

HINDUSTHAN College of engineering and technology

(An Autonomous Institution)

Coimbatore- 641032

DEPARTMENT OF CHEMICAL ENGINEERING

CURRICULUM

(UNDER REGULATIONS 2022)



E.

Hindusthan College of Engineering and Technology Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC

(An Autonomous Institution, Affiliated to Anna University, Chennai)



Coimbatore - 641 032

DEPARTMENT OF CHEMICAL ENGINEERING

REGULATION-2022

B.TECH. CHEMICAL ENGINEERING

I TO VIII SEMESTERS CURRICULUM (BATCH 2022-2026)

S.No.	Course Code	Course Title	Category	L	Т	P	C	ТСР	CIA	ESE	TOTAL
		SEMEST	ER I								
Theor	y		-	_	_	_		-	-		
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
2.	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100
Theor	y with Lab Cor	nponent									
3.	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
4.	22PH1151	Engineering Application of Physics	BSC	2	0	2	3	4	50	50	100
5.	22IT1151	Python Programming and Practices	ESC	2	0	2	3	4	50	50	100
EEC	Courses (SE/AF	E)									
6.	22HE1095	Universal Human Values	AEC	2	0	0	1	2	40	60	100
7.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
8.	22HE1073	Introduction to Soft skills	AEC	2	0	0	1	1	100	0	100
Mand	latory Courses										
9.	22MC1093/	□□□□□□□□□□ /Heritage of	MC	2	0	0	•	2	0	0	0
	22MC1094	tamil	MC	2	0	0	U	Z	0	0	0
	•		TOTAL	15	5	6	19	27	370	330	700
S.No.	Course Code	Course Title	Category	L	Т	Р	С	TCP	CIA	ESE	TOTAL
		SEMEST	ER II								
1	22MA2104	Fourier Analysis and Laplace	BSC	3	1	0	4	4	40	60	100
		Transforms									
2	22PH2101	Basics of Material Science	BSC	2	0	0	2	2	40	60	100
3	22CY2101	Environmental Studies	ESC	2	0	0	2	2	40	60	100
4	22CH2201	Introduction to Chemical	PCC	3	0	0	3	3	40	60	100
		Engineering									
Theor	y with Lab Cor	nponent	T				1	-	-		T
5	22CY2151	Chemistry for Engineers	BSC	2	0	2	3	4	50	50	100
6	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
Pract	ical		T				1				T
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AE	2)	1	1	1		1		r	·	1
8.	22HE2071	Design Thinking	AEC	1	0	2	2	3	100	0	100
9.	22HE2072	Soft Skills and Aptitude-I	SEC	1	0	0	1	1	100	0	100
Mand	atory Courses	1	1	1							
10.	22MC2093	NCC */NSS / YRC / Sports / Clubs	MC	A	All s	tude	ents	shall e	enroll, c	on admi	ssion, in
		/ Society Service -			any	one	of	the pers	sonality	7 and ch	aracter
		Enrollment			dev	elop	pme	nt prog	gramme	s and u	ndergo
11	2214C2004/		MC	2		tr	aini	ng for	about 1	00 nou	rs
11.	22MC2094/		MC	2	0	0	0	Z	0	0	0
	22IVIC2095										
		TECHNOLOGY									
	1		TOTAL	18	1	10	22	29	520	380	900
5.No.	Course Code	Course Title	Category	Ĺ	Т	P	C	ТСР	CIA	ESE	TOTAL
		SEMESTE	K III								
Theor	y		DCC		-		4	4	40	<u> </u>	100
1.	22MA3107	Numerical Methods	BSC	3	1	0	4	4	40	60	100
2.	22CH3201	Chemical Process Calculations	PCC	3	1	0	4	3	40	60	100

3.	22CH3202	Fluid Flow Operations	PCC	3	0	0	3	3	40	60	100
4.	22CH3203	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
		Thermodynamics – I									
Theo	ry with Lab Cor	nponent				1		-			
5.	22CH3251	Mechanical Operations	PCC	2	0	2	3	4	50	50	100
6.	22ME3253	Basic Mechanical Engineering	ESC	2	0	2	3	4	50	50	100
Pract	tical		1	-	-		-		<u> </u>		
7.	22CH3001	Fluid Flow Operations Lab	AEC	0	0	4	2	4	60	40	100
8.	22CH3002	Technical Analysis Lab	PCC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AE		arc.	1	0	0	1	1	100		100
9.	22HE30/1	Soft Skills -2	SEC	1	0	0	I	I	100	0	100
	22MC2001	Essence of Indian Traditional	AC	2	0	0	0	2	100		100
10	22IVIC 5091	Knowledge	AC	2	0	0	0	Z	100	0	100
-		Kilowicage	ΤΟΤΑΙ	17	2	12	25	30	480	420	900
S.No.	Course Code	Course Title	Category	I.	T	P	C	ТСР	CIA	ESE	TOTAL
	course coue	SEMESTE	R IV		-	-	Ŭ	101	0		101112
Theo	rv										
1.	22HE4101	IPR and Start-ups(Common)	HSC	2	0	0	2	2	40	60	100
2.	22CH4201	Mass Transfer Operations - I	PCC	3	0	0	3	3	40	60	100
3.	22CH4202	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
		Thermodynamics – II									
4.	22CH4203	Process Heat Transfer	PCC	3	0	0	3	3	40	60	100
5.	22CH4204	Chemical Process Industries	PCC	2	0	0	2	2	40	60	100
Theo	ry with Lab Cor	nponent				1			. 		
6.	22EE4251	Basics of Electrical &Electronics	ESC	1	0	2	2	3	50	50	100
7	000114051	Engineering	DCC	_	0	~	2	4	50	50	100
/.	22CH4251	Chemical Reaction Engineering - I	PCC	2	0	2	3	4	50	50	100
8.	22MA4151	programming	DSC	2	0	2	3	4	50	50	100
Pract	lical	programming									
9	22CH4001	Heat Transfer Lab	PCC	0	0	4	2	4	60	40	100
FEC	Courses (SE/AF		ree	U	0	-	2	-	00	40	100
10.	22HE4071	Soft Skills -3(Common)	SEC3	1	0	0	1	1	100	0	100
Mano	datory Courses		~								
11	22MC4091	Indian Constitution	AC	2	0	0	0	2	100	0	100
	•	1	TOTAL	21	0	10	24	31	510	490	1000
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL
		SEMESTI	ER V								
Theo	ry										
1.	22CH5201	Mass Transfer Operations - II	PCC	3	0	0	3	3	40	60	100
2.	22CH5202	Process Instrumentation Dynamics	PCC	3	0	0	3	3	40	60	100
-	2201152111	and Control	DEC	-		0	-	2	10		100
3.	22CH53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4.	22CH53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
D.	22CH55AA	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
1 neo	ry with Lab Col	Chamical Pasation Engineering II	PCC	2	Δ	2	3	4	50	50	100
0.	220113231	Chemical Reaction Engineering - II	FUL		0	2	3	4	50	50	100
Pract	lical					I					
7	22CH5001	Mass Transfer Operations Lab	PCC	0	0	4	2	4	60	40	100
FEC	Courses (SE/AF		ree	U	0	-	2	-	00	40	100
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	17	1	6	21	24	410	390	800
					1						

S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL
		SEMESTE	R VI								
Theor	y										
1.	22CH6201	Transport Phenomena	PCC	3	0	0	3	3	40	60	100
2.	22CH6202	Instrumental Method of Analysis	PCC	3	0	0	3	3	40	60	100
3.	22HE6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
4.	22CH63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
5.	22CH63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
Practi	cal										
7.	22CH6001	Process Control Lab	PCC	0	0	4	2	4	60	40	100
8.	22CH6002	Computational Chemical	PCC	0	0	4	2	4	60	40	100
		Engineering Lab									
EEC (Courses (SE/AE										
9.	22HE6071	Soft Skills – 5(Common)	SEC	2	0	0	2	2	100	0	100
			TOTAL	20	0	8	24	28	460	440	900
S No	Course Code	Course Title	Category	T.	т	Р	С	тср	СІА	ESE	ΤΟΤΑΙ
	course coue	SEMESTEI	R VII		-	-	U	101	Uni	LOL	TOTAL
		Theor	v								
1.	22CH7201	Process Economics and Engineering	PCC	3	0	0	3	3	40	60	100
		Management	100	2	Ŭ	Ŭ	U	U		00	100
2.	22CH7202	Process Equipment Design	PCC	3	1	0	4	4	40	60	100
3.	22CH7203	Bio Chemical Engineering	PCC	3	0	0	3	3	40	60	100
4.	22CH73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
5.	22XX74XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
Practi	cal										
6.	22CH7001	Design and Simulation Lab	PCC	0	0	4	2	4	60	40	100
		EEC Courses	(SE/AE)								
7.	22CH7701	Internship	SEC	-	-	-	2	2	100	0	100
			TOTAL	15	1	4	20	22	360	340	700
* - Fo	ur weeks internsl	hip carries 2 credit and it will be done i	n before Se	eme	ster	VI	sun	nmer va	acation	/placem	ent
trainin	g and same will	be evaluated in Semester VII.								-	
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL
		SEMESTER	R VIII								
EEC (Courses (SE/AE		T			1			-	•	
1.	22CH8901	Project Work/Granted	SEC	0	0	20	10		100	0	100
		Patent(Common)									
			TOTAL	0	0	20	10	20	100	0	100
* 1.	As per the AIC	CTE guideline, in Semester I, II, III &	IV NCC	one	cre	dit	sub	ject is	added	as Valu	e Added
	Course with I	Extra Credit. Further, the students' wh	o enrolled	h1S/	her	nai	ne	in HIC	ET NC	C and A	Air Wing
	are eligible to	undergo this subject. The earned extr	a credits pi	rinte	ed 1	n th	e C	onsolic	lated N	lark she	et as per
2	the regulation	lovel 1 & Lovel 2 will be added in	the list of	for		<u></u>	otit	o oubi	ooto in	the en	proprieto
۷.	semester Fu	rther the students' who have onted N	CC subject	r Up ts it	וושק י א	ene me	ster			uic ap Vare e	joible to
	undergo NCC	Onen Elective Subjects	CC subject	13 II	1.30	me	3101	1, 11, 1	in a l		
3.	The above-me	entioned NCC Courses will be offered	to theStud	lent	s w	ho :	are	going t	o be	admitt	ed in the
	Academic Ye	ar 2021 – 22.					-	0	2.		

