-	1	1	-	2	-	-
CO (W.A)	**2.6**	**2.0**	**2.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**1.0**	**0.0**	**1.0**	**0.0**	**1.0**

22CYBO6 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to CHEM-2nd, BME-3rd, ECE-4th AND EEE-4th SEM)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To recognize the basic concepts of environment, ecosystems and biodiversity.	**1.1**	Students will be able to know the importance of environment and functions ecosystems and biodiversity		
2.0	To impart knowledge on the causes, effects and control measures of environmental pollution.	**2.1**	Students will be able to identify the causes, effects of environmental pollution and contribute the preventive measures to the society.		
3.0	To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.	**3.1**	Students will be able to identify and understand the renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.		
4.0	To familiarize the concept of sustainable development goals, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.	**4.1**	Students will be able to recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.		
5.0	To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyzes the role of sustainable urbanization.	**5.1**	Students will be able to demonstrate the sustainability practices and identify green materials, energycycles.		

UNIT I - ENVIRONMENT AND BIODIVERSITY	**(9)**
Environment - scope and importance - Eco-system- Structure and function of an ecosystem - 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	**(9)**
Pollution – Causes - Effects and Preventive measures of Water – Soil - Air - Noise Pollution - Solid waste management - methods of disposal of solid waste – various steps of Hazardous waste management - E-Waste management - Environmental protection – Air acts – water acts.	
UNIT III - RENEWABLE SOURCES OF ENERGY	**(9)**
Energy management and conservation -New Energy Sources - Different types new energy sources – Hydrogen energy – Geothermal energy - Solar energy – wind energy – biomass energy - Applications of Hydrogen energy - Ocean energy resources -Tidal energy conversion..	

UNIT IV – SUSTAINABILITY AND MANAGEMENT	**(9)**
Development – Factors affecting development – advantages – disadvantages – GDP - Sustainability- needs – concept - from unsustainability to sustainability - millennium development goal - Sustainable Development goals - Climate change – Concept of carbon credit – carbon footprint - Environmental management.	
UNIT V – SUSTAINABILITY PRACTICES	**(9)**
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable habitat - Green buildings - Green materials- Sustainable energy - Non-conventional Sources - Energy Cycles- carbon cycle and carbon emission - Green Engineering - Sustainable urbanization.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15th Edition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.

REFERENCES:

1. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
2. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEB LINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/

Mappig of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2			3	3	2	1			2		
2	2	2	2			3	3	2	1			2		
3	2	2	2			3	3	2	1			2		
4	2	2	2			3	3	2	1			2		
5	2	2	2			3	3	2	1			2		
CO (W.A)	**2**	**2**	**2**			**3**	**3**	**2**	**1**			**2**		

*Ratified by Eleventh Academic Council

22CSC01 - PROBLEM SOLVING AND C PROGRAMMING *(Common to all Branches)*					
			L	**T**	**P**	**C**
			3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand problem solving, problem solving aspects, programming and to know about various program design tools.	**1.1**	The student will be able to identify the appropriate problem solving techniques to drive the solution for the given problem.		
2.0	To learn basic structure and Control Statements in C programming.	**2.1**	The student will be able to implement the appropriate looping and control statements in C for developing applications.		
3.0	To learn the manipulation of arrays and strings	**3.1**	The student will be able to develop programs on arrays of different dimensions of arrays and strings concepts.		
4.0	To understand the concept of modular programming using user defined functions.	**4.1**	The student will be able to implement programs using user defined functions.		
5.0	To acquaint with the use and benefits of Memory Allocation and file handling.	**5.1**	The student will be able to use dynamic memory allocation functions for assigning memory space during execution.		

UNIT I -PROBLEM SOLVING AND C PROGRAMMING BASICS	**(9)**
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms **Basics of C Programming** : Introduction to C - Structure of C program - Programming Rules – Compilation – Errors - C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initialization - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	**(9)**
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	**(9)**
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	**(9)**
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	
UNIT V - POINTERS AND FILE MANAGEMENT	**(9)**
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation	
	TOTAL (L:45) :45 PERIODS

TEXT BOOKS:

1. Ashok N. Kamthane, "Programming in C", 2nd Edition, Pearson Education, 2013.
2. Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.

REFERENCES:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st Edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th Edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
4. ReemaThareja., "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.
5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mappig of Course Outcomes (COs) with Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	-	-	-	-	-	-	-	-	3	3	3
3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
4	3	2	3	-	-	-	-	-	3	-	3	3	3	3
5	3	2	3	-	-	-	-	-	-	-	3	3	3	3
CO (W.A)	3	2	3	-	-	-	-	-	3	-	3	3	3	3

*Ratified by Eleventh Academic Council

22CHC01 – FUNDAMENTALS OF CHEMICAL ENGINEERING					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To understand the Fundamentals and basic concepts of Chemical Process Industries	1.1	Students will be able to apply the Concepts and Basics with suitable examples of Unit operations and Unit processes.		
2.0	To gain an exposure on fluid behavior and its properties and types of fluids	2.1	Students will be able to explain the importance of fluid properties, types of fluids and select the manometers for pressure measurement. To predict the type of flow from Osborne Reynolds experiment.		
3.0	To learn the fundamentals of Mechanical Operations and their significance in Solid handling Process industries	3.1	Students will be able to apply the principles of size reduction, separation and transportation of solids in chemical Industries.		
4.0	To understand the basic concepts of Heat Transfer and Mass Transfer mechanisms and its Industrial equipment's	4.1	Students will be able to describe various modes of heat transfer and discuss about industrial equipment which falls on heat transfer with and without phase change and basic concepts and law in Mass transfer operation and discuss about gas – liquid contact equipment.		
5.0	To have a basic idea on process calculations carried out in Chemical Process Industries.	5.1	Students will be able to apply the concepts of units and dimensions, basic chemical principles, weight percentage, mole percentage and material balances in process calculations.		

UNIT I: BASICS OF CHEMICAL PROCESS INDUSTRIES	**(9)**
Unit process and Unit Operations concepts- Outlines of Unit process- Calcination, Carbonylation, Combustion, Hydration, dehydration, Hydrolysis, Nitration, Sulfonation, Polymerization – Addition and Condensation Polymerization.	
UNIT II: FUNDAMENTALS OF FLUID MECHANICS	**(9)**
Definition of fluids, Types of Fluids -compressible and incompressible fluids, Ideal and Real fluids. Physical properties of fluids-density, specific weight, specific volume, specific gravity, viscosity and vapor pressure. Pressure Measurement – Simple U-tube Manometer. Dimensionless Number– Reynolds number. Osborne Reynolds experiment – Laminar flow and Turbulent flow	
UNIT III: FUNDAMENTALS OF MECHANICAL OPERATIONS	**(9)**
Size reduction-Crushing and Grinding Equipment's and Uses, Solid - fluid Separations Equipment and Industrial uses, Gas-solid Separations Equipment and Industrial uses. Solid handling - Conveyors types and uses.	

UNIT IV: BASICS OF HEAT AND MASS TRANSFER	(9)
Heat Transfer –Modes of heat transfer-Principles of Conduction, Convection and Radiation. Definition of Boiling and Condensation. –Heat Transfer equipment's - Exchanger, Reboiler and Evaporator. Concept of Mass Transfer Operations - Diffusion, Humidification, Drying, Distillation, Absorption, Extraction, Leaching, Adsorption with examples.	
UNIT V: BASICS OF CHEMICAL PROCESS CALCULATIONS	**(9)**
Basic concepts: Units and Dimensions, systems of units, conversion and conversion factors of units, Basic chemical principles - Atomic weight , Molecular weight, Basis of calculation, concept of Mole, Mole fraction ,Mole percent, Weight percent, simple problems. Simple material balance calculations on drying, evaporation, distillation, absorption and Extraction	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Dryden's Outlines of Chemical Technology for the 21st Century – GopalRao & Sittig 3rd Edition- AffiliatedEast West Press Pvt.Ltd, New Delhi.
2. Venkataramani V,Anantharaman N. and Meera Sheriffa Begum K.M, Process Calculation ", 2nd edition, Prentice Hall of India , New Delhi ,2011.
3. McCabe, W.L., Smith, J. C. and Harriot, P. "Unit operations in Chemical Engineering", McGraw Hill, 7th Edition, 2001.

REFERENCES:

1. Salil K. Ghosal, Siddhartha Datta "Introduction to Chemical Engineering" Tata McGraw Hill Education.
2. Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", 6th Edition, Tata McGraw Hill, 1997.
3. Randolph Norris Shreve, George T. Austin, "Shreve'e Chemical Process Industries", 5th edition, McGraw Hill, 1984.

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	-	-	1	-	-	-	-	-	-	-	-	3	2
2	2	1	1	1	-	-	-	-	-	-	-	-	3	2
3	-	1	1	1	-	-	-	-	-	-	-	-	3	3
4	-	2	1	1	-	-	-	-	-	-	-	-	3	2
5	2	1	1	-	-	-	-	-	-	-	-	-	3	2
CO (W.A)	1	1	1	1	-	-	-	-	-	-	-	-	**3**	**2**

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22PYP01 - PHYSICS LABORATORY (Common to All Branches)					
		L	**T**	**P**	**C**
		0	**0**	**2**	**1**
PRE REQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To provide the basic practical exposure to all the engineering and technological streams in the field of physics.	1.1	Apply the concept of stress, strain and elastic limit for a given sample to find their properties		
2.0	To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory.	2.1	Gain the basic knowledge about handling the laser light and Identify the basic parameters of an optical fibre		
3.0	To enable the students to correlate the theoretical principles with application oriented studies.	3.1	Analyze the properties of matter with sound waves		
4.0	To introduce different experiments to test basic understanding of physics concepts applied in optics and electronics	4.1	Recall the knowledge of properties of light through spectrometer grating and fiber optic cable		
5.0	To analyze the behavior and characteristics of solar cells and LED	5.1	Acquire the knowledge in semiconducting devices such as solar cells and LED		

Physics Laboratory

1. Determination of Young's modulus by non-uniform bending method
2. Determination of (a) wavelength and (b) particle size using Laser.
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of band gap of a semiconductor.
6. Determination of thickness of a thin wire – Air wedge method.
7. Determination of V-I characteristics of solar cell.