B.E. / B.TECH.PROGRAMMES												
S.No.	Course			(Credits pe	er Semeste	er			Total		
	Area	Ι	II	III	IV	V	VI	VII	VIII	Credits		
1	HSC	3	3	-	2	-	3	-	-	11		
2	BSC	7	9	4	3	-	-	-	-	23		
3	ESC	6	4	3	2	-	-	-	-	15		
4	PCC	-	3	15	16	11	10	12	-	67		
5	PEC	-	-	-	-	9	6	3	-	18		
6	OEC	-	-	-	-	-	3	3	-	6		
7	EEC	3	3	3	1	1	2	2	10	25		
8	MC	~	√									
Total 19 22 25 24 21 24 20 10												

SEMESTER WISE CREDIT DISTRIBUTION

OPEN ELECTIVE I (EMERGING TECHNOLOGIES) To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits
	Code	Course Title		L	Т	Р	Contact	
							Periods	
1	22AI6451	Artificial Intelligence and Machine	OEC	2	0	2	4	3
		Learning Fundamentals						
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPENELECTIVE I

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL.	COURSE	COURSE TITLE	P PE	ERIOI RWEI	DS EK	TOTAL CONTACT	CREDITS	
NO.	CODE			L	Т	Р	PERIODS	
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3

6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Waste to Energy Conversion	OEC	3	0	0	3	3

Note:Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPENELECTIVE II

SL. NO.	Course		Category	y Periods Per week			Total	Credits
	Code	Course Title		L	Т	Р	Contact	
							Periods	
1	22LS7401	General studies for competitive	OEC	3	0	0	3	3
		examinations						
2	22LS7402	Human Rights, Women Rights and	OEC	3	0	0	3	3
		Gender equity						
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and	OFC	3	0	0	3	3
		management	UEC					
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3
8	22LS7408	Cybercrime And Awareness	OEC	3	0	0	3	3
9	22LS7409	First Aid And Emergency Care	OEC	3	0	0	3	3
10	22LS7410	Business Communication	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS												
Vertical I Petroleum Process Technology	Vertical II Energy Engineering	Vertical III Biochemical Engineering	Vertical IV Environmental and Safety Engineering	Vertical V Computation Chemical Engineering	Vertical VI Blue Economy and Ocean Studies							
Petroleum Chemistry and Refining Fundamentals	Bioenergy	Biochemistry	Membrane Separation Process	Computational Techniques	Aquaculture and Fisheries Business Management							
Primary Refining Technology	Renewable Energy Resources	Bioprocess Technology	Waste Water Treatment	Optimization of Chemical Processes	Climate-Resilient Coastal and Ocean Entrepreneurship							
Secondary Refining Technology	Pinch Technology	Fermentation & Bioprocessing	Solid waste Management	Process Modeling and Simulation	Marine and Coastal Resource Management							
Refinery Advancements and Environmental Regulations	Hydrogen and Fuel Cell Technology	Bio separation & Downstream Processing	Environmental Impact Assessment	Pinch Analysis and Heat Exchange Network Design	Ocean Engineering							
Petroleum Equipment Design	Power Plant Engineering	Enzyme Immobilisation Technology	Chemical Process Plant Safety	Chemical Process Flow sheeting	Sustainable Marine Resources and Circular Economy							
Petrochemical Technology	Non-Renewable Energy Sources	Bioreactor Design	Carbon Capture Technology	Computational Fluid Dynamics	Blue Economy Entrepreneurship							
Note: Students are per	mitted to choose all	Professional Ele	ectives from a particu	lar vertical								

Note: Students are permitted to choose all Professional Electives from a particular vertical

	DETAILS OF VERTICAL I :PETROLEUM PROCESS TECHNOLOGY												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH5301	Petroleum Chemistry and Refining	PEC	3	0	0	3	3	40	60	100		
		Fundamentals											
2.	22CH5302	Primary Refining Technology	PEC	3	0	0	3	3	40	60	100		
3.	22CH5303	Secondary Refining Technology	PEC	3	0	0	3	3	40	60	100		
4.	22CH5310	Refinery Advancements and	PEC	3	0	0	3	3	40	60	100		
		Environmental Regulations											
5.	22CH5311	Petroleum Equipment Design	PEC	3	0	0	3	3	40	60	100		
6.	22CH5312	Petrochemical Technology	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL II :ENERGY ENGINEERING												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH5304	Bioenergy	PEC	3	0	0	3	3	40	60	100		
2.	22CH5305	Renewable Energy Resources	PEC	3	0	0	3	3	40	60	100		
3.	22CH5306	Pinch Technology	PEC	3	0	0	3	3	40	60	100		
4.	22CH5313	Hydrogen And Fuel Cell	PEC	3	0	0	3	3	40	60	100		
		Technology											
5.	22CH5314	Power Plant Engineering	PEC	3	0	0	3	3	40	60	100		
6.	22CH5315	Non-Renewable Energy Sources	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL III : BIOCHEMICAL ENGINEERING												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH5307	Biochemistry	PEC	3	0	0	3	3	40	60	100		
2.	22CH5308	Bioprocess Technology	PEC	3	0	0	3	3	40	60	100		
3.	22CH5309	Fermentation & Bioprocessing	PEC	3	0	0	3	3	40	60	100		
4.	22CH5316	Bio separation & Downstream	PEC	3	0	0	3	3	40	60	100		
		Processing											
5.	22CH5317	Enzyme Immobilization	PEC	3	0	0	3	3	40	60	100		
		Technology											
6.	22CH5318	Bioreactor Design	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL IV: ENVIORNMENTAL AND SAFETY ENGINEERING												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH6301	Membrane Separation Process	PEC	3	0	0	3	3	40	60	100		
2.	22CH6302	Waste Water Treatment	PEC	3	0	0	3	3	40	60	100		
3.	22CH6303	Solid waste Management	PEC	3	0	0	3	3	40	60	100		
4.	22CH6304	Environmental Impact Assessment	PEC	3	0	0	3	3	40	60	100		
5.	22CH6305	Chemical Process Safety	PEC	3	0	0	3	3	40	60	100		
6.	22CHXXXX	Carbon Capture Technology	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL V: COMPUTATIONAL CHEMICAL ENGINEERING												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH6307	Computational Techniques	PEC	3	0	0	3	3	40	60	100		
2.	22CH6308	Optimization of Chemical Processes	PEC	3	0	0	3	3	40	60	100		
3.	22CH6309	Process Modeling and Simulation	PEC	3	0	0	3	3	40	60	100		
4.	22CH6310	Pinch Analysis and Heat Exchange	PEC	3	0	0	3	3	40	60	100		
		Network Design											
5.	22CH6311	Chemical Process Flow sheeting	PEC	3	0	0	3	3	40	60	100		
6.	22CH6312	Computational Fluid Dynamics	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL VI : BLUE ECONOMY AND OCEAN STUDIES												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH7301	Aquaculture and Fisheries Business	PEC	3	0	0	3	3	40	60	100		
		Management											
2.	22CH7302	Climate-Resilient Coastal and	PEC	3	0	0	3	3	40	60	100		
		Ocean Entrepreneurship											
3.	22CH7303	Marine and Coastal Resource	PEC	3	0	0	3	3	40	60	100		
		Management											
4.	22CH7304	Ocean Engineering	PEC	3	0	0	3	3	40	60	100		
5.	22CH7305	Sustainable Marine Resources and	PEC	3	0	0	3	3	40	60	100		
		Circular Economy											
6.	22CH7306	Blue Economy Entrepreneurship	PEC	3	0	0	3	3	40	60	100		

Enrolment for B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation.

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

(i) B.E. / B.Tech. Honours (specialisation in the same discipline):

a. The student should have earned additionally a minimum of 18 credits from a vertical of the same programme.

- b. Should have passed all the courses in the first attempt.
- c. Should have earned a minimum CGPA of 7.50.

(ii) B.E. / B.Tech. Honours:

a. The students should have earned additional courses (minimum of 18 credits) from more than one vertical of the same programme.

- b. Should have passed all the courses in the first attempt.
- c. Should have earned a minimum CGPA of 7.50.

(iii) B.E. / B.Tech. (Minor in other specialisation):

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E. / B.Tech. programmes or from any one of the following verticals

VERTICAL I: FINTECH AND BLOCK CHAIN VERTICAL II: ENTREPRENEURSHIP VERTICAL III: ENVIRONMENT AND SUSTAINABILITY

- Students can earn maximum of 6 credits in online mode (SWAYAM platform), out of these 18 credits as approved by Centre for Academic Courses.
- B.E. / B. Tech. (Honours) Specialisation in the same discipline, B.E / B.Tech. Honours and B.E. / B.Tech. Minor in other specialisation degree will be optional for students.
- For the categories (i) to (ii), the students will be permitted to register the courses from V Semester onwards provided the marks earned by the students until III semester should be of CGPA 7.50 and above and cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- ✤ If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- ✤ If a student decides not to opt for Minor, after completing certain number of courses, the

additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

The Head of Department, shall forward the proposal to the Controller of Examinations after getting the approval from Head of the Institution / Dean Academics, before the commencement of the fifth semester of the programme for the students undergo optionally B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation

VERTICALS FOR MINOR DEGREE CHEMICAL ENGINEERING OFFERING MINOR DEGREE

SL. NO.	Course		Category	Perio	Periods Per week		Total	Credits
	Code	Course Title		L	Т	Р	Contact Periods	
1	22CH5471	Introduction to Chemical Process	MDC	3	0	0	3	3
2	22CH6471	Fluid Flow Operations in Chemical Engineering	MDC	3	0	0	3	3
3	22CH6472	Fundamentals of Chemical Thermodynamics	MDC	3	0	0	3	3
4	22CH7471	Process Heat and Mass Transfer	MDC	3	1	0	4	4
5	22CH7472	Reaction Engineering	MDC	3	0	0	3	3
6	22CH8471	Unit Operations and Process Laboratory	MDC	0	0	4	4	2

Minor Specialization in Chemical Process Engineering

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

	VERTICAL I: FINTECH AND BLOCK CHAIN											
s	Course			Perio	ds Per	week	Total					
No	Code	Course Title	Category	L	Т	Р	Contact Periods	Credits				
1	22MB5231	Financial Management	MDC	3	0	0	3	3				
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3				
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3				
4	22MB7231	Introduction to Block chain and its Applications	MDC	3	0	0	3	3				
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3				
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3				

	VERTICAL II: ENTREPRENEURSHIP										
S	Course	Course Title	Category	Peri wee	iods P k	er	Total Contact	Credits			
INO	Code			L	Т	Р	Periods				
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3			
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3			
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3			
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3			
5	22MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3			
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3			

		VERTICAL III: ENVIR	ONMENT A	ND S	USTA	INAB	ILITY	
C N	Course	C TH	G (Peri	ods P	er	Total	
S NO	Code	Course Title	Category	wee	K		Contact	Credits
				L	Т	P	Periods	
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

VERTICALS FOR B Tech (Hons) and B Tech (Hons) in Chemical Engineering with Specialization