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3	3	-	-	-	-	-	-	1	-	2	1	-
2	3	3	2	-	-	-	-	-	-	-	-	1	1	-
3	3	3	2	-	-	-	-	-	1	-	-	1	-	-
4	3	2	3	-	-	-	-	-	-	-	-	2	-	-
5	3	2	2	-	-	-	-	-	-	1	-	1	-	-
CO (W.A)	**3.0**	**2.0**	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**1.0**	**0.0**	**1.0**	**1.0**	**0.0**

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22CSP01 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY *(Common to all Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**
PREREQUISITE : NIL					
Course Objectives		**Course Outcomes**			
1.0	To study, analyze and understand logical structure of a computer program, and different construct to develop a program in 'C' language.	**1.1**	The student will be able to identify the appropriate programming construct to develop programs for all types of problems.		
2.0	To study, analyze and implement the concepts of arrays and strings in C programming.	**2.1**	The student will be able to implement programs on arrays of different dimensions and string concepts.		
3.0	To learn the importance user defined functions and pointers.	**3.1**	The student will be able to develop programs using user defined functions and pointers.		
4.0	To gain knowledge in user defined data types and file handling functions in C programming	**4.1**	The student will be able to design programs using user defined data types and various file handling functions.		
5.0	To acquire skill in dynamic memory allocation	**5.1**	The student will be able to use dynamic memory allocation functions for assigning memory space during execution.		

C-Programming:

1. Draw the flowchart for the following using Raptor tool.
    a) Simple interest calculation
    b) Greatest among three numbers
    c) Find the sum of digits of a number
2. Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential and Selection structures)
3. Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures)
4. Programs for demonstrating one-dimensional and two-dimensional numeric array
5. Programs to demonstrate modular programming concepts using functions
6. Programs to implement various character and string operations with and without built-in library functions.
7. Programs to demonstrate the use of pointers
8. Programs to illustrate the use of user-defined data types
9. Programs to implement various file management.
10. Program Using Dynamic memory allocation functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
Hardware: • LAN System with 33 nodes (OR) Standalone PCs – 33 Nos. • Printers – 3 Nos. **Software:** • RAPTOR Tool • Compiler – C
TOTAL (P:60) : 60 PERIODS

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	-	-	-	-	-	-	-	-	3	3	3
3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
4	3	2	3	-	-	-	-	-	3	-	3	3	3	3
5	3	2	3	-	-	-	-	-	-	-	3	3	3	3
CO (W.A)	3	2	2	-	-	-	-	-	3	-	3	3	3	3

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22MAN05- SOFT/ANALYTICAL SKILLS - II					
		L	**T**	**P**	**C**
Prerequisite : *NIL*		**1**	**0**	**2**	**0**
Course Objectives		**Course Outcomes**			
1.0	To acquire satisfactory competency in use of Verbal Reasoning	**1.1**	The students will be able to enhance their vocabulary which in turn will be helpful in developing their speaking skills.		
2.0	To develop skill to meet the competitive examinations for better job opportunity.	**2.1**	The students will be able to solve the problems easily by using Short-cut method with time management.		
3.0	To enrich their knowledge and to develop their logical reasoning thinking ability.	**3.1**	The students will be able to analyze the problems logically and approach the problems in a different manner.		

UNIT I – VERBAL COMPETENCY	**(10)**
Voice - Modal Verbs – Synonyms & Antonyms - Confusable Words	
UNIT II – NUMERICAL REPRESENTATION	**(10)**
Average – Data Interpretation – Simple Interest and Compound Interest – Venn Diagram.	
UNIT III - RESOLUTION TENDENCY	**(10)**
Time and Work – Pipes and Cistern – Number Series and Odd man Out – Cube Problems.	
TOTAL(L :10,P:20) : 30 PERIODS	

REFERENCES:

1. Ashish Aggarwal, "Quick Arithmetic", S Chand and Company Limited, New Delhi, 2014.
2. Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand and Company Limited, New Delhi, 2014.
3. Raymond Murphy, "English grammar in use", Fourth Edition, Cambridge University 2012.

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

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									3	3		2		1
2		3	2	2			1		2			3	2	
3		3	2	2			1		2			3	2	
CO (W.A)		**2**	**1.3**	**1.3**			**0.6**		**2.3**	**1**		**2.6**	**1.3**	**0.3**

22MAN06 YOGA – II *(For Common To All Branches)*					
		L	**T**	**P**	**C**
		0	**0**	**I**	**0**
PRE REQUISITE : NIL					

Course Objectives		**Course Outcomes**	
1.0	To strengthen the body through physical exercises.	**1.1**	Student will be able to perform physical exercises like spine exercises, massage and acupressure.
2.0	To understand the importance of value system and ethics.	**2.1**	Student will be able to learn the human values, ethics, time management and the importance of introspection.
3.0	To know the life philosophy of yogis and maharishis.	**3.1**	Student will be able to analyze various life philosophies of yogi's and rishi's.
4.0	To understand the nature laws, cause and effect theory.	**4.1**	Student will be able to understand life lessons and nature laws.
5.0	To inculcate knowledge about different types of Asanas and their benefits.	**5.1**	Students will be able to demonstrate different types of yoga Asanas and improve their personal fitness.

UNIT I – PHYSICAL EXCERCISES (PART-II)	**(3)**
Breathing Exercises – Kapalapathi – Maharasanam (Spine Exerices) – Massage and Acupressure.	
UNIT II – HUMAN VALUE	**(3)**
Divine power – Life force (Bio magnetism) – Importance of Introspection – Time management – Punctuality – self confidence – mind control.	
UNIT III – PHILOSOPHY OF LIFE	**(3)**
Basic needs for life – Hunger and thirst – climatic/weather changes – Body wastes – pressure of excretory organs – safety measures – protection from natural disaster – protection from enmity – protection from accidents – ethics – morality – duty – charity – Wisdom of perfection stages – faith – understanding – realization.	
UNIT IV – NATURE'S LAW OF CAUSE AND EFFECT	**(3)**
Food transformation into seven minerals – Natural actions – pattern – precision – regularity – Required skills – planned work – awareness – introspection.	
UNIT V – ASANAS (PART-II)	**(3)**
Ustrasana – Vakrasana –Komugasana – Padmasana – Vajrasana – Sukhasana – Yogamudra – mahamudra.	
TOTAL (P:15) : 15 PERIODS	

TEXT BOOKS/REFERENCES:
Light On Yoga by B.K.S. Iyengar.

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

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						1	2	3	3	2	1	3		
2						1	2	3	3	2	1	3		
3						1	2	3	3	2	1	3		
4						1	2	3	3	2	1	3		
5						1	2	3	3	2	1	3		
CO (W.A)						1	**2**	**3**	**3**	**2**	1	**3**		

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22MYB03 - STATISTICS AND NUMERICAL METHODS
(Common to Mech, Civil, Agri, Chemical Branches)

L	T	P	C
3	1	0	4

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.	1.1	The students will be able to select a hypothesis testing method for the given numerical set of data to analyze the significance.
2.0	To understand the knowledge of design of experiments	2.1	The students will be able to apply analysis of Variance for the data set of selected number factors for analyzing the significance.
3.0	To introduce the basic concepts of solving algebraic and transcendental equations.	3.1	The students will be able to solve an algebraic or transcendental equation using an appropriate numerical method.
4.0	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.	4.1	The students will be able to appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
5.0	To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.	5.1	The students will be able to solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

UNIT I - TESTING OF HYPOTHESIS	**(9+3)**
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z ,t -distribution, F – distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	**(9+3)**
Analysis of variance- Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE 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 – Iterative methods of Gauss Jacobi and Gauss Seidel Methods- Eigenvalues of a matrix by Power method.	
UNIT IV - INTERPOLATION AND APPROXIMATION	**(9+3)**
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules - Romberg's Methods.	
UNIT V - NUMERICAL DIFFERENTIATION AND INTEGRATION	**(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 (L:45+T:15) : 60 PERIODS	

TEXT BOOK:

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.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

REFERENCES:

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.

WEB REFERENCES:

1. https://youtu.be/zmyh7nCjmsg
2. https://youtu.be/NmgbFJ4UwPs
3. https://youtu.be/RgKy7URFx1c
4. https://archive.nptel.ac.in/courses/111/107/111107105/

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

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

22MEC08- BASICS OF MECHANICAL ENGINEERING (Chemical Engineering only)					
		L	T	P	C
		3	0	0	3
PRE- REQUISITE : NIL					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes			
1.0	To acquire knowledge on the effect of pressure and temperature on gases.	1.1	The students will be able to understand the effect of pressure and temperature on gases.		
2.0	To introduce the properties of steam and energy conservation opportunities in steam systems	2.1	The students will be able to understand the steam distribution and utilization systems to identify the energy conservation opportunities		
3.0	To introduce types of boilers, mounting and accessories	3.1	The students will be able to understand the basics of boilers and perform simple calculations of boiler efficiencies		
4.0	To acquire knowledge of turbines and vacuum systems	4.1	The students will be able to Comprehend principles of steam turbines and calculation of turbine efficiencies and understand		
5.0	To know about basic machine elements parts and its functions	5.1	The students will be able to parts and its function of basic machine elements.		