Vertical I Computer Aided Process Engineering	Vertical II Polymer Technology	Vertical III Petroleum Engineering	Vertical IV Analytical Instrumentation
Process Flow Sheeting	Polymer Chemistry	Petroleum Geology	Principles of Mass Spectrometry
Transport Phenomena	Processing Technology	Petroleum Exploration	Advanced Analytical Separation Techniques
Advanced Process Optimization	Rubber Technology	Drilling Technology	Advanced Spectrometry: ICP- MS and LC-MS
Artificial Intelligence in Process Engineering	Polymer Product Design, Blends, and Alloys	Petroleum Production Engineering	Instruments for Morphology and Structural Characterization
Digital Twin and Soft Computing in Process Modelling	Polymer Structure and property relationships	Petroleum Reservoir Engineering	Statistical Analysis and Data Processing (Lab)
Advanced ProcessPolymer CompoundingModelling and SimulationTechnology		Offshore Engineering	Troubleshooting Analytical Methods and Instruments

B Tech (Hons) Chemical Engineering with Specialization in Computer Aided Process Engineering

S No	Course	Course Title	Category	Peri wee	ods P k	er	Total Contact	Credits
	Code			L	Т	Р	Periods	
1	22CH5371	Process Flow Sheeting	MDC	2	0	2	4	3
2	22CH6371	Transport Phenomena	MDC	3	1	0	3	4
3	22CH6372	Advanced Process Optimization	MDC	2	0	2	4	3
4	22CH7371	Artificial Intelligence in Process Engineering	MDC	2	0	2	4	3
5	22CH7372	Digital Twin and Soft Computing in Process Modelling	MDC	2	0	2	4	3
6	22CH8371	Advanced Process Modelling and Simulation	MDC	0	0	4	4	2

B Tech (Hons) Chemical Engineering with Specialization in Polymer Technology

S No	Course	Course Title	Category	Periods Per week			Total Contact	Credits
	Code		8- ,	L	Т	Р	Periods	
1	22CH5372	Polymer Chemistry	MDC	3	0	0	3	3
2	22CH6373	Processing Technology	MDC	3	0	0	3	3
3	22CH6374	Rubber Technology	MDC	3	0	0	3	3
4	22CH7373	Polymer Product Design, Blends, and Alloys	MDC	3	0	0	3	3
5	22CH7374	Polymer Structure and property relationships	MDC	3	0	0	3	3
6	22CH8372	Polymer Compounding Technology	MDC	3	0	0	3	3

B Tech (Hons) Chemical Engineering with Specialization in Petroleum Engineering

S No	Course	Course Title	Category	Periods Per week			Total Contact	Credits
	Code			L	Т	Р	Periods	
1	22CH5373	Petroleum Geology	MDC	3	0	0	3	3
2	22CH6375	Petroleum Exploration	MDC	3	0	0	3	3
3	22CH6376	Drilling Technology	MDC	3	0	0	3	3
4	22CH7375	Petroleum Production Engineering	MDC	3	0	0	3	3
5	22CH7376	Petroleum Reservoir Engineering	MDC	3	0	0	3	3
6	22CH8373	Offshore Engineering	MDC	3	0	0	3	3

B Tech (Hons) Chemical Engineering with Specialization in ANALYTICAL INSTRUMENTATION

S No	Course	Course Title	Category	Peri wee	ods P k	'er	Total Contact	Credits
	Code			L	Т	Р	Periods	
1	22CH5374	Principles of Mass Spectrometry	MDC	3	0	0	3	3
2	22CH6377	Advanced Analytical Separation Techniques	MDC	3	0	0	3	3
3	22CH6378	Advanced Spectrometry: ICP-MS and LC-MS	MDC	3	0	0	3	4
4	22CH7377	Instruments for Morphology and Structural Characterization	MDC	3	0	0	3	3
5	22CH7378	Statistical Analysis and Data Processing (Lab)	MDC	3	0	0	4	2
6	22CH8374	Troubleshooting Analytical Methods and Instruments	MDC	3	0	0	3	3

Chairman, Board of Studies

Dean (Academics)

Principal



HINDUSTHAN College of engineering and technology

(An Autonomous Institution)

Coimbatore- 641032

DEPARTMENT OF CHEMICAL ENGINEERING

CURRICULUM

(UNDER REGULATIONS 2022) FOR THE BATCH ADMITTED 2024-2025 ONWARDS



Hindusthan College of Engineering and Technology

Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC (An Autonomous Institution, Affiliated to Anna University, Chennai) Coimbatore – 641 032



DEPARTMENT OF CHEMICAL ENGINEERING REGULATION-2022 FOR STUDENTS ADMITTED 2024-25 ONWARDS B.TECH. CHEMICAL ENGINEERING I TO VIII SEMESTERS CURRICULUM

5.No.	Course Code	Course Title	Category	L	Т	P	C	ТСР	CIA	ESE	TOTAL
		SEMEST	ER I								
Theo	ory			_	-	-					
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
Theo	ry with Lab Co	nponent		_							
2	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
3	22PH1151	Elements of Physical Science	BSC	2	0	2	3	4	50	50	100
4	22IT1151	Python Programming and Practices	ESC	2	0	2	3	4	50	50	100
5	22CH1251	Introduction to Chemical	ESC	2	0	2	3	4	50	50	100
		Engineering									
EEC	Courses (SE/AI	E)	T	1	1	1	1	I	1	1	T
6	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
7	7 22HE1073 Introduction to Soft skills			2	0	0	0	1	100	0	100
Man	datory Courses										
8	22MC1093/	HERITAGE	MC	2	0	0	1	2	40	60	100
	22MC1094	OF TAMIL	MC	2	U	0	1	2	-10	00	100
9	22HE1071	Universal Human Values	MC	2	0	0	0	2	100	0	100
			TOTAL	15	5	6	18	26	580	320	900
S.No.	Course Code	Course Title	Category	L	Т	P	С	TCP	CIA	ESE	TOTAL
		SEMESTI	ER II								
1	22MA2104	Fourier Analysis and Laplace	BSC	3	1	0	4	4	40	60	100
		Transforms								ļ	ļ
2	22CH2203	Sustainable Practices in Chemical	BSC	2	0	0	2	3	40	60	100
		Engineering									
3	22CY2101	Environmental Studies	ESC	2	0	0	2	3	40	60	100
4	22CH2204	Principles of Chemical Engineering	PCC	3	0	0	3	3	40	60	100
Theo	ry with Lab Cor	nponent									
5	22CY2151	Chemistry for Engineers	BSC	2	0	2	3	4	50	50	100
6	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
Prace	tical										
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AF	<u> </u>									
8.	22HE2071	Design Thinking	AEC	1	0	2	2	3	100	0	100
9.	22HE2072	Soft Skills and Aptitude	SEC	1	0	0	1	1	100	0	100
Man	datory Courses										
10.	22MC2093	NCC */NSS / YRC / Sports / Clubs	MC	All students shall enroll, on admi				on admi	ssion, in		
		/ Society Service -			any	one	of	the per	sonality	and ch	naracter
		Enrollment			dev	eloj	pme	ent prog	gramme	es and u	ndergo
				-	-	t	rain	ing for	about 8	80 hour	S
11.	22MC2094/		MC	2	0	0	1	2	40	60	100
	22MC2095										
		IEUTINULUUI	TOTAL	10	1	10	22	20	5(0	440	1000
1			IUIAL	19		10	23	29	560	440	1000

S.No.	Course Code	Course Title	Category	L	Т	P	С	TCP	CIA	ESE	TOTAL
		SEMESTE	ER III								
Theory	y			-		~					
1.	22MA3107	Numerical Methods	BSC	3	1	0	4	4	40	60	100
2.	22CH3201	Chemical Process Calculations	PCC	3	1	0	4	3	40	60	100
3.	22CH3202	Fluid Flow Operations	PCC	3	0	0	3	3	40	60	100
4.	22CH3203	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
		Thermodynamics – I									
Theory	y with Lab Cor	nponent	Daa		0		0		7 0		100
5.	22CH3251	Mechanical Operations	PCC	2	0	2	3	4	50	50	100
6.	22ME3253	Basic Mechanical Engineering	ESC	2	0	2	3	4	50	50	100
Practic			1.50		0	4	2	4	60	10	100
7.	22CH3001	Fluid Flow Operations Lab	AEC	0	0	4	2	4	60	40	100
8.	22CH3002	Technical Analysis Lab	PCC	0	0	4	2	4	60	40	100
EEC C	Courses (SE/AF								100		100
9.	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100
Manda	atory Courses			1	1	1		1		r	
10.	22MC3091	Essence of Indian tradition	MC	2	0	0	0	2	100	0	100
		knowledge									1000
~	~ ~ -		TOTAL	17	2	12	25	32	580	420	1000
S.No.	Course Code	Course Title	Category	L	Т	P	C	ТСР	CIA	ESE	TOTAL
-		SEMESTE	IV IV								
Theory	y		LIG C			0			10	0	100
1.	22HE4101	IPR and Start-ups(Common)	HSC	2	0	0	2	2	40	60	100
2.	22CH4201	Mass Transfer Operations - I	PCC	3	0	0	3	3	40	60	100
3.	22CH4202	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
	22 CH 12 02	Thermodynamics – II	200					-	10		100
4. -	22CH4203	Process Heat Transfer	PCC	3	0	0	3	3	40	60	100
5.	22CH4204	Chemical Process Industries	PCC	2	0	0	2	2	40	60	100
6.	22EE4205	Basics of Electrical & Electronics	ESC	2	0	0	2	3	40	60	100
		Engineering									
Theory	y with Lab Cor	nponent	DCC		0	•	2	4	7 0	50	100
1.	22CH4251	Chemical Reaction Engineering - 1	PCC	2	0	2	3	4	50	50	100
8.	22MA4151	Probability and statistics with R	BSC	2	0	2	3	4	50	50	100
	•	programming									
Practic		Head The market Lak	DCC		0	4	2	4	(0)	40	100
9.	22CH4001	Heat Transfer Lab	PCC	0	0	4	2	4	60	40	100
LEC C	Jourses (SE/AE		CE C2	1	0	0	1	1	100		100
10.	22HE4071	Soft Skills -3(Common)	SEC3	1	0	0	1	1	100	0	100
	atory Courses	In the Constitution	10		0	0	0	2	100		100
11	22MC4091	Indian Constitution	AC	2	0	10	24	2	510	400	100
C No.	Come Codo	Corres Title	Catageme	21 T	U T	10 D	24 C	31 TCD	510 CIA	490 ESE	
5.INO.	Course Code	Course Thie	Category	L	I	r	U	ICP	CIA	ESE	IUIAL
Theorem		SEWIES II									
	y 22CU5201	Mass Transfer Organitions II	DCC	2	0	0	2	2	40	60	100
1. 2	22CHJ201	Process Instrumentation Dynamics	PCC	2	0	0	2	2	40	60	100
∠.	220113202	and Control	ru	3	0	0	3	3	40	00	100
3	22CU52VV	Drofossional Electiva 1	DEC	2	0	0	2	2	40	60	100
з. 4	22CHJJAA 22CHJJAA	Professional Elective 2	DEC	2	0	0	2	2	40	60	100
+. 5	22CHJJAA 22CHJJAA	CH53XX Professional Elective 3		2	0	0	2	2	40	60	100
J. Theorem	FEC	5	0	U	3	3	40	00	100		
6	y with Lab COI	Chamical Deaction Engineering	DCC	n	0	n	2	1	50	50	100
0.	220113231	Chemical Reaction Engineering - II	rtt		0	2	3	4	50	50	100
Practic	ral	1	1	I	<u> </u>	<u> </u>	<u> </u>				

7.	22CH5001	Mass Transfer Operations Lab	PCC	0	0	4	2	4	60	40	100
EEC (Courses (SE/AF										
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	17	1	6	21	24	410	390	800
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL
		SEMESTE	R VI								
Theor	У										
1.	22CH6201	Transport Phenomena	PCC	3	0	0	3	3	40	60	100
2.	22CH6202	Instrumental Method of Analysis	PCC	3	0	0	3	3	40	60	100
3.	22HE6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
4.	22CH63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
5.	22CH63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
Practi	ical										
7.	22CH6001	Process Control Lab	PCC	0	0	4	2	4	60	40	100
8.	22CH6002	Computational Chemical	PCC	0	0	4	2	4	60	40	100
		Engineering Lab									
EEC (Courses (SE/AF	E)									
9.	22HE6071	Soft Skills – 5(Common)	SEC	2	0	0	2	2	100	0	100
			TOTAL	20	0	8	24	28	460	440	900
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL
		SEMESTE	R VII								
		Theor	y		-	-		-	-	-	
1.	22CH7201	Process Economics and Engineering	PCC	3	0	0	3	3	40	60	100
		Management									
2.	22CH7202	Process Equipment Design	PCC	3	1	0	4	4	40	60	100
3.	22CH7203	Bio Chemical Engineering	PCC	3	0	0	3	3	40	60	100
4.	22CH73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
5.	22XX74XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
Practi	ical		1	1	-	-	1				
6.	22CH7001	Design and Simulation Lab	PCC	0	0	4	2	4	60	40	100
	1	EEC Courses	(SE/AE)	1			1		1		
7.	22CH7701	Internship	SEC	-	-	-	2	2	100	0	100
			TOTAL	15	1	4	20	22	360	340	700
* - Fo	ur weeks interns	hip carries 2 credit and it will be done i	n before Se	eme	ster	VI	sun	nmer va	acation	/placem	lent
trainin	g and same will	be evaluated in Semester VII.	~			_	~		~	[_~_	
5.No.	Course Code	Course Title	Category	L	Т	P	C	ТСР	CIA	ESE	TOTAL
		SEMESTER	R VIII								
EEC	Courses (SE/AF					• •	10		100		100
1.	22CH8901	Project Work/Granted	SEC	0	0	20	10		100	0	100
		Patent(Common)	TOTAL	0	0	•	10	•	100	-	100
	4 .1 4 7		TOTAL	0	0	20	10	20	100		100
* 1.	* 1. As per une AICTE guidenne, in Semester I, II, III & IV NCC one credit subject is added as value Added										
	Course with a	Extra Credit. Further, the students wh	o enrolled	nis/	ner	nai	me :	in HIC	ET NC lotad M	C and A	Air wing
	the regulation	o undergo uns subject. The earned extr	a creans p	mu	eu i	n u	le C	onsone	lated IV	Tark she	et as per
2	NCC course	l. Javal 1 & Laval 2 will be added in	the list of	for	non	مام	ctiv	o cubi	acts in	the an	propriate
2.	semester Fu	rther the students' who have onted N	CC subject	s ir	Sen S∉	ene	ster		я ш []] & Г	V are e	ligible to
	undergo NCC	Open Elective Subjects		.5 11	. 50		SICI	1, 11, 1	in a l	, are c	
3.	The above-me	entioned NCC Courses will be offered	to theStud	lent	s w	ho :	are	going t	o be	admitt	ed in the
	Academic Year 2021 – 22.										

	B.E. / B.TECH.PROGRAMMES													
S.No.	Course			(Credits po	er Semest	er			TotalCredits				
	Area	Ι	II	III	IV	V	VI	VII	VIII					
1	HSC	3	3	-	2	-	3	-	-	11				
2	BSC	7	9	4	3	-	-	-	-	23				
3	ESC	6	4	3	2	-	-	-	-	15				
4	PCC	-	3	15	16	11	10	12	-	67				
5	PEC	-	-	-	-	9	6	3	-	18				
6	OEC	-	-	-	-	-	3	3	-	6				
7	EEC	3	3	3	1	1	2	2	10	25				
8	MC	~	✓											
	Total	19	19	22	25	24	21	24	20	10				

SEMESTER WISE CREDIT DISTRIBUTION

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES) To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits
	Code	Course Title		L	Т	Р	Contact Periods	
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPENELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL.	COURSE	COURSE TITLE	CATEGORY	P PE	ERIOI RWEI	DS EK	TOTAL CONTACT	CREDITS
NO.	CODE			L	Т	Р	PERIODS	
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using	OEC	3	0	0	3	3

		Virtual Instrumentation						
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Waste to Energy Conversion	OEC	3	0	0	3	3

Note:Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III (Offered by Chemical Engineering)

Students shall choose any one of the open elective courses such that the course content or title not belongs to their own programme.

SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits			
	Code	Course Title		L	Т	Р	Contact Periods				
1	22CH7401	Biomass Conversion and Bio refinery	OEC	3	0	0	3	3			
	OPENELECTIVE IV										

SL. NO.	Course		Category Periods Per week			week	Total	Credits
	Code	Course Title		L	Т	Р	Contact Periods	
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Petroleum	Vertical II Energy	Vertical III Biochemical	Vertical IV Environmental	Vertical V Computation	Vertical VI Chemical Plant
Process	Engineering	Engineering	and Safety	al Chemical	Design
Technology			Engineering	Engineering	
Petroleum					
Chemistry and Refining	Bioenergy	Biochemistry	Membrane	Computational	Chemical Plant
Fundamentals			Separation Process	Techniques	Design
Primary	RenewableEnergy	Bioprocess	Waste Water	Optimization of	
RefiningTechnology	Resources	Technology	Treatment	Chemical	Plant Layout
				Processes	
Secondary Refining	Pinch Technology	Fermentation &	Solid waste	Process	
Technology		Bioprocessing	Management	Modeling and	Design Safety
				Simulation	
Refinery	Hydrogen and	Bio separation	Environmental	Pinch Analysis	
Advancements and	Fuel Cell	& Downstream	Impact Assessment	and Heat	Material Selection
Environmental	Technology	Processing		Exchange	
Regulations				Network Design	
Petroleum Equipment		Enzyme	Process Safety	Chemical	Statutory
Design	Power Plant	Immobilisation	Management	Process	Requirements&Cus
	Engineering	Technology		Flowsheeting	tomer Care
Petrochemical	Non-Renewable	Bioreactor	Risk and HAZOP	Computational	Process Plant
Technology	Energy	Design	Analysis	Fluid Dynamics	Utilities

	Sources				
Note: Students are per	mitted to choose all	Professional Ele	ectives from a partic	ular vertical	

	DETAILS OF VERTICAL I :PETROLEUM PROCESS TECHNOLOGY												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH5301	Petroleum Chemistry and Refining Fundamentals	PEC	3	0	0	3	3	40	60	100		
2.	22CH5302	Primary Refining Technology	PEC	3	0	0	3	3	40	60	100		
3.	22CH5303	Secondary Refining Technology	PEC	3	0	0	3	3	40	60	100		
4.	22CH5310	Refinery Advancements and Environmental Regulations	PEC	3	0	0	3	3	40	60	100		
5.	22CH5311	Petroleum Equipment Design	PEC	3	0	0	3	3	40	60	100		
6.	22CH5312	Petrochemical Technology	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL II :ENERGY ENGINEERING												
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL		
1.	22CH5304	Bioenergy	PEC	3	0	0	3	3	40	60	100		
2.	22CH5305	Renewable Energy Resources	PEC	3	0	0	3	3	40	60	100		
3.	22CH5306	Pinch Technology	PEC	3	0	0	3	3	40	60	100		
4.	22CH5313	Hydrogen And Fuel Cell	PEC	3	0	0	3	3	40	60	100		
		Technology											
5.	22CH5314	Power Plant Engineering	PEC	3	0	0	3	3	40	60	100		
6.	22CH5315	Non-Renewable Energy Sources	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL III :BIOCHEMICAL ENGINEERING											
S.No.	Course Code	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL	
1.	22CH5307	Biochemistry	PEC	3	0	0	3	3	40	60	100	
2.	22CH5308	Bioprocess Technology	PEC	3	0	0	3	3	40	60	100	
3.	22CH5309	Fermentation & Bioprocessing	PEC	3	0	0	3	3	40	60	100	
4.	22CH5316	Bio separation & Downstream	PEC	3	0	0	3	3	40	60	100	
		Processing										
5.	22CH5317	Enzyme Immobilisation	PEC	3	0	0	3	3	40	60	100	
		Technology										
6.	22CH5318	Bioreactor Design	PEC	3	0	0	3	3	40	60	100	

	DETAILS OF VERTICAL IV: ENVIORNMENTAL AND SAFETY ENGINEERING												
S.No.	Course Code	Course Title	Category	L	Т	P	С	ТСР	CIA	ESE	TOTAL		
1.	22CH6301	Membrane Separation Process	PEC	3	0	0	3	3	40	60	100		
2.	22CH6302	Waste Water Treatment	PEC	3	0	0	3	3	40	60	100		
3.	22CH6303	Solid waste Management	PEC	3	0	0	3	3	40	60	100		
4.	22CH6304	Environmental Impact Assessment	PEC	3	0	0	3	3	40	60	100		
5.	22CH6305	Process Safety Management	PEC	3	0	0	3	3	40	60	100		
6.	22CH6306	Risk and HAZOP Analysis	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL V: COMPUTATIONAL CHEMICAL ENGINEERING												
S.No. Course Code Course Title Category L T								ТСР	CIA	ESE	TOTAL		
1.	22CH6307	Computational Techniques	PEC	3	0	0	3	3	40	60	100		
2.	22CH6308	Optimization of Chemical Processes	PEC	3	0	0	3	3	40	60	100		
3.	22CH6309	Process Modeling and Simulation	PEC	3	0	0	3	3	40	60	100		
4.	22CH6310	Pinch Analysis and Heat Exchange	PEC	3	0	0	3	3	40	60	100		
		Network Design											
5.	22CH6311	Chemical Process Flow sheeting	PEC	3	0	0	3	3	40	60	100		
6.	22CH6312	Computational Fluid Dynamics	PEC	3	0	0	3	3	40	60	100		

	DETAILS OF VERTICAL VI : CHEMICAL PLANT DESIGN												
S.No.	Course Code	Course Title	Category	L	Т	P	С	ТСР	CIA	ESE	TOTAL		
1.	22CH7301	Chemical Plant Design	PEC	3	0	0	3	3	40	60	100		
2.	22CH7302	Plant Layout	PEC	3	0	0	3	3	40	60	100		
3.	22CH7303	Design Safety	PEC	3	0	0	3	3	40	60	100		
4.	22CH7304	Material Selection	PEC	3	0	0	3	3	40	60	100		
5.	22CH7305	Statutory Requirements &	PEC	3	0	0	3	3	40	60	100		
		Customer Care											
6.	22CH7306	Process Plant Utilities	PEC	3	0	0	3	3	40	60	100		

Enrolment for B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation.