UNIT I - HEATING AND EXPANSION OF GASES	**(9)**
Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.	
UNIT II - PROPERTIES OF STEAM	**(9)**
Properties of steam, Mollier chart, dryness fraction of steam- Different types of calorimeters. Concept of Steam distribution systems. Steam traps- types and their characteristics. Energy conservation opportunities in steam systems.	
UNIT III - BOILERS	**(9)**
Types and classification of boilers: water tube, fire tube, coal, oil and gas fired boilers; Stoker fired, pulverized and fluidized bed boilers. Mountings and accessories. Performance and Efficiency of boilers.	
UNIT IV - TURBINES AND VACUUM SYSTEMS	**(9)**
Steam turbines- types and working principles: Reaction and impulse turbines; Application of co-generation principles in process industries. Gas turbines- principle and working. Production of Vacuum: Systems and Equipment- Vacuum Pumps, Steam Ejectors; Instrumental methods of Vacuum measurement.	

UNIT V – BASIC MECHINE ELEMENTS	(9)
Gears (Terminology, spur, helical and bevel gear, gear train) Belt drives. Robe drives, Chain drives - types and its applications. Simple problems.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. Rajput R.K., "Thermal Engineering", 10th Edition, Laxmi Publications, 2010.
2. Rudramoorthy R., "Thermal Engineering", 4thEdition, Tata McGraw Hill PublishingCompany, New Delhi, 2006.
3. Kumar. T, Leenus Jesu Martin and Murali. G., "Basic Mechanical Engineering", Suma Publications, Chennai, 2007.

REFERENCES:

1. Kothandaraman, C.P., Domkundwar and Domkundwar, "Course in Thermodynamics and Heat Engines", 3rdEdition, DhanpatRai& Sons, New Delhi, 2011.
2. Ballaney P.L., "Thermal Engineering", Khanna Publishers, New Delhi, 2005.

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2								1	3	1
2	2	2	2	2								2	2	1
3	2	2	1	2								1	1	1
4	2	2	2	1								2	1	1
5	2	2	1	1								2	1	1
CO (W.A)	2	2	2	2								2	1	1

22CHC02 CHEMICAL ENGINEERING FLUID MECHANICS					
		L	T	P	C
		2	1	0	3
PREREQUISITE: 22CHC01					

Course Objectives		Course Outcomes	
1.0	To understand the basic concepts of fluid statics and dimensional analysis	1.1	Understand the concept of fluid statics and its applications; Apply the principles of dimensional analysis for engineering applications.
2.0	To learn the fluid flow operations in pipes and basic equations associated with flow through pipes.	2.1	Analyze the types of fluid flow in pipes; Understand the basic equations in fluid flow operations.
3.0	To gain knowledge over packed and fluidized beds used in process industries.	3.1	Retrieve and apply the concepts of flow around solids in packed and fluidized beds.
4.0	To understand the types of flow measuring devices and to determine coefficient of discharge.	4.1	Appraise and select the flow measuring devices in process industries.
5.0	To gain knowledge over classification of fluid moving machinery and their performance analysis.	5.1	Analyze the performance of fluid moving machinery and appraise the types of valves and pipe fittings in process industries.

UNIT I - FLUID STATICS AND DIMENSIONAL ANALYSIS	**(6+3)**
Introduction to Fluid statics, properties and Based problems; Hydrostatic equation and its applications; Pressure measurement – Manometers and its types - Decanters; Units and Dimensions; Dimensional analysis – Models and Similitude –Types and principles of Similarity;	
UNIT II - FLOW THROUGH CONDUITS	**(6+3)**
Types of flow – Shear stress distribution - Laminar and turbulent flow in pipes; Friction factor - Moody Chart – Losses in piping system; Introduction to Boundary layer; Flow through non-circular conduits; Basic equations - Continuity equation - Bernoulli's equation and its applications;	
UNIT III - FLOW AROUND SOLIDS	**(6+3)**
Drag and its types - Drag coefficient; Industrial applications of Packed and fluidized bed - Packing materials; Pressure drop across packed bed - Ergun's equation; Fluidization and its classification - Pressure drop across the fluidized bed – Minimum fluidization velocity- Motion of particles through fluids – Terminal settling velocity;	
UNIT IV - FLOW METERING	**(6+3)**
Classification and Selection of flow meters; Principle, working and applications of Venturimeter, Orificemeter, rotameters and pitot tube; Determination of discharge coefficient; Other meters: Anemometer - Mass flow meter - High viscous flow meter; Notches and weirs;	

UNIT V - FLUID MOVING MACHINERY	(6+3)
Classification and selection of fluid moving machinery; Principle, working and applications of Centrifugal pump and Reciprocating pump - Characteristics curves of centrifugal pump; Elementary principles of gear, air lift, diaphragm and submersible pumps; Types and application of valves and pipe fittings;	
TOTAL (L:30 + T:15) = 45 PERIODS	

TEXT BOOKS:

1. Dr. R.K.Banzal ,"ATextbook of Fluid Mechanics and Hydraulic Machines , Nineth dition.2010. 2.McCabe W.L, Smith J.C. and Harriot P., "Unit Operations in Chemical Engineering", 7th Edition, McGraw Hill International Edition, New York, 2006.
2. Noel De Nevers,"Fluid Mechanics for Chemical Engineers", 3rd Edition, McGraw Hill, New York, 2004.

REFERENCES:

1. Cengel, Yunus and Cimbala John M, "Fluid Mechanics Fundamentals and Applications", 2nd Edition, Tata McGraw Hill Publishing Company, NewDelhi, 2006
2. J.M.Coulson and J.F.Richordson, "Chemical Engineering Vol - I & II", 6th Edition Butterworth – New Delhi-2000.

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2									2	
2	2	3	1	1		1							2	
3	2	3	3		2	1							2	
4	2	2	2	1									2	
5	1	2	3	2					1				2	
CO (W.A)	2	3	2	2	2	1			1				2	

22CHC03 - CHEMICAL PROCESS CALCULATIONS					
			L	T	P	C
			2	1	0	3
PREREQUISITE : 22CHC01					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes			
1.0	To provide basic idea of basic chemical calculations.	1.1	Understand and apply composition of mixtures/solution and determine Pressure, volume and temperature of glass using equation of state		
2.0	To gain fundamental knowledge and apply material balance without chemical reaction in process industry	2.1	Apply the law of conversion of mass for different batch and continues unit operations		
3.0	To understand the material balance with chemical reaction in process industry	3.1	Apply the law of conversion of mass for unit processes and evaluate yield, conversion, recycle ratio/purge/bypass of chemical reactors		
4.0	To Provide education and understand the apply energy balance in system	4.1	Apply energy balance for reacting system and understand the effect of temperature and pressure on heat of reaction		
5.0	To learn the combined material and energy balances specific industries	5.1	Evaluate the combined material and energy balance of specific industries and understand industrial need for material and energy balance		

UNIT I - BASIC CHEMICAL CALCULATIONS	**(6+3)**
Methods of expression; the ideal gas law; calculation of pressure, volume and temperature using ideal and Vander Waals equations. Use of partial pressure and pure component volume in gas mixture calculations; average molecular weight of gas mixture; density of gas mixture;	
UNIT II - MATERIAL BALANCE WITHOUT CHEMICAL REACTION	**(6+3)**
Stoichiometric principles, application of material balance to unit operation like Distillation, Evaporation, Crystallization, Drying, Extraction, Mixing/Blending and Absorption. Humidification and dehumidification basic concepts -calculation of absolute molal, relative and percentage humilities; Use of psychometric chart;	
UNIT III - MATERIAL BALANCE WITH CHEMICAL REACTION	**(6+3)**
Material balance for the systems involving chemical reaction; limiting and excess reactants- yield and selectivity. Bypass, recycle and purging.	

UNIT IV – ENERGY BALANCE	(6+3)
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 – COMBUSTION AND FLUE GAS ANALYSIS	**(6+3)**
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	
TOTAL(L:30:T:15) = 45 PERIODS	

TEXT BOOKS:

1. Bhatt B.L and Thakore S.B, "Stoichiometry", 5th edition, Tata McGraw Hill publishing company, New Delhi, 2017.
2. Venkataramani V,Anantharaman N. and MeeraSheriffa Begum K.M, "Process Calculation ", 2nd edition, Prentice Hall of India , New Delhi ,2011.

REFERENCES:

1. Himmelblau D.M, "Basic Principle and calculation in Chemical Engineering", 8thedition,Prentice Hall of India, New Delhi, 2013.
2. Richard M.Felder Ronald W .Rousseau, "Elementary Principles of Chemical Process", 3rdedition, 2005.