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

(i) B.E. / B.Tech. Honours (specialisation in the same discipline):

a. The student should have earned additionally a minimum of 18 credits from a vertical of the same programme.

- b. Should have passed all the courses in the first attempt.
- c. Should have earned a minimum CGPA of 7.50.

(ii) B.E. / B.Tech. Honours:

a. The students should have earned additional courses (minimum of 18 credits) from more than one vertical of the same programme.

- b. Should have passed all the courses in the first attempt.
- c. Should have earned a minimum CGPA of 7.50.

(iii) B.E. / B.Tech. (Minor in other specialisation):

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E. / B.Tech. programmes or from any one of the following verticals

VERTICAL I: FINTECH AND BLOCK CHAIN VERTICAL II: ENTREPRENEURSHIP VERTICAL III: ENVIRONMENT AND SUSTAINABILITY

- Students can earn maximum of 6 credits in online mode (SWAYAM platform), out of these 18 credits as approved by Centre for Academic Courses.
- B.E. / B. Tech. (Honours) Specialisation in the same discipline, B.E / B.Tech. Honours and B.E. / B.Tech. Minor in other specialisation degree will be optional for students.
- For the categories (i) to (ii), the students will be permitted to register the courses from V Semester onwards provided the marks earned by the students until III semester should be of CGPA 7.50 and above and cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- If a student decides not to opt for Minor, after completing certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- The Head of Department, shall forward the proposal to the Controller of Examinations after getting the approval from Head of the Institution / Dean Academics, before the commencement of the fifth semester of the programme for the students undergo optionally B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation

VERTICALS FOR MINOR DEGREE CHEMICAL ENGINEERING OFFERING MINOR DEGREE

SL. NO.	Course		Category	Periods Per week			Total	Credits
	Code	Course Title		L	Т	Р	Contact Periods	
1	22CH5471	Introduction to Chemical Process	MDC	3	0	0	3	3
2	22CH6471	Fluid Flow Operations in Chemical Engineering	MDC	3	0	0	3	3
3	22CH6472	Fundamentals of Chemical Thermodynamics	MDC	3	0	0	3	3
4	22CH7471	Process Heat and Mass Transfer	MDC	3	1	0	4	4
5	22CH7472	Reaction Engineering	MDC	3	0	0	3	3
6	22CH8471	Unit Operations and Process Laboratory	MDC	0	0	4	4	2

Minor Specialization in Chemical Process Engineering

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

	VERTICAL I: FINTECH AND BLOCK CHAIN												
s	Course		~	Periods l	Per w	veek	Total	~					
No	No Code Course Title Category		L	Т	Р	Contact Periods	Credits						
1	22MB5231	Financial Management	MDC	3	0	0	3	3					
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3					
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3					
4	22MB7231	Introduction to Block chain and its Applications	MDC	3	0	0	3	3					
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3					
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3					

	VERTICAL II: ENTREPRENEURSHIP													
S	Course	Course Title	Category	Per wee	iods F k	er	Total Contact	Credits						
INO	Code		L		Т	Р	Periods							
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3						
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3						
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3						
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3						
5	22MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3						
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3						

	VERTICAL III: ENVIRONMENT AND SUSTAINABILITY											
C N	Course	а т и	a t	Peri	ods P	er	Total	a lit				
S No	Code	Course Title	Category	wee	K T		Contact	Credits				
				L	Т	P	Periods					
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3				
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3				
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3				
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3				
5	22CE7233	Green Technology	MDC	3	0	0	3	3				
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3				

VERTICALS FOR B Tech (Hons) and B Tech (Hons) in Chemical Engineering with Specialization

Vertical I Computer Aided Process	Vertical II Polymer Technology	Vertical III Petroleum Engineering	Vertical IV Instrumental Chemical
Engineering			Analysis
Process Flow Sheeting	Polymer Chemistry	Petroleum Geology	Principles of Mass Spectrometry
Transport Phenomena	Processing Technology	Petroleum Exploration	Advanced Analytical Separation Techniques
Advanced Process	Rubber Technology	Drilling Technology	Advanced Spectrometry: ICP-
Optimization			MS and LC-MS
Artificial Intelligence in	Polymer Product Design,	Petroleum Production	Instruments for Morphology and
Process Engineering	Blends, and Alloys	Engineering	Structural Characterization
Digital Twin and Soft	Polymer Structure and	Petroleum Reservoir	Statistical Analysis and Data
Computing in Process	property relationships	Engineering	Processing (Lab)
Modelling			
Advanced Process	Polymer Compounding	Offshore Engineering	Troubleshooting Analytical
Modelling and Simulation	Technology		Methods and Instruments

B Tech (Hons) Chemical Engineering with Specialization in Computer Aided Process Engineering

S No	Course	Course Title	Category	Periods Per week			Total Contact	Credits
	Code			L	Т	P	Periods	
1	22CH5371	Process Flow Sheeting	MDC	2	0	2	4	3
2	22CH6371	Transport Phenomena	MDC	3	1	0	3	4
3	22CH6372	Advanced Process Optimization	MDC	2	0	2	4	3
4	22CH7371	Artificial Intelligence in Process Engineering	MDC	2	0	2	4	3
5	22CH7372	Digital Twin and Soft Computing in Process Modeling	MDC	2	0	2	4	3
6	22CH8371	Advanced Process Modelling and Simulation	MDC	0	0	4	4	2

B Tech (Hons) Chemical Engineering with Specialization in Polymer Technology

S No	Course	Course Title	Category	Peri wee	Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Periods Per week		Total Contact	Credits
	Code			L	Т	Р	Periods																																							
1	22CH5372	Polymer Chemistry	MDC	3	0	0	3	3																																						
2	22CH6373	Processing Technology	MDC	3	0	0	3	3																																						
3	22CH6374	Rubber Technology	MDC	3	0	0	3	3																																						
4	22CH7373	Polymer Product Design, Blends, and Alloys	MDC	3	0	0	3	3																																						
5	22CH7374	Polymer Structure and property relationships	MDC	3	0	0	3	3																																						
6	22CH8372	Polymer Compounding Technology	MDC	3	0	0	3	3																																						

B Tech (Hons) Chemical Engineering with Specialization in Petroleum Engineering

S No	Course	Course Title	Category	Peri wee	ods P k	er	Total Contact	Credits
	Code			L	Т	Р	Periods	
1	22CH5373	Petroleum Geology	MDC	3	0	0	3	3
2	22CH6375	Petroleum Exploration	MDC	3	0	0	3	3
3	22CH6376	Drilling Technology	MDC	3	0	0	3	3
4	22CH7375	Petroleum Production Engineering	MDC	3	0	0	3	3
5	22CH7376	Petroleum Reservoir Engineering	MDC	3	0	0	3	3
6	22CH8373	Offshore Engineering	MDC	3	0	0	3	3

B Tech (Hons) Chemical Engineering with Specialization in Instrumental Chemical Analysis

S No	Course	Course Title	Category	Peri wee	ods P k	er	Total Contact	Credits
	Code			L	Т	P	Periods	
1	22CH5374	Principles of Mass Spectrometry	MDC	3	0	0	3	3
2	22CH6377	Advanced Analytical Separation Techniques	MDC	3	0	0	3	3
3	22CH6378	Advanced Spectrometry: ICP-MS and LC-MS	MDC	3	0	0	3	4
4	22CH7377	Instruments for Morphology and Structural Characterization	MDC	3	0	0	3	3
5	22CH7378	Statistical Analysis and Data Processing (Lab)	MDC	3	0	0	4	2
6	22CH8374	Troubleshooting Analytical Methods and Instruments	MDC	3	0	0	3	3

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D	Course		T	т	n	C
Programme	Code		L	1	Г	C
B.TECH.	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	2	0	2	3
	The student	t should be able				
~	1. To help	the students of engineering and technology develop a strong b	ase in the	use of	Engli	sh.
Course	2. To help	learners use language effectively in professional writing.				
Objective	3. To impa	art basic English grammar and essentials of important language	skills			
	4 To impa	art knowledge about the importance of vocabulary and gramma	r			
	5 To dev	elop the communication skills of the students in both forr	nal and	inform	al situ	ations
Unit		Description			Inst	ructional Hours
I	Language Pr Acronyms Wi Environment. questions, Spe Interviewing a interviews Re Interpreting G	oficiency: Parts of Speech, Degrees of Comparison, Abbreviat riting: Process Description, Instructions. Vocabulary – Words of Practical Component: Listening- Watching Short Videos and a eaking- Self introduction, Narrating personal experiences / eve a celebrity; Reporting / and summarizing of documentaries / pc ading- Purpose of Reading - Churning & Assimilation, Inter- transhs in Technical Writing.	ion& on nswer th nts; dcasts / preting I	e deas -	35), 33 	7+2
Ш	Language Pro Writing: Writ Entertainment Speaking- Sto	oficiency: Types of Sentences, Framing Question, One Word ting Checklist, Reading Comprehension. Vocabulary– Words c . Practical Component: Listening-Comprehensions based on T ry Telling Reading - Skimming – Scanning – Reading: Scienti	Substitut n ED talks fic Texts	ion		7+2
III	Language Pro Writing: Form Vocabulary – English langua articles (from perspective (o	ficiency: Tenses, Conditional Clause ('If' clause), Active and I nal letter (invitation, acceptance, decline, Congratulation) Cloze Words on Tools. Practical Component: Listening-Listening pro age learning programme Speaking - Just a minute Reading- Re newspapers and magazines) -Reading to identify point of view pinion pieces, editorials etc.)	Passive v e test. e-recorde ading fea and	oices, d iture	2.	5+4
IV	Language Prot Writing: Prepa Engineering pr works for recr Reading Comp	ficiency: Subject Verb Concord, Articles, The Use of Prefixes aring Agenda & Minutes, Writing Recommendations. Vocabula rocess. Practical Component: Listening-An interview with som uitment personnel. Speaking-Presentation on a general topic. R orehension - Literary Texts.	and Suff ry– Wor leone wh leading-	ixes ds on o		5+4
V	Language Prof the Editor, Sec Component: L videos Speakin Fravelogues, 7	ficiency: Prepositions, Phrasal Verbs, Modal Auxiliaries, Writi quencing of Sentences Vocabulary –Words on Engineering ma istening- Listening- Comprehensions based on Nat Geo/Disco ng- Preparing posters and presenting as a team. Reading- Biogr Fechnical blogs.	ng: Lette terial Pra very chan raphies,	r to ctical nnel	,	6+3
I	CO1 Unda	I otai Instru	cuonai r	Tours		45
ŀ	CO2 Emet	Is the students to write opherently and ophesively.				
Course	CO3 Enab	ble the development of basic grammar to enhance language for	a better		comm	inication
Outcome	CO4 Use	suitable vocabulary and grammar with confidence and express	their ide	as in sr	beech a	nd writing.
F	CO5 follo	w the etiquettes in formal and informal communication				
TEXT BOOK	:					
T1	Raymond Mu	rphy, "English Grammar in Use"-5 th editionCambridgeUnivers	sityPress	, 2019.		
T2	Norman Whit	tby, "Business Benchmark-Pre-intermediate to Intermediate",	Cambrid	ge Univ	versity	Press, 2016.
REFERENCE	S:					
R1	Kapoor A.N.	, Business Letters for Different Occasions, New Delhi: S. Cha	nd & Co	o. Pvt.	Ltd., 20	012
R2	RaymondMu	rphy, " English Grammar For ESL Learners - Premium Fourth	Edition.			
R3	McCarthy, M	ichael et.al (2011) English Vocabulary in Use – advanced, Car	mbridge	Univer	sity Pre	ss.