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	1							1	2	1
2	3	3	3	2	1							1	2	1
3	3	3	3	3	1							1	2	1
4	3	3	2	3	2	2						2	2	2
5	3	3	3	3	1	2						2	1	1
CO (W.A)	3	3	3	3	1	2						1	2	1

22CHC04 UNIT PROCESSES FOR CHEMICAL ENGINEERS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
COURSE OBJECTIVES AND OUTCOMES:				

Course Objectives		Course Outcomes	
1.0	To learn the principle of Nitration and manufacture of amino compounds	1.1	Understand the various unit process in synthesis of organic compounds
	To develop knowledge about Halogenation, Sulfonation and Sulfation	4.1	Identify reaction schemes and mechanisms for a number of important reaction used in organic synthesis
3.0	To understand types of Oxidation, Ammonolysis,	3.1	Analysis of chemical reaction and reaction conditions of Oxidation, Ammonolysis.
5.0	To provide fundamental knowledge of Hydrogenation and Hydroformylation	5.1	Understand the synthesis of Hydrogenation and Hydroformylation.
	To have a basic ideas about production and properties of Hydrogenation and Alkylation	2.1	Understand the application of organic compounds in various industries

UNIT I : Nitration and Amination	**(9)**
Principle of Nitration, nitrating agents and Nitration esters- Typical industrial equipment and processes- Nitration of Benzene and Propane; Principle of Amination methods – reduction and its methods, Manufacture of Aniline and Nitro-Aniline by different methods.	
UNIT II : Halogenation and Sulfonation Processes	**(9)**
Halogenation reactions, Chlorination mechanism, Manufacture of Vinyl Chloride and Chloral. Sulfonation and sulfation agents, Industrial process- sulfonation of benzene and production of ethanol; Desulfonation reactions	
UNIT III : Ammonolysis and Oxidation	**(9)**
Principles of Ammonolysis. Aminating agents and amination reactions, Manufacture of Aniline, p-Pheneyldiamine and Methylamines; Principles of Oxidation, Oxidizing agents, Types of Oxidative reaction, Synthesis of Acetic acid, Formaldehyde and Styrene.	
UNIT IV : Hydrogenation and Hydroformylation	**(9)**
Production and Properties of Hydrogen, Catalytic hydrogenation and Hydrogenolysis - Hydrogenation of Cotton seed oil and Synthesis of Methanol; Methanation and Fisher-Tropsch reactions- Oxo, Synol processes.	

UNIT V : Esterification, Hydrolysis and Alkylation	(9)
Esterification of organic and inorganic acids, applications in chemical industries- Manufacture of ethyl acetate and vinyl acetate monomer; Hydrolyzing agents, processes and equipment-manufacture of Glycerol, Furfural and Ethanol. Types and Factors affecting alkylation, Industrial alkylation process-Alkyl aryl detergent	
TOTAL (L:45)= 45 PERIODS	

TEXT BOOK:

1. Austin G.T., "Shreve's Chemical Process Industries ",5th edition (Special Reprint edition),McGraw Hill International co., 2005.
2. Groggins P.H.,"Unit Processes in Organic Synthesis",5th edition (reprint),McGraw Hill International Co.,2001.

REFERENCES:

1. K.S.Tewari&N.K.Vishnoi, "A Textbook of Organic Chemistry" ,4rd Edition, Vikas Publishing House,New Delhi, 2017.
2. Graham Solomons T.W.,Craig B.Fryhle and scott A. Snyder,"Organic Chemistry",11th edition,international student version, John Wiley And sons inc, New York,2013.

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

Mapping of COs with POs / PSOs														
CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	1	1	1	2	2	1	-	-	1	1	3	2
2	3	2	2	2	2	1	1	-	-	-	-	-	3	2
3	3	2	2	2	2	1	1	-	-	-	-	-	3	2
4	2	2	2	1	1	-	1	-	-	-	-	-	3	3
5	2	1	2	1	1	1	2	-	-	-	2	2	3	3
CO (W.A)	2	1	2	1	1	1	1	-	-	-	1	1	3	2

22CHC05 - MECHANICAL OPERATIONS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22CHC01				
COURSE OBJECTIVES AND OUTCOMES:				

Course Objectives		Course Outcomes	
1.0	To understand how the solids are characterized and methods for storage and transportation of solids	1.1	The student will be able to demonstrate the knowledge of particle characterization, size analysis, storage and transportation of solids
2.0	To gain knowledge over size reduction equipments and industrial screens	2.1	The student will be able appraise and select the size reduction equipments and industrial screens
3.0	To obtain idea on the mechanical separation equipments in process industries	3.1	The student will be able understand and select the mechanical separation equipments based on surface properties of solids
4.0	To gain knowledge over filtration and types of industrial filters	4.1	The student will be able exhibit the principle of filtration and types of industrial filters
5.0	To understand and compare mixing and agitation process	5.1	The student will be able compare and recognize mixing and agitation equipments

UNIT I - CHARACTERISTICS AND HANDLING OF PARTICULATE SOLIDS	**9**
Characteristics of particulate solids, techniques for particle size analysis, agglomeration and segregation; different methods for storage and transportation of solids	
UNIT II - SIZE REDUCTION AND SCREENING	**9**
Laws of size reduction; classification, principle and working of size reduction equipments; screening-screen effectiveness- industrial screening equipments	
UNIT III - MECHANICAL SEPARATIONS	**9**
Principles and equipment for gravity settling, sedimentation, thickening, centrifugal separation, froth flotation, magnetic and electrostatic separators, heavy media separations	
UNIT IV - FILTRATION	**9**
Theory of filtration, constant pressure and constant rate filtration; batch and continuous filters; principle and equipment for gravity, pressure and centrifugal filters; selection of filters; vacuum filter and its application.	
UNIT V - MIXING AND AGITATION	**9**
Principles,typesandequipmentformixing;Impellers,powerrequirementforagitation; Mixer for powders and pastes, equipment for blending and kneading	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Coulson J.M.and Richardson J.F.,"Chemical Engineering", Volume II, 5thEdition, Elsevier publication,2006.
2. G.G. Brown "Unit Operations " 1stedition , CBSPublishers,2005

REFERENCES:

1. Badger WalterL.and BancheroJulius T,"Introduction to Chemical Engineering", Tata McGraw Hill Publishing Company,NewDelhi,21stReprint, 2008
2. Alans Foust, "Principles of Unit Operations", 2ndEdition,John Wiley &SonsInternational Edition, 2008.

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	2	1	1	3	-	-	-	-	-	-	-	2	2	1
1	3	2	3	2	2	-	-	-	-	-	-	1	3	1
2	3	2	3	2	2	-	-	-	-	-	-	-	3	2
3	2	2	2	3	1	-	-	-	-	-	-	-	3	2
4	2	2	2	2	1	-	-	-	-	-	-	-	3	2
5	3	2	3	3	2	-	-	-	-	-	-	2	3	2
CO (W.A)	2	1	1	3	-	-	-	-	-	-	-	2	2	1

22CHP01 - FLUID MECHANICS LABORATORY

	L	T	P	C
	0	0	4	2

PRE REQUISITE : 22CHC02

	Course Objectives		Course Outcomes
1.0	To determine the coefficient of discharge of variable head and variable area flow meters	1.1	Determine the coefficient of discharge of venture meter, orifice meter, rotameter, open drum orifice and V notch.
2.0	To understand the relation between friction factor and Reynolds number for the flow through closed pipes.	2.1	Verify the Moody's chart for flow through straight pipe/concentric pipes and helical coil
3.0	To determine the energy loss for the flow through valves and pipe fittings	3.1	Predict the frictional loss coefficient for different valves and pipefittings
4.0	To study the pressure drop and superficial velocity for flow past immersed bodies.	4.1	Determine the pressure drop through packed bed and minimum fluidization velocity in fluidized bed
5.0	To test the performance of centrifugal and reciprocating pump	5.1	Draw the characteristics curves of centrifugal pump and reciprocating pump

LIST OF EXPERIMENTS

1. Determination of coefficient of discharge of venturimeter.
2. Determination of coefficient of discharge of orifice meter.
3. Determination of coefficient of discharge of notch.
4. Determination of friction factor for flow through straight pipe.
5. Determination of friction factor for flow through concentric pipes.
6. Determination of friction factor for flow through Spiral and helical coil.
7. Determination of pressure drop in packed bed.
8. Determination of minimum fluidization velocity flow through fluidized bed.
9. The study of characteristics curves of centrifugal pump.
10. The study of characteristics curves of reciprocating pump.

Total (60 P) = 60 periods

Reference

1. Lab Manual

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	3	2	2									2	
2	1	1	1	1									1	
3	2	2	1	1									1	
4	2	2	2	2		1								
5	1	2	2	1		1							2	
CO (W.A)	2	2	2	1		1							2	

22CHP02 CHEMICAL ANALYSIS LABORATORY					
		L	T	P	C
		0	0	4	2
PRE REQUISITE : NIL					
Course Objectives		Course Outcomes			
1.0	Students will be able to prepare the various organic compounds at certain reaction conditions.	1.1	Make the student to acquire practical skills in the preparation of various organic compounds		
2.0	To gain the knowledge in basic principle involved in analysis and identification of different organic compounds	2.1	Students will be able to learn the basic principle involved in analysis and identification of different organic compounds		
3.0	To acquire knowledge and estimate the turbidity of water	3.1	Students will be able to gain the knowledge about turbidity and colour in water analysis		
4.0	To provide hands on exposure for analyzing the given fuel oil sample	4.1	Students will be able to analyze the given fuel oil sample		
5.0	To provide hands on exposure for performing cement analysis	5.1	Students will be able to understand the concept of cement analysis		

LIST OF EXPERIMENTS (Any Ten)

1. Preparation of meta di nitro benzene from Nitro benzene.
2. Preparation of Benzoic acids from Ethyl benzoate.
3. Preparation of Benzoic acid from Benzaldehyde.
4. Determination of Turbidity and colour of waste water by using Nephlometer.
5. Determination of flash point, fire point, cloud and pour point of fuel oil.
6. Determination of aniline point of given fuel oil sample.
7. Determination of saponification value of oil.
8. Determination of purity of washing soda.
9. Identification of carbohydrates and/or acids from unknown organic compounds.
10. Identification of Phenol and/or ester from unknown organic compounds.
11. Identification of amine and/or Urea from unknown organic compounds.
12. Identification of Aldehyde and/or Ketone from unknown organic compounds.
13. Estimation of purity of Glycerol.

Total (60 P) = 60 periods

Reference:
1.Lab Manual

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	2	1	1									1	-
2	1	2	3	1									-	1
3	2	1	3	1	1	1							-	-
4	1	2	3	1	1	2							1	-
5	2	1	3	1	1	2							-	-
CO (W.A)	1	2	3	1	1	1							1	1

22MAN06– SOFT / ANALYTICAL SKILLS - III (Common to ------- Branches)				
	L	T	P	C
	1	0	2	0
PRE REQUISITE : NIL				

Course Objectives		Course Outcomes	
1.0	Improving overall language proficiency for personal or professional reasons	1.1	The students will be able to enhance their writing skills
2.0	To develop problem solving skills across all levels	2.1	The students will be able to develop problem solving skills across all levels
3.0	To develop students to workout solutions for problems that involving general reasoning.	3.1	The students will be able to solve reasoning problems with ease.

UNIT I – Verbal Competency	(10)
Sentence Selection, Paragraph Formation, Sentence Correction, Spellings.	
UNIT II - Aptitude	(10)
Clocks, Calendar, Age Problems, Problem on Trains, Problems on Numbers - Partnerships.	
UNIT III – Logical & Reasoning	(10)
Coding & Decoding, Logical Equivalent, Venn Diagram Problem.	
TOTAL (L:10, P:20) : 30 PERIODS	

REFERENCES:

1. Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand and Company Limited, New Delhi, 2014.
2. Ashish Aggarwal, "Quick Arithmetic", S Chand and Company Limited, New Delhi, 2014.
3. Raymond Murphy, "English grammar in use", Fourth Edition, Cambridge University, 2012.

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

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	3	3	-	2	-	1
2	-	3	2	2	-	-	1	-	2	-	-	3	2	-
3	-	3	2	2	-	-	1	-	2	-	-	3	2	-
CO (W.A)	-	2	1.3	1.3	-	-	0.6	-	2.3	1	-	2.6	1.3	0.3

22MAN08 INDIAN CONSTITUTION (Common to All Branches)					
		L	T	P	C
		1	0	0	0
PRE REQUISITE : NIL					
Course Objectives		Course Outcomes			
1.0	To educate students to learn about the Constitutional Law of India.	1.1	The students will be able to Gain Knowledge about the Constitutional Law of India.		
2.0	To motivate students to Understand the role of Union Government.	2.1	The students will be able to know the Union Government and role of President and Prime Minister.		
3.0	To make students to understand about State Government.	3.1	The students will be able to acquire knowledge about State Government and role of Governor, Chief Minister.		
4.0	To understand about District Administration, Municipal Coporation and Zila Panchayat.	4.1	The students will be able to understand the District Administration, Municipal Coporation and Zila Panchayat.		
5.0	To encourage students to Understand about the election commission.	5.1	The students will be able to understand the role and function of election commission.		

Unit I: The Constitution - Introduction	(9)
• The History of the Making of the Indian Constitution • Preamble and the Basic Structure, and its interpretation • Fundamental Rights and Duties and their interpretation • State Policy Principles	
Unit II – Union Government	(9)
• Structure of the Indian Union • President – Role and Power • Prime Minister and Council of Ministers • Lok Sabha and Rajya Sabha	
Unit III – State Government	(9)
• Governor – Role and Power • Chief Minister and Council of Ministers • State Secretariat	
Unit IV – Local Administration	(9)
• District Administration • Municipal Corporation • Zila Panchayat	

Unit V – Election Commission	(9)
• Role and Functioning • Chief Election Commissioner • State Election Commission	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Rajeev Bhargava, Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.
2. B.L. Fadia, The Constitution of India, Sahitya Bhawan; New edition (2017).
3. DD Basu, Introduction to the Constitution of India, Lexis Nexis; Twenty-Third 2018 edition.

REFERENCES:

1. Steve Blank and Bob Dorf, The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K & S Ranch ISBN – 978-0984999392
2. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" , Penguin UK ISBN – 978-0670921607
3. Adrian J. Slywotzky with Karl Weber, Demand: Creating What People Love Before They Know They Want It, Headline Book Publishing ISBN – 978-0755388974
4. Clayton M. Christensen, The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business, Harvard business ISBN: 978-142219602.

REFERENCES: Web link

1. https://www.fundable.com/learn/resources/guides/startup
2. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/
3. https://www.finder.com/small-business-finance-tips
4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						3		3		2		3		
2						3		3		2		3		
3						3		3		2		3		
4						3		3		2		3		
5						3		3		2		3		
CO (W.A)						3		3		2		3		

22CHC06- CHEMICAL REACTION ENGINEERING					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		Course Outcomes			
1.0	To understand the basic concepts of chemical kinetics studies and types of reactions.	1.1	The students will be able to understand the concept of stoichiometric equations, order of reaction and chemical kinetic theories.		
2.0	To learn the mass and energy balance of ideal reactors of batch and continues operations.	2.1	The students will be able to understand the performance equations of ideal reactors.		
3.0	To gain knowledge over multiple rectors with series/parallel configurations.	3.1	The students will be able to apply knowledge of performance studies to compare reactors of different types in series and parallel.		
4.0	To understand the types of multiple reactions.	4.1	The students will be able to learn the concepts of multiple reactions involved in PFR and MFR.		
5.0	To gain knowledge of non-isothermal and adiabatic reactor performance.	5.1	The students will be able to analyze the performance of reactors under steady state non-isothermal conditions.		

UNIT I : FUNDAMENTAL CONCEPTS AND CHEMICAL KINETICS	**(9)**
Chemical Kinetics, Classification of chemical reactions, Rate, rate equation, rate constant, Order and Molecularity, activation energy, Arrhenius theory, collision theory ,transition state theory, Elementary and non-elementary reactions, half-life period, constant volume reaction- Irreversible unimolecular type first order reactions. Variable volume Batch reactor. Zero order reaction.	
UNIT II : DESIGN OF SINGLE IDEAL REACTORS	**(9)**
Chemical reactors: Batch reactors, performance equation. Advantages and disadvantages of Batch reactors, Space time and space velocity. Simple calculations. CSTR, performance equation, Conversion yield, Simple problems.	
UNIT III : DESIGN OF MULTIPLE REACTORS	**(9)**
Steady state Mixed flow reactors performance equation, Plug flow reactor Design equation, Mixed flow reactors in series and parallel connection, Plug flow reactors in series and parallel connection, reactors of different types in series. Simple problems	
UNIT IV : DESIGN FOR MULTIPLE REACTIONS	**(9)**
Series reactions, parallel reactions, series-parallel reactions, qualitative discussion about product distribution in mixed flow reactor, quantitative treatment of product distribution in mixed flow reactor, overall fractional yield ,instantaneous fractional yield, selectivity.Simple problems.	
UNIT V :BASIC CONCEPTS OF NON-IDEAL FLOW	**(9)**
Residence time distribution, RTD Measurement, Characteristics of a tracer, E curve, C curve and F curve, Mean residence time, The RTD in a plug flow reactor, State of aggregation of the flowing stream, Simple problems.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:
1. H.S. Fogler, Elements of Chemical Reaction Engineering, 3rd Ed., Prentice Hall India Pvt. Ltd., New Delhi,2001 2. O. Levenspiel, Chemical Reaction Engineering, 3rd Ed., Wiley Publications, 1999.
REFERENCES:
1. Gilbert F Froment, Kenneth B Bischoff and Juray D Wilde "Chemical Reactor Analysis and Design", Wiley, New York (2010). 2. J.M. Smith, Chemical Engineering Kinetics, 2nd Ed., McGraw-Hill, 1981. 3. P.V. Danckwerts, Gas-liquid reactions, Sharma and Doraiswamy Vols. I & II Froment and Bischoff.

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	2	2	1									1	-
2	1	3		1									2	2
3	1	3		2	2								-	-
4	1	3		1	2								-	2
5	1	2		1	2								-	2
CO (W.A)	1	3	2	1	2								1	2

22CHC07 PROCESS HEAT TRANSFER					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : 22CHC01					
Course Objectives		Course Outcomes			
1.0	To understand nature and modes of heat transfer	1.1	Students will be able to familiarize with the fundamental concepts of Heat Transfer. Provide the student with knowledge about heat transfer by conduction in solids for steady state		
2.0	To gain explosive nature and forced convections and dimensional analysis	2.1	Apply convective heat transfer and use of heat transfer coefficients for laminar and turbulent flows conditions.		
3.0	To provide fundamentals of convection with phase change and thermal radiation concepts.	3.1	The course provides the student with knowledge about heat transfer with phase change (boiling and condensation) and thermal radiation.		
4.0	To gain idea of different types of heat exchanger and performances	4.1	Students will be able to calculate and use overall heat transfer coefficients in designing heat exchangers		
5.0	To have a basic idea of heat transfer with phase change and design evaporator	5.1	Students will be able to estimate the heat transfer rate and surface area of evaporators.		