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-		2	-;	3	2	1	-	-
CO2	-	-	-	-	2	3	2	3	1	3	1	-	-	-
CO3	-	-	-	3		2	-	2	2	3.	2	2 ·	-	-
CO4	-	-	-	-	-	2	<u>i</u>	2 -	1	3	1	1	-	-
CO5	-	· _	-	2	-	-		2	3	3.	3	1	-	-
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Programme	Course	Name of the Course	L	Т	Р	C
В.ТЕСН.	22PH1151	ELEMENTS OF PHYSICAL SCIENCE (For B.Tech. Agricultural Engineering, Chemical Engineering & Food Technology)	2	0	2	3
	The studer	t should be able to		L		
	1 Have k	nowledge on heat and thermodynamics				······································
Course	2 Acqui	re knowledge on Illtrasound and their applications.				
Objective	3. Enhanc	the fundamental knowledge in properties of materials				
	4 Adequi	ate knowledge on laser fundamentals and their applications				
	5 Extend	the knowledge about wave optics.				
Unit	• • • • • • • • • • • • • • • • • • •	Description			Instr l	uctiona Hours
I	THERMAL radiation- the conductivity heat conduct applications:	PHYSICS: Thermal expansion - thermal conduction, convection ermal stress - Thermal expansion- Expansion joints - bimetallic -Lee's disc method to determine the thermal conductivity of ba ons in solids - flow of heat through compound media (series ar refrigerators and solar water heaters.	ion and strips - t id conduc id paralle	hermal ctor el) –		6
	ULTRASON	NICS: Production – Piezoelectric generator – Properties of U.	ltrasonic	waves.		6
п	Determinatio welding – No Scanner – A	n of velocity using acoustic grating –Industrial applications ondestructive testing (pulse echo system). Medical application – mode – B- mode and C –mode	– Drilli ns – Ultr	ng and asound		
III	MECHANIC ratio – Bendi the material torsion pend uniform ben	CAL PROPERTIES OF MATERIAL: Elasticity – Hooke's ng moment – Depression of a cantilever – Derivation of Youn of the beam by Uniform bending theory and experiment. Tw ulum: theory and experiment.Determination of Young's ding method.Determination of Rigidity modulus – Torsion	law –Pc ngʻs mod visting c s modul pendulu	isson's ulus of ouple - l us by I m		12
IV	PHOTONIC emission - A Merits, Dem profiling), las	S: Characteristics of Laser - Principle of spontaneous emission ctive medium - Types of laserPrinciple, Construction, Work erits and applications of Nd-YAG laser – Applications – H er drilling, and laser welding.	n and stir king, Pro Holograph	nulated perties, 1y (3D		9
V	WAVE ME Antireflectior hin wire - D Rayleigh's cr Determination	CCHANICS : Interference -Conditions for sustained a coating – air wedge and it's applications. Determination of iffraction of light –Fraunhofer diffraction at single slit –Diffr. iterion of resolution power - resolving power of grating. on of wavelength of mercury spectrum – spectrometer grating on of thickness of a thin wire – Air wedge method.	Interfere f thickne action gr	ence - ss of a ating –]	12
F		Total Instru	ictional]	lours	4	45
Course Outcome	CO1 CO2 CO3 CO4 CO5	Familiarize the concepts of heat and thermodynamics Relate the Ultrasound and their applications Illustrate the fundamental properties of materials Relate the advanced technology of LASER in the field of Engi Analyze the wavelength of different colors by spectral analysis	neering			
TEXT BOOK		Analyze the wavelength of unterent colors by spectral analysis	3			
TI	Rajendran V	, Applied Physics, Tata McGraw Hill Publishing Company Lir	nited, Ne	ew Delh	i, 2017	
T2	Gaur R.K. an Delhi 2018	nd Gupta S.L., Engineering Physics, 8 th edition, Dhanpat Rai I	Publicatio	ons (P)	Ltd., N	ew
REFERENCE	S:	· · · · · · · · · · · · · · · · · · ·				
R1	M.N Avadha New Delhi 2	nulu and PG Kshirsagar "A Text Book of Engineering physics 018	s" S. Cha	nd and	l Comp	any ltd.,
R2	Halliday, D.,	Resnick, R. and Walker, J. "Principles of Physics". Wiley, 20	20.			A

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	1	-	1	1	1	2	3	2	2 -
CO2	3	3	3	2	2	1	1	-	1	1	1	2	3	2	2
CO3	3	3	3	2	2	1	1	-	1	1	1	2	3	2	2
CO4	3	3	3	1	1	1	1	-	1	1	1	2	3	2	1
CO5	3	3	3	3	3	1	1	-	1	1	1	2	3	2	1
			L	L	L	l									

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Programme	Course Code	Name of the Course	L	Т	Р	С
B.TECH.	22MA1101	MATRICES AND CALCULUS	3	1	0	4
		(Common to all Branches)				
	The student	t should be able to		· · · · · ·		
Course	1. Constru	ict the characteristic polynomial of a matrix and use it	to iden	tify Ei	gen val	ues and
Objective	Eigenve					
Ū	2. Impart (ne knowledge of single variate calculus.				
	J. Failina	the student with nunctions of several variables.	na multi	nle inte	arale a	nd their
	4 Acquait	ions	ing munu	pic nic	grais a	nu then
	5 Make a	vector differential operator for vector function and theorems t	o solve e	ngineeri	ing prof	lems
	J pviake a	vector unreferritar operator for vector function and theorems t	0 30110 0	ingineer	Instri	ictiona
Unit		Description			11	Hours
	Matrices: Eig	zen values and Eigen vectors – Properties of Eigen values and	Eigen ve	ctors	1	2
I	(without proo	f) - Cayley - Hamilton Theorem (excluding proof) - Reduction	of a qua	dratic		
	form to canon	ical form by orthogonal transformation.	1			
ΥY	Single Variat	e Calculus: Rolle's Theorem – Lagrange's Mean Value Theo	rem - Ma	ixima	1	2
11	and Minima –	Taylor's and Maclaurin's Series.				1
	Functions of	Several Variables: Partial derivatives - Total derivative - Jac	obians –		1	2
ш	Maxima and n	ninima of functions of two variables and Lagrange's method of	of undeter	mined		
	multipliers.					
	Integral Calo	culus: Double integrals in Cartesian coordinates – Area enclo	sed by pl	ane	1	2
IV	curves (exclud	ling surface area) – Triple integrals in Cartesian co-ordinates -	- Volume	of		
	solids (Sphere	, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	0.1.1			-
v	Vector Calcul	lus: Gradient, divergence and curl vectors - Green's theorem -	Stoke's	and	1	2
•	Gauss diverge	nce theorem (statement only) for cubes only.				
	,	Total Instru	ictional l	Hours	6	0
	CO1	Compute Eigen values and Eigen vectors of the given matrix	k and tra	nsform	given q	uadratic
Course	1	form into canonical form.				
Outcome	<u>CO2</u>	Apply the concept of differentiation to identify the maximum	and minii	num va	lues of	curve.
		Jse differential calculus ideas on several variable functions.				
	<u> </u>	Apply multiple integral ideas in solving areas, volumes and of	ner practi	ical pro	biems.	
TEVT POOK		Apply the concept of vector calculus in two and three-dimension	snar spac	es		
ILAI DUUN	Emuin Krowai	a "A duanced Engineering Mathematics" John Wiley & Son	a 10 th ed	ition 20	010	
T1	EIWIII KIEyszi	g, Advanced Engineering Mathematics, John Whey & Son	s, 10 cu	111011, 20	51.5	
	K P IIma and	S. Padma "Engineering Mathematics I (Matrices and Calcul	us)" Pea	urson Lt	d 2022	
T2		5. Fadma, Engineering Mathematics F (Mathees and Calcul	(13),100		u ,2022.	
REFERENCE	ES:					
D:	Jerrold E. Ma	rsden, Anthony Tromba, "Vector Calculus", W.H.Freeman, 2	003-Stra	uss M	J, G. L I	Bradley
RI	and K. J .Smi	th, "Multivariable calculus", 6 th edition, Prentice Hall, 2011.			-	_
R2	T, "Engineeri	ng Mathematics", 5 th edition, Mc Graw Hill Education(India)	Pvt Ltd,	New D	elhi, 20	16
P3	G. B. Thomas	and R. L. Finney, "Calculus and Analytical Geometry", 9th E	dition, A	ddison	Wesley	
NJ I	Publishing Co	ompany, 2016.				