UNIT I: CONDUCTION	**(9)**
Importance of heat transfer in Chemical Engineering operations - Modes of heat transfer – Concept of thermal conductivity measurement-effect of temperature on thermal conductivity - Fourier's Law - One dimensional steady state heat conduction through plane and composite walls, hollow cylinder and composite cylinder - critical thickness of insulation; fundamental concepts in extended surfaces heat transfer; Transient heat conduction.	
UNIT II : CONVECTION (without phase change)	**(9)**
Concepts of heat transfer by convection - Natural and forced convection - Application of dimensional analysis for convection and dimensionless numbers - Relationship between Individual and overall heat transfer coefficients - Equations for natural convection in vertical plates and vertical and horizontal cylinders - Equations for forced convection under laminar and turbulent flow conditions in pipes.	
UNIT III: CONVECTION (with phase change) AND RADIATION	**(9)**
Heat transfer to fluids with phase change - heat transfer from condensing vapours, drop wise and film wise condensation - Heat transfer to boiling liquids - mechanism of boiling, nucleate boiling and film boiling - condensers-vertical and horizontal types. Concept and nature of thermal radiations -Concept of Black and grey bodies; Stefan Boltzmann, Kirchhoff,,s, Planck,,s and Wien laws- Radiation shield.	
UNIT IV: HEAT EXCHANGERS	**(9)**
Heat Exchangers – Classification- Types and practical application (Double Pipe and Shell and Tube heat exchanger) – LMTD - use of correction factor charts - Fouling factors - surface area calculations for double pipe and shell and tube heat exchangers - NTU and efficiency of Heat exchangers.	

UNIT V: EVAPORATORS	(9)
Introduction – Types of Evaporators (Standard vertical tube, long tube, Forced circulation)– Capacity – Steam economy – Boiling point elevation - Material and energy balance of single effect evaporator - surface area calculations for single effect evaporator - Theory of multiple effect evaporators.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

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

REFERENCES:

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

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2									2	3	2
2	3	3	2									2	3	2
3	3	3	2									2	3	2
4	3	3	3		1							2	3	3
5	3	3	3		1							2	3	3
CO (W.A)	3	3	2		1							2	3	2

22CHC08 - CHEMICAL ENGINEERING THERMODYNAMICS					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		Course Outcomes			
1.0	To Have a basic concepts and laws of thermodynamics	1.1	The students will be able to apply thermodynamic concepts and the laws of thermodynamics to various systems and processes		
2.0	To learn the fundamental properties of Real gases and thermodynamics formulation	2.1	The students will be able to evaluate the PVT behavior of ideal and real gases		
3.0	To gain exposure to properties of solution	3.1	The students will be able to understand the properties of solution and determine the partial molar properties from mixture properties and vice- versa		
4.0	To understand the Phase equilibrium between phase and engineering systems	4.1	The students will be able to apply chemical reaction equilibrium between phase to engineering system with two or more coexisting phases		
5.0	To develop knowledge on chemical reaction equilibrium for homogenous reactions	5.1	The students will be able to understand chemical reaction equilibrium for thermodynamic analysis of homogeneous reaction		

UNIT I: LAW OF THERMODYNAMICS	**(9)**
Basic concepts; Terminology of Thermodynamics, Zeroth law; First law; application to non-flow and flow processes; second law –heat engine, Carnot cycle and theorem, Entropy calculation; Third law of thermodynamics.	
UNIT II: PROPERTIES OF REAL GASES AND THRMODYNAMICS FORMULATIONS	**(9)**
Ideal Gas law -simple problems, PVT behavior of fluids – compressibility factor; two and three parameter theorems of corresponding states. Equation of state – Virial, Vander Waals, Redlich-Kwong and Peng-Robinson equation; Basic energy relations; Maxwell relations and Pnemonic diagram.	
UNIT III: PROPERTIES OF SOLUTIONS	**(9)**
Partial molar properties Chemical potential, Fugacity, Activity and Activity coefficient; Gibbs-Duhem equation, Applications, Raoult's law and Henry's law; simple problems, enthalpy and Gibbs free energy change in mixing of ideal solution	
UNIT IV -PHASE EQUALIBRIA	**(9)**
Phase equilibrium and stability criteria for equilibrium between phases in single and multi-component non-reacting system; vapor –liquid equilibrium of binary solution (ideal and non ideal) ; Azeotropes; P-x-y and T-x-y diagrams.	

UNIT V - CHEMICAL EQUILIBRIA	(9)
Criteria of equilibrium; standard free energy change and reaction equilibrium constant Kp and Kc; effect of temperature and pressure on reaction equilibrium constant Relationship between Kp and Kc. Simple problems.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Narayanan K.V., "A Text book of Chemical Engineering Thermodynamics", 2ndedition,Prentice Hall India Pvt. ltd., New Delhi,2013
2. SmithJ.M., Van Ness H.C and Abbot M.M "Introduction to Chemical Engineering Thermodynamics", 7thedition,McGraw Hill,2009.

REFERENCES:

1. Rao Y.V.C., "Chemical Engineering Thermodynamics", Universities press (India) Ltd., Hyderabad (A.P), India,2004.
2. KyleB.G.,"Chemical and Process Thermodynamics",3rdEdition,Prentice Hall India Pvt. ltd., New Delhi,1999

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	1	2	1									1	-
2	1	2	3	2									-	2
3	1	2	3	1	1	2							-	1
4	1	3	2	1	1	1							1	-
5	1	2	3	1	2								2	-
CO (W.A)	1	2	3	1	1	1							1	1

22CHC09 - MASS TRANSFER I					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 22CHC01					
COURSE OBJECTIVES AND OUTCOMES					
Course Objectives		Course Outcomes			
1.0	To understand the basic concepts of types of diffusion in mass transfer.	1.1	Able to calculate mass transfer flux and know the methods of diffusivity measurement.		
2.0	To understand the mass transfer theories and inter-phase mass transfer.	2.1	Understand the theories of mass transfer and can calculate mass transfer coefficient.		
3.0	To gain knowledge over cooling tower and its operations.	3.1	Able to calculate humidification operations in cooling tower and applications of humidity chart.		
4.0	To understand the mechanism of drying and types of dryers	4.1	Understand the concept drying rate and able to find drying time in various drying operations.		
5.0	To gain knowledge over crystallization and its application.	5.1	Understand the concept of crystallization process and identification of suitable crystallizer		

UNIT I : DIFFUSION	**(9)**
Introduction to mass transfer operations - Molecular and eddy diffusion in gases and liquids – Steady state molecular diffusion in fluids at rest and in laminar flow - Binary diffusivity measurement and prediction - Multi component diffusion and diffusion in solids.	
UNIT II : INTERPHASE MASS TRANSFER	**(9)**
Concept of mass transfer co-efficient, Theories of mass transfer - film, penetration and surface renewal theories; momentum, heat and mass transfer analogies. Inter phase mass transfer – relationship between individual and overall mass transfer coefficient – Equipment for gas-liquid operations – Sparged and agitated vessels, Sieve and tray tower, Venturi scrubber and packed tower.	
UNIT III : HUMIDIFICATION	**(9)**
Humidification –Terminology and definitions - Equilibrium, humidity chart, adiabatic saturation and wet bulb temperatures; Cooling tower construction and its operation, calculations - Adiabatic humidification and dehumidification operations.	
UNIT IV : DRYING	**(9)**
Drying Terms and definitions – Equilibria, the drying rate curve, Batch Drying – material and energy balance - Theoretical estimation of drying time from rate data - determination of length of rotary dryer using rate concept - Mechanism and time of cross through circulation drying. Classification of dryers - Advance drying techniques such as freeze drying, microwave drying;	

UNIT V : CRYSTALLIZATION	(9)
Principle of crystallization - Equilibrium, theory of super saturation, nucleation and crystal growth, Batch and continuous operation - mass and energy balance - yield and purity of products; classification of crystallizers and crystallisation equipment.	
TOTAL(L:45 T:15) = 60 PERIODS	

TEXT BOOKS:

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

REFERENCES:

1. Anantharaman N. and MeeraSheriffa Begum K.M., —Mass Transfer: Theory and Practice‖ , Prentice Hall of India, New Delhi, 2011.
2. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7 thEdition., McGraw-Hill, 2005.
3. Seader J.D. and Henley E.J., "Separation Process Principles", 4th Ed., John Wiley, 2016
4. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I and II, 5th Edition, Asian Books Pvt. Ltd., India, 2002.

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

Mapping of COs with POs / PSOs														
CO No	POs												PSOs	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1	3	3	3	1	1	-	1	-	-	-	-	3	3	1
2	3	3	3	1	1	-	1	-	-	-	-	3	3	1
3	3	3	3	1	1	-	1	-	-	-	-	3	3	1
4	3	3	3	1	1	-	1	-	-	-	-	3	3	1
5	3	3	3	1	1	-	1	-	-	-	-	3	3	1
CO (W.A)	3	3	3	3	1	0	1					3	3	1

22CHC10 - INSTRUMENTAL METHODS OF ANALYSIS					
		L	T	P	C
		3	0	0	3
PRE REQUISITE : NIL					
Course Objectives		Course Outcomes			
1.0	To understand the concept of instrumental method of analysis	1.1	Gain the knowledge about analysis method and the traditional method of analysis		
2.0	To learn basic idea, Principles and applications of various spectroscopic methods	2.1	Known the principles of UV -Visible spectroscopy, IR spectroscopy and other modern instrumental method of analysis		
3.0	To explore a knowledge in thermal analysis and morphology analysis	3.1	Understand the concept and theory behind in thermal analysis and morphology analysis		
4.0	To have a basis knowledge and principles in conductance and electrophoresis techniques	4.1	Gain the knowledge about working principles and application of conductance, potential measurements and electrophoresis		
5.0	To learn the principles, working and applications of various chromatography methods	5.1	Examine the concept, working principle and applications of various chromatography methods		

UNIT I: INTRODUCTION OF INSTRUMENTAL METHODS	**(9)**
Introduction-Methods of detecting analytes-Qualitative and Quantitative Analysis-Volumetric analysis-Gravimetry-Traditional analytical techniques - Spectroscopy, Crystallography, Electrochemical analysis and separation techniques	
UNIT II: MOLECULAR SPECTROSCOPY	**(9)**
Modern instrumental Methods of analysis - Principles and applications of UV-Visible Spectroscopy, IR Spectroscopy and Non –dispersive IR, Raman spectroscopy, NMR Spectroscopy, Atomic absorption spectroscopy, X-ray fluorescence and ION Chromatography	
UNIT III: THERMAL METHODS AND MORPHOLOGY ANALYSIS	**(9)**
Thermogravimetry: Principle, instrumentation and applications, factors affecting shapes of thermograms. Differential Thermal Analysis: Principle, instrumentation and applications. Differences between DSC and DTA. Application of DSC (Inorganic & Polymer samples). Morphology Analysis – Scanning Electron Microscopy – Transmission Electron Microscopy – Principle and Applications	
UNIT IV: CONDUCTANCE, POTENTIAL MEASUREMENT AND ELECTROPHORESIS	**(9)**
Definitions, conductance measurements, applications, Types, advantages and disadvantages of Conductometric titrations. Potential measurements, pH determination, Potentiometric Titrations. Basic principles of electrophoresis, theory and application of paper, starch gel, agarose, PAGE, SDS-PAGE electrophoresis.	