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	-	-	1	2	2	3	2
CO2	3	3	3.	3	2	2	2	-	-	1	2	2	2	2
CO3	3	3	3	3	2	2	2	-	-	1	2	2	2	2
CO4	3	3	3	3	2	2	2	-	-	. 1	2	2	2	2
CO5	3	3	3	3	2	2	2	-	-	1	2	2	3	3
AVG	3	3	3	3	2.2	2	2			1	2	2	2.4	2.2

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Programme	Course	Name of the Course	L	Т	Р	С
B.E./B.Tech/	22HE1095	UNIVERSAL HUMAN VALUES (COMMON TO ALL BRANCHES)	2	0	0	0
Course Objectives	The studentsh1. To he ensure2. Tofae as to the re move3. Tohi	ouldbemade elp the students appreciate the essential complementarily between ' re sustained happiness and prosperity which are the core aspiration cilitatethedevelopmentofaHolisticperspectiveamongstudentstoward wards happiness and prosperity based on a correct understanding est of existence. Such a holistic perspective forms the basis of Un ement towards value-based living in a natural way.	VALU s of all slifean of the iversal	ES' and human dprofes Humar Humar lhuman	l'SKI being sion a n real n Valu	LLS' to as well ity and les and loct,
	trustf	ful and mutually fulfilling human behavior and mutually enriching	interac	tion wit	th Nat	ure.
Unit		Descrip			Inst	ruction
Ι	Introduction to Right Understar Education)-Und Education - Con	tion Value Education nding, Relationship and Physical Facility (Holistic Development an erstanding Value Education - Self-exploration as the Proce ntinuous Happiness and Prosperity – the Basic Human Aspiration	nd the l ss for s - Haj	Role of Value opiness		6
П	and Prosperity – Harmony in th Understanding I between the New Understanding I	- Current Scenario - Method to Fulfill the Basic Human Aspiration e Human Being and Harmony in the Family Human being as the Co-existence of the Self and the Body - Disting eds of the Self and the Body - The Body as an Instrument of the Se Harmony in the Self- Harmony of the Self with the Body - Program and Health	s guishin lf - me to (g ensure		6
III	Harmony in the Harmony in the Relationship 'T Relationship 'Re Understanding I	e Family and Society E Family – the Basic Unit of Human Interaction. Values in Hum rust' – the Foundational Value in Relationship Values in Hum espect' – as the Right Evaluation Harmony in the Society	an to l an to l	Human Human		6
IV	Harmony in th Understanding Fulfillment amo mutually intera Levels The Holi	e Nature / Existence Harmony in the Nature.Inter connectedness, self-regulation ong the Four Orders of Nature- Understanding Existence as Co cting units in all pervasivespace Realizing Existence as Co-ex- istic Perception of Harmony in Existence. Vision for the Universal	and - existe stence Humar	Mutual ince of at All i Order		6
V	Implications of Natural Accepta Humanistic Edu Professional Et Typical Case St	the Holistic Understanding – a Look at Professional Ethics ince of Human Values Definitiveness of (Ethical) Human Conduc ication, Humanistic Constitution and Universal Human Order-C hics Holistic Technologies, Production Systems and Manager udies Strategies for Transition towards Value-based Life and Profe	t A Ba ompete nent N ssion	usis for ence in Iodels-		6
		Total Instruct	ional I	Iours	3	0 ′
Course Outcome Reference Bo {1.A Foundati y ^{ad} Revised Ed {2.Teachers'M R Asthana,G H R3.JeevanVidy R4.Human Val	At the end of the CO1: To become Solutions. CO3: To sensitive Socially res CO4: To able to a In handling CO5: To develop oks: on Course in Hur lition, Excel Book fanualforAFound P Bagaria, 2 nd Rev ya: EkParichaya, Jues, A.N. Tripath	course, the learner will be able more aware of holistic vision of life - themselves and their surroun more responsible in life, in the Society and in handling problems w e towards their commitment towards what they understood towards ponsible behavior. pply what have learnt to their own self in different day-to-day setti problems with sustainable solutions. competence and capabilities for maintaining Health and Hygiene. nan Values and Professional Ethics, R R Gaur, R Asthana, G P Bag ts, New Delhi, 2019. ISBN 978-93-87034-47-1 ationCourseinHumanValuesandProfessionalEthics,RRGaur, vised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034 A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999. hi, New Age Intl. Publishers, New Delhi, 2004.	dings. /ith sus enviro ngs in n garia, J-53-2	tainable nment a real life	and and	

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	-	2	-		-	2	-	-	2
CO2	2	3	- 3	-	2	-	-	-	2	-	-	2
CO3	2	3	3	-	2	-	-		2	-	-	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2
AVG	2	3	3		2		-		2	-	-	2

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Programme B.E./B.Tech			<u> </u>			
	Code	Name of the Course	L	T	P	
	22HE1072	ENTREPRENEURESHIP AND	1	0	0	
		INNOVATION				
		(Common to all Branches)				
	The student sh	ould be made		L	L	
0	1. To acqui	ire the knowledge and skills needed to manage the	developm	ent of inn	ovation.	
Objectives	2. To rect	specific and detailed method to exploit these oppo	ortunities.	mnovau	0115.	
Objectives	4. To acq	uire the resources necessary to implement these pla	ns.			
	5. To mak	e students understand organizational performance	and its im	portance.		
Module	1	Description			-	
1	Entrepreneurial	Thinking				
2	Innovation Man:	agement				
3	Design Thinking					
4	Opportunity Spo	otting / Opportunity Evaluation				
5	Industry and Ma	rket Research				
6	Innovation Strat	egy and Business Models				
7	Financial Foreca	sting				
8	Business Plans/ H	Business Model Canvas				
9	Entrepreneurial	Finance				
10	Pitching to Resou	urces Providers / Pitch Deck				
11	Negotiating Deal	s				
12	New Venture Cro	eation			·	
13	Lean Start-ups					
14	Entrepreneurial	Ecosystem				
15	Velocity Venture		VOTION		mo	
		TOTAL INSTR	UCTION	AL HOU	JRS	15
	At the end of the	course, the learner will be able to Ithenatureofbusinessonnortunities resources and in	lustriesin	criticaland	dcreative	
Course	aspects.					
Outcome	CO2: Understand	I the processes by which innovation is fostered, ma	anaged, ai	nd comme	ercialized.	
	CO3:Remember	effectively and efficiently the potential of new bu	siness opp	oortunities	S. itora and ir	due
	attractiveness	market potential for a new venture, including cusic	mer neeu	, compen	noro, anu n	iaus
	CO5:Developabi	isiness model for a new venture, including revenue	e. Margins	s, operatio	ons,	
	Working capital, a	nd investment	· · · · · · · · · · · · · · · · · · ·			
EXT BOOKS		anotin con dia dia con Patrona con initia dia con anti-	Deerson	SecondEd	lition (2012)	`
1:AryaKumar"E [2:EmrahVavici"	'DesignThinkingM	realingandleadinganEntrepreneurialOrganization" ethodology" Arthiztech FirstEdition(2016)	,r carson,	SCLOHUEU	111011(2012)	,.
ayiei	2 Jongin I mitkiligivi	······································				
DEFEDENCE D	OOKS	· · · · · · · · · · · · · · · · · · ·				
CEFERENCE B C1: Christopher (Golis "Enterprise &	Venture Capital", Allen &Unwin Publication. For	urth Editio	on (2007).	•	
2: ThomasLock	Wood&EdgerPapk	e"InnovationbyDesign",CareerPress.com,SecondE	dition(20	17).		
3: Jonathan Wils	son "Essentials of I	Business Research", Sage Publication, First Edition	n(2010).			
VEB RESOURC	JES of forgeforward in	tagged/startun-lessons				
W2:https://blo	of.forgeforward.in/	tagged/entrepreurship				
	of.forgeforward.in/ta	gged/minimum-viable-product				
W3:https://blo	of.forgeforward.in/ta	gged/minimum-viable-product				
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22HE1072 ENTREPRENEURSHIP&INNOVATION

PO CO	P 0 1	РО 2	PO 3	PO4	PO5	PO6	PO 7	РО 8	PO9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2
COI	3	3	3	3	3	-	~	-	-	-	-	2	Ż	1
CO2	3	3	3	2	2	1	-	-	-	ļ	-	2	2	2
CO3	μ)	3	3	2	ini.	-	-	-	-	~	-	2	Ž	2
CO4	3	3	3	3	3	-	-	~	-	-	-	2	2	3
C05	W.	ίν)	m,	3	3	-	-	-	-	-	-	2	ł	2
AV G	3	3	3	2.6	2.8	-	-	-	-	•	-	2	1.8	2

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n		C	Name of the Course	1	T	D	C		
B.E./B.Tech		Code	Name of the Course		1		C		
		22MC1094	HERITAGE OF TAMIL	2	0	0	1		
			(Common to all Branches)						
Cours Objecti	The learner should be able to 1. Introduce students to the great History of Tamil, literature. Course 2. Establish the heritage of various forms of Rock art and Sculpture art. Objective 3. To study and understand the various folk and Martial arts of Tamil culture 4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil					literature.	•		
TT \$4		5. To learn at	Description	uage in n	idian cuitt	Instruct	ional		
Unit		Description				Hours			
I I La Li Li Ja	Language and Literature Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry _						6		
II H H ten Ka	II Heritage _ Rock Art Paintings to Modern Art - Sculpture Hero Stone to Modern Sculpture - Bronze icons - Tribes and their handcrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments - Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.						6		
III Fo Th Si	III Folk and Martial Arts Therukoothu, Karagattem, Villupattu, Kaniyankoothu, Oyilattam, Leather puppertry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.								
IV IV Li Cit	Thinai Concept of Tamils IV 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								
V Co ot	 Contribution of Tamils to Indian National Movement and Indian Culture V 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. 						6		
			Total Ins	truction	al Hours	30)		
At the end of the course, the learner will be able to CO1: Learn about the works pertaining to Sangam age CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture. Course C03Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture. Outcome CO4: Appreciate the intricacies of Tamil literature that had existed in the past. CO5: Understand the contribution of Tamil Literature to Indian Culture									
TEXT B T1: Socia T2: Socia T3: Histo Institute o REFERI R1-The C Studies) R2- Poru Services	I Life of I Life of orical He: of Tamil i ENCE BC Contributi nai Civili	Tamils (Dr.K.K. the Tamils - The ritage of the Tam Studies). DOKS: ons of the Tamil zation (Jointly P ton, Tamil Nadu)	Pillay) A joint publication of TNTB & ESC and RM Classical Period (Dr.S.Singaravelu) (Published by: ils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkara s to Indian Culture (Dr.M.Valarmathi) (Published b ublished by: Department of Archaeology & Tamil N o Vaigai (P. Balakrishnan) (Published by: PMPL)	IRL (in Internatio su)(Publi y: Interna Jadu Text	print) nal Institu shed by: I tional Inst Bookand I	te of Tamil nternationa itute of Tan Educationa	Studies. 1 nil 1		

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Programme	Course Code	Name of the Course	L	Т	Р	(
B.E./B.Tech	22MC1093	TAMIZHAR MARABHU தமிழர் மரபு	2	0	0	1
c	GE3152				LTPC	

மொழி மற்றும் இலக்கியம்: ച്ചഖങ്ങി

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி

இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நலீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு il மரபு – பாறை ஒளியங்கள் முதல் நவீன ஒளியங்கள் வரை –

சிற்பக் கலை: 9ற்பக் கலை: நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – துமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம். பன்ற., , () வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்ப<u>றக் கலைகள் மற்றும் வீர விளையாட்டுகள்</u> 3 தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாலைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், கமிழர்களின் சுயார (இதன் விளையாட்டுகள்.

<u>தமிழர்களின் திணைக் கோட்பாடுகள்</u> அலகு IV தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

20100 (05 V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குக் தமிழர்களின் பங்களிப்பு:

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: 1. தமிழ்நாடு பாடதால் மற்றும் கல்வியியல் பணிகள் கழகம்).