UNIT V: CHROMATOGRAPHIC METHODS	(9)
Introduction – Classification of chromatographic methods: Column chromatography, Thin Layer chromatography, Paper chromatography, Gas chromatography and High-Performance Liquid Chromatography (HPLC) – Principle, important components and their functions mode of separation, Instrumentation and applications	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Gurdeep R. Chatwal Shan K Anand, "Instrumental methods of Chemical Analysis", 5th Edition, Himalaya Publishing House, New Delhi, 2018
2. Muralidharan Rao.D , Swamy A.V.N , Dharaneeswaran Reddy D, "Instrumental Method of Analysis", CBS Publishers and Distributors, 2013.

REFERENCES:

1. Willard H.H., Merritt L.L., Dean J.A., and Settle F.A., "Instrumental Methods of Analysis", 7th Edition, C B S Publishers & Distributors, Delhi, 2004.
2. Daniel C. Harris, "Qualitative chemical analysis", 9th Edition, W. H. Freeman and Company, New York, 2015
3. Skoog D.A and West D.M "Fundamental of Analytical Chemistry", 7 th edition, Saunders college publishing, New York,1996.

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	-		-	-	-	-	-	-	3	2
2	2	2	2	2	1	1	-	-	-	-	-	-	3	2
3	2	2	1	1	2	1	-	-	-	-	-	-	3	3
4	2	2	1	1	1	1	-	-	-	-	-	-	3	2
5	2	2	2	2	1	1	-	-	-	-	-	-	3	2
CO (W.A)	2	2	1	2	1	1	-	-	-	-	-	-	3	2

22CHC11 - CHEMICAL PROCESS INDUSTRIES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 22CHC01					
Course Objectives		Course Outcomes			
1.0	To understand the properties and production of fuels and Industrial gases	1.1	The student will be able to understand the nature, properties and method of production of fuels and Industrial gases.		
2.0	To gain the knowledge about the cement industries and the production of various acids	2.1	The student can gain knowledge about the cement industries and the production of various acids		
3.0	To gain knowledge over the pulp, paper, sugar and starch industries	3.1	The student can gain knowledge over the pulp, paper, sugar and starch industries and its importance		
4.0	To gain knowledge about the fertilizers and its production methods.	4.1	The student will be able to understand the method of production of various fertilizers and its uses.		
5.0	To understand the concept of different polymers and its production methods.	5.1	The student will be able to understand production of different types polymers		

UNIT I: FUEL AND INDUSTRIAL GASES	**(9)**
Fuel Gases – Natural gas, Liquefied natural gas, Synthesis Gas. Industrial gases – Carbon dioxide, hydrogen, nitrogen and oxygen – Argon.	
UNIT II: ACIDS AND CEMENT INDUSTRY	**(9)**
Sulfuric acid, Nitric acid and Phosphoric acid. Cement – properties of Cement – Methods of production – Overall factors for Cement industry.	
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: FERTILIZER INDUSTRY	**(9)**
Major Components of Fertilizer industries – Nitrogen industries, ammonia, urea – Phosphorus industries, Single Super Phosphate, DAP, MAP and NPK – Potassium chloride, Potassium Sulphate – Liquid Fertilizers – Bio Fertilizers.	
UNIT V: POLYMERS	**(9)**
Polymers production: Fibers, Rubbers and Plastics. Acrylonitrile butadiene styrene (ABS), polyethylene - LDPE, HDPE, Polypropylene, PVC, PS, SAN, SBR, PAN, Nylon and Polycarbonates.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Austin G.T., —Shreve's Chemical Process Industries‖ , 5th Edition, McGraw-Hill International Book Company, Singapore, 2012.
2. GopalaRao M. and Marshall Sittig, — Dryden‘s Outlines of Chemical Technology‖ , 3rd Edition, East- West Press, New Delhi, 2008.

REFERENCES:

1. Mark W.V. and Bhatia S.C., —Chemical Process Industries‖ , Volume - I and II, 2nd Edition, CBS Publishers and Distributors, New Delhi, 2007
2. Kent J.A., —Riggel's Hand Book of Industrial Chemistry‖ , Van Nostrant Reinhold, 1974

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	2	1	2	2	2					2	1
2	3	2	2	2	1	2	2	2					2	1
3	2	2	2	1	1	1	1						2	1
4	3	3	3	2	2	2	2	2					2	2
5	2	2	2	2	1	1	1	1					1	1
CO (W.A)	3	3	3	2	1	2	2	2					2	1

22CHP03 PROCESS HEAT TRANSFER LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE: 22CHC07					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes			
1.0	To determine individual and overall heat transfer coefficient using packed column and thermal conductivity of a material	1.1	Determine heat transfer coefficient for packed column apparatus and determine the thermal conductivity of given material		
2.0	To estimate individual heat transfer coefficient under forced convection	2.1	Evaluate the performance and determine individual and overall HTC		
3.0	To study the radiation heat transfer and calculate Stefan-Boltzmann constant.	3.1	Able to understand radiation heat transfer		
4.0	To estimate the HTC for heat transfer through heat exchangers.	4.1	Estimate the HTC for heat transfer through double pipe heat exchangers and shell and tube heat exchangers.		
5.0	To estimate steam economy and efficiency of an evaporator	5.1	Appraise the performance of evaporator and determine steam economy		

LIST OF EXPERIMENTS
MECHANICAL OPERATIONS LABORATORY (Any Ten)

1. Estimation of individual and overall heat transfer coefficient for heat transfer in Packed Column
2. Estimation of unsteady state temperature values using transient heat conduction experiment constant flux and constant temperature.
4. Estimation of individual heat transfer coefficient under forced convection heat transfer.
5. Estimation of individual heat transfer coefficient under natural convection heat transfer.
6. Estimation of individual and overall heat transfer coefficient for heat transfer in shell and tube heat exchanger
7. Estimation of individual and overall heat transfer coefficient for heat transfer in double pipe heat exchanger
8. Estimation of individual heat transfer coefficient and fin efficiency for heat transfer through extended surface
9. Estimation of steam economy and efficiency of an evaporator
10. Heat transfer studies in pool boiling
11. Estimation of individual heat transfer coefficient for heat transfer through horizontal and vertical condenser
12. Estimation of individual and overall heat transfer coefficient for heat transfer in jacketed vessel

13. Estimation of thermal conductivity of a material. 14. Studies on radiation heat transfer 15. Determination of Stefan Boltzmann constant using Stefan Boltzmann experiment
TOTAL(P:60) = 60 Periods
References: 1. Laboratory manual

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	2			1			1		1	2	2
2	3	3	1	2			1			1		1	2	2
3	3	3	1	2			1			1		1	2	2
4	3	3	1	2			1			1		1	2	2
5	3	3	1	2			1					1	2	2
CO (W.A)	3	3	1	2			1			1		1	2	2

22CHP04 - MECHANICAL OPERATIONS LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE: 22CHC05					
COURSE OBJECTIVES AND OUTCOMES:					
Course Objectives		Course Outcomes			
1.0	To determine power requirements and crushing laws constants using Jaw crusher and Roll crusher	1.1	The student will be able to assess power requirements and crushing laws constant using Jaw crusher and Roll crusher.		
2.0	To predict the critical speed and work index by using Ball mill and particle size analysis by conducting Sieve Analysis	2.1	The student will be able to determine the critical speed and assess work index by using Ball mill and particle size analysis by conducting Sieve Analysis		
3.0	To determine specific cake and filter medium resistance using Filter press, Leaf filter and Rotary drum filters.	3.1	The student will be able to determine specific cake and filter medium resistance using Filter press, Leaf filter and Rotary drum filters.		
4.0	To design a thickener by conducting batch sedimentation test and to determine the separation efficiency of cyclone separator.	4.1	The student will be able to design a thickener using batch sedimentation test data and assess the separation efficiency of cyclone separator.		
5.0	To find the separation efficiency of froth flotation equipment.	5.1	The student will be able to find the separation efficiency of froth flotation equipment.		