- கணினித் தமிழ் முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
- 3 😫 முடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை ഖെണിഡീറ്റാ
- பொருறை ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
- Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL (in print) 5.
- Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: 6. International Institute of Tamil's tudies. (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)
- 7 (Published by International Institute of Tamil Studies).
- The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) 8
- Keeladi 'Sangam City Civilization on the banks of river Valgai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Q. Tamil Nadu)

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计分子分词 计正式分子
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12
CO1	2	3	3	-	-	-	-	-	2			2
CO2	2	3,	3	-	-	-	-	-	2			2
CO3	2	3	3	-	. –	-	-	-	2			2
CO4	2	3	-	-	-	-	-	-	2			2
C05	2	3	-	-	-	-	-	-	2			2
AVG	- 2	3	1.8		-	-	-	-	2		,	2
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Progra	amme	Course Code	Course Title	L 1	Γ	Р	С
B.E/B.	TECH	22HE1073	INTRODUCTION TO SOFT SKILLS	2 ()	0	0
Cou	irse	 To develop and demonstration a To enhance the 	nurture the soft skills of the students through instruction, knowledg nd practice. students ability to deal with numerical and quantitative skills.	e acq,	uisi	itior	1,
Objec	tives:	3. To identify the c	core skills associated with critical thinking.				
		4. To develop and	integrate the use of English language skills.				
Unit			Description	Instr H	ucti our	ion: rs	al
	Lesso	ns on excellence					
1	Skill i	ntrospection, Skill	acquisition, consistent practice		2		
II	Logica Codin Sudok Quanti	I Reasoning Probl g and Decoding – tu puzzles - Attenti itative Aptitude	em Solving - Critical Thinking- Lateral Thinking - Series – Analogy - Odd Man Out - Visual Reasoning - on to detail		11		
111	Additi and cu Multip fractio Algebr	on and Subtraction be roots - Vedic m plication of 3 and h ons - Shortcuts to fi ra and functions	n of bigger numbers - Square and square roots - Cubes naths techniques - Multiplication Shortcuts - igher digit numbers – Simplifications - Comparing nd HCF and LCM - Divisibility tests shortcuts -		11		
	Recrui	tment Essentials					
IV	Resum	e Building - Impre	ession Management		2		
	Verbal	Ability					
V	Nouns – Agre	and Pronouns – V ement – Punctuation	erbs - Subject-Verb Agreement - Pronoun-Antecedent ons		4		
			Total Instructional Hours		30		
Course		01: Students will an 02: Students will ex 03: Students will 1 guantitative pro	aalyze interpersonal communication skills. public speaking skills. templify tautology, contradiction and contingency by logical thinking be able to develop an appropriate integral form to solve all bleme	g. sorts	of	•	
Outcome	e: CC)4: Students can p measurable ach	broduce a resume that describes their education, skills, experier ievements with proper grammar, format and brevity.	ices a	and		

CO5: Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar.

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B.TECH.	22CH1251	1 INTRODUCTION TO CHEMICAL ENCINEERING	2	0	2
	The studen	t should be able to			
Course Objectiv	1.	Understand the history of chemical engineering and p Engineering in daily life applications.	ervasive p	resence	of Ch
e	2.	Outline the interdisciplinary intersections and under	rstand the	importa	ance o
		and dimensions in chemical engineering.	. 1 1		C Cl
	3.	Interpret the paradigm shifts shaping the curr Engineering	ent lands	cape o	of Ch
Unit		Description		Instr	uction
I	FOUNDAT	FION & SIGNIFICANCE : What is Chemical Eng	gineering?		Juio
	Origin and	growth of chemical Engineers in chemical process	ndustries;		
	Personalitie	s of Chemical Engineering; Greatest achievements of	Chemical		9
	Engineering	g - plastics, cleaner ruels, synthetic rubbers; Koles of the	itional ve		
	modern che	mical engineering	monai və.		•
II	VERSATII	LITY OF CHEMICAL ENGINEERS: Relation	between		
	Chemical E	Engineering and other engineering disciplines; Role of	Chemical		6
	Engineers -	Food, Medical, Energy, Environmental, Biochemical, El	ectronics;		U
	Portable De	WICES;	manaiana		
ш	BASICS (or Uneivideal Englineering: Units and all declassification of unit processes and unit operations.	Flowsheet		
	representati	on of process plants-synthesis gas, natural gas, coke	oven gas;		9
	Batch, conti	inuous, recycle, bypass and purge process.			
IV	DYNAMIC	CS OF CHEMICAL ENGINEERING: Chemical Engin	neering in		
	Everyday L	ife; Similarities in Dissimilar Applications; Scaling Up	or Down;		616
	waste mai	nagement (solid, liquid and gas) – Removal of c	olor and waste to		0+0
	recover val	uable products.	maste to		
V	CONTEMI	PORARY STATUS: Role of Computer in C	hemical		
	Engineering	g; Chemical Engineering Software - Design of Plant	Process		6+3
	using Asp	en Plus, CAD.Paradigm shifts in Chemical Engi	neering;		
	Opportuniti	es for Chemical Engineers; Future of Chemical Engineer	ing. nal Hours		45
	CO1 Ext	plain the fundamental relationships and significant	ce of Ch	emistry	$\frac{10}{1.00}$
Course	Eng	gineering, and Chemical Technology in industrial and soc	cietal conte	xts.	
Outcom	CO2 Red	cognize and articulate the diverse applications of Chem	ical Engin	eering	princij
e	eve	ryday life scenarios.	- F (1)		Errei
	CO3 Der	monstrate an understanding of the interdisciplinary national evolution of its connections with other engineering	ure of Che	sinicai	сngir
	CO4 Acc	quire proficiency in using units and dimensions relevant	to Chemic	al Engi	ineerin
	clas	ssify unit processes and operations used in industry.			
	CO5 Ma	ke use of paradigm shifts on modern Chemical Engin	eering pra	ctices,	and ic
	eme	erging opportunities and trends in the field.			
TEXT BOO	K: C Duchnorro	mam Introduction to Chemical Engineering Prentice Ha	II India 20	11	
11	0. i usupava	and and a chomoar Engineering, i fontice Ha		* *	
T2 ¹	K.A. Solen	and J.N. Harb, Introduction to Chemical Engineer	ing – Too	ols for	Toda
	Tomorrow,	5th Edition, Wiley, 2011.			
REFEREN	CES:				
R1	Morton M.	Denn, Chemical Engineering – An Introduction, Cambrid	Ige Univers	ity Pre	ss, 20
R2	Walter L.	Badger and Julian Banchero, Introduction to Ch	nemical Er	igineer	ing, T
1	McGraw-Hi	ill, 1955			\sim
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CO	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	3	2	1	-	-	-			-	120	3	3	1	
CO2	3	3	2	1	-	-	-	-	-	-	0 .	3	3	1	
CO3	3	3	2	1	-		-	-	-	-	-	3	3	1	L
CO4	3	3	1	1	-	-	-	-	-	-	-	3	3	1	1
CO5	3	3	1	1		-	1.0	-	12	1020	120	3	3	1	
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8	Course Code	Name of the Course	L	T	Р	C							
B.TECH.	22CH2203	SUSTAINABLE PRACTICES IN CHEMICAL ENGINEERING	2	0	0	2							
	The student sl	hould be able to				7							
Course	1. Understar	nd the fundamental concepts of sustainability in chemi-	cal engi	neering.									
Objective	2. Develop a	an understanding of green chemistry and sustainable pr	rocess d	esign pri	nciples	5.							
	3. Familiariz	ze students with sustainable manufacturing techniques	and circ	ular eco	nomy i	nodels.							
Unit	Description				Ins Ho	tructiona urs							
l ·	INTRODUCT	TON: Sustainability Concepts-Definition of sustaina	bility- tı	iple bot	tom	6							
	line: economi	c, environmental, and social aspects-Sustainable	develop	ment ge	bals								
	(SDGs) related	to the chemical industry.	-										
Π	ENERGY EF	FICIENCY AND RESOURCE MANAGEMENT:	Energy	/ Efficie	ncy	6							
	in Process Des	cess Design-Process design and analysis for energy efficiency-Pinch technology											
	for heat integration-Energy recovery in chemical processes (heat exchangers, combined												
	heat and power systems).												
Ш	GREEN PROCESS DESIGN AND LIFE CYCLE ASSESSMENT (LCA): Design												
	GREEN PROCESS DESIGN AND LIFE CYCLE ASSESSMENT (LCA): Design for Sustainability Green design principles: Inhorantly safer design officient recourses												
	use Life Cycl	e Assessment (ECA)-Stens in conducting ECA-Appl	ications	of ICA	in								
	evaluating envi	ironmental impact	leations	OF LCT	X 1 11								
	evaluating envi	nonmental impact.											
IV	SUSTAINABI	LE MANUFACTURING AND CIRCULAR ECON	OMY:	Sustaina	ible	6							
	Manufacturing	Principles-Resource efficiency, waste minimizati	ion, an	d pollut	ion								
	prevention in	manufacturing-Lean manufacturing and Six Sigma	for su	stainabil	ity-								
	Sustainable Su	pply Chains.											
V	POLICY, REC	GULATIONS, AND FUTURE TRENDS: Environn	nental P	olicies a	nd	6							
$\mathbf{V}_{\mathbf{v}}$	POLICY, REC Regulations-Ke	GULATIONS, AND FUTURE TRENDS: Environmeted by global environmental regulations and policies (e.g.,	nental P Paris A	olicies a greemen	nd t,	6							
V	POLICY, REC Regulations-Ke REACH, Kyote	GULATIONS, AND FUTURE TRENDS: Environmeter global environmental regulations and policies (e.g., o Protocol)-Environmental compliance and sustainability of the second substainability of t	nental P Paris A ity repo	olicies a greemen rting for	nd t,	6							
V	POLICY, REC Regulations-Ke REACH, Kyoto chemical indus	GULATIONS, AND FUTURE TRENDS: Environm ey global environmental regulations and policies (e.g., o Protocol)-Environmental compliance and sustainabil tries- Emerging Technologies for Sustainability.	nental P Paris A ity repo	olicies a greemen rting for	nd t,	6							
V	POLICY, REC Regulations-Ke REACH, Kyote chemical indus	GULATIONS, AND FUTURE TRENDS: Environm ey global environmental regulations and policies (e.g., o Protocol)-Environmental compliance and sustainabil tries- Emerging Technologies for Sustainability. Total I	nental P Paris A ity repo	olicies a greemen rting for	nd t,	6							
V On completion	POLICY, REG Regulations-Ko REACH, Kyoto chemical indus	GULATIONS, AND FUTURE TRENDS: Environm ey global environmental regulations and policies (e.g., o Protocol)-Environmental compliance and sustainabil tries- Emerging Technologies for Sustainability. Total I the students will be able to	nental P Paris A ity repo nstruct	olicies a greemen rting for ional Ho	nd t,	6 30							
V On completion	POLICY, REG Regulations-Ke REACH, Kyote chemical