LIST OF EXPERIMENTS

MECHANICAL OPERATIONS LABORATORY (Any Ten)

1. Determination of the crushing law constants using Jaw crusher
2. Determination of the Reduction ratio using crushing rolls
3. Determination of the critical speed of ball mill
4. Determination of the average particle size using size analysis and finding the effectiveness of Screen
5. Determination of the specific cake resistance and filter medium resistance using plate and frame filter press
6. Determination of the specific cake resistance and filter medium resistance using vacuum leaf filter.
7. Determination of the specific cake resistance and filter medium resistance using vacuum rotary drum filter

8. Determination of minimum thickener area by batch sedimentation test
9. Determination of the separation efficiency of cyclone separator.
10. Determination of separation efficiency of froth flotation equipments.
11. Determination of the specific surface area of the given powder using air permeability apparatus
12. Determination of Power Consumption & Power Number by using Mixing apparatus.

TOTAL(P:60) = 60 Periods

REFERENCES:

1. Laboratory manual:

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

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	2	2	-	-	-	-	-	-	-	-	2	1
2	2	2	3	2	-	-	-	-	-	-	-	-	2	2
3	2	3	2	2	2	-	-	-	-	-	-	-	3	1
4	2	1	2	1	1	-	-	-	-	-	-	-	2	1
5	2	1	2	1	1	-	-	-	-	-	-	-	2	1
CO (W.A)	2	2	2	2	1	-	-	-	-	-	-	-	2	1

22MAN07 – SOFT / ANALYTICAL SKILLS - IV (Common to ------- Branches)					
		L	T	P	C
		1	0	2	0
PRE REQUISITE : Nil					
Course Objectives		Course Outcomes			
1.0	To recollect the functional understanding of basic grammar and its structure	1.1	The students will be able to apply the knowledge of basic grammar to construct the sentences.		
2.0	To develop students to workout solution for problems that involves mathematics aptitude.	2.1	The students will be able to solve aptitude problems with ease		
3.0	To enrich their knowledge and to develop their logical reasoning ability	3.1	The students will be able to solve reasoning problems with ease.		

UNIT I - Verbal	(10)
Articles , Fill in the blanks , Grammatical Error , Sentence improvement	
UNIT II – Aptitude	(10)
Speed and Distance, Time and Work, Mixture And Alligations, Permutation and Combinations	
UNIT III - Logical and Reasoning	(10)
Seating Arrangement, Directions and Distance, Non verbal Reasoning	
TOTAL (L:10, P:20) : 30 PERIODS	

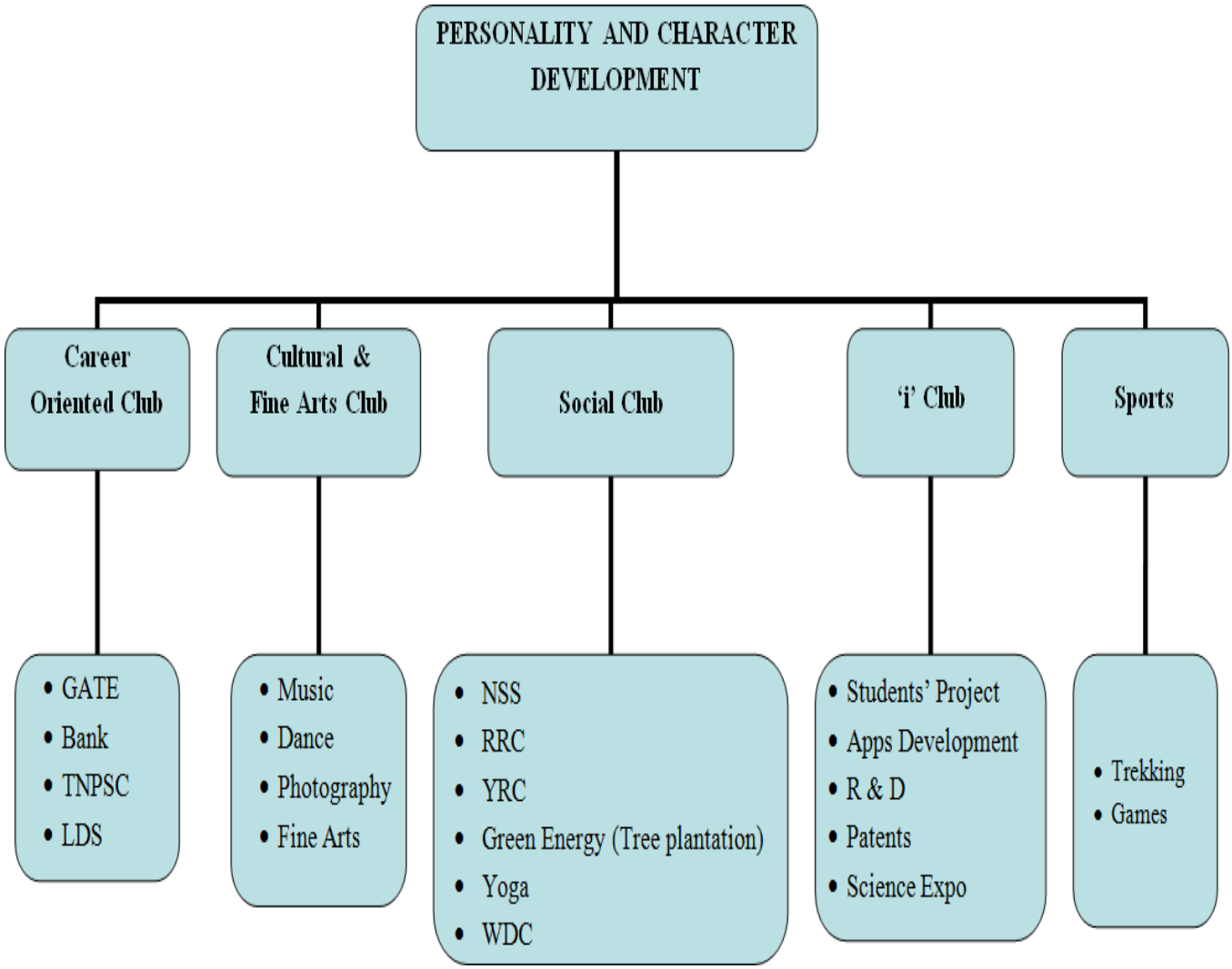
REFERENCES:

1. Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand and Company Limited, New Delhi, 2014.
2. Ashish Aggarwal, "Quick Arithmetic", S Chand and Company Limited, New Delhi, 2014.
3. Raymond Murphy, "English grammar in use", Fourth Edition, Cambridge University, 2012.

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

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	-	-	-	-	-	3	3	-	2	-	1
2	-	3	2	2	-	-	1	-	2	-	-	3	2	-
3	-	3	2	2	-	-	1	-	2	-	-	3	2	-
CO (W.A)	-	2	1.3	1.3	-	-	0.6	-	2.3	1	-	2.6	1.3	0.3

22GED01 PERSONALITY AND CHARACTER DEVELOPMENT (Common to all Branches)				
	L	T	P	C
	0	0	I	0



*LDS - Leadership Development Skills

OBJECTIVES :				
Career Oriented Club	Cultural & Fine Arts Club	Social Club	'i' club	Sports
To provide support for identifying specific career field of interests and career path To provide support for preparing for competitive exams	To bring out the hidden talent of students in music, dance and other fine arts. To promote photography skill among the students To develop and enhance the performance of students by participating in various events To inculcate managerial capabilities such as event management and stage organization	To create social awareness and develop a sense of social and civic responsibility To inculcate socially and environmentally sound practices and be aware of the benefits To encourage the students to work along with the people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community.	To inculcate the basic concepts of innovation To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities To enrich the academic experience, build competencies and relationships beyond the classroom	To provide opportunities to excel at sports To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities. To develop leadership skills and nurture the team building qualities. Trekking: To provide opportunities to explore nature and educating about the purity of nature To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
Find a better career of their interest. Make use of their knowledge during competitive exams and interviews.	Take part in various events Develop team spirit, leadership and managerial qualities	Develop socially responsive qualities by applying acquired knowledge Build character, social consciousness, commitment and discipline	Apply the acquired knowledge in creating better solutions that meet new requirements and market needs Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team	Demonstrate positive leadership skills that contribute to the organizational effectiveness Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [2 x (P: 15)]: 30 PERIODS

(Cumulatively for Two Semesters)

22GYA01 HERITAGE OF TAMILS *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

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

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City 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.

22GYA01 தமிழர் மரபு (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	1	0	0	1
முன் தேவை: இல்லை				

அலகு 1 மொழி மற்றும் இலக்கியம்	(3)
இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை– சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு 2 மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்கலை:	**(3)**
நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள்– தேர் செய்யும் கலை– சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	
அலகு 3 நாட்டுப்பறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**(3)**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டாம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	
அலகு 4 தமிழர்களின் திணைக் கோட்பாடுகள்:	**(3)**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளின் சோழர்களின் வெற்றி.	
அலகு 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**(3)**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் –இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ் புத்தக்களின் அச்சு வரலாறு.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City 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.

22GYA02 TAMILS AND TECHNOLOGY *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

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

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City 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.

22GYA02 தமிழரும் தொழில்நுட்பமும் (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	I	0	0	I
முன் தேவை: இல்லை				

அலகு 1 நெசவு மற்றும் பானைத் தொழில்நுட்பம்:	(3)
சங்ககாலத்தில் நெசவுத்தொழில் – பானைத் தொழிலநுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.	
அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:	**(3)**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுக்கல்லும் – 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 3 உற்பத்தி தொழில் நுட்பம்:	**(3)**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எக்கு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	
அலகு 4 வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்:	**(3)**
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.	
அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:	**(3)**
அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City 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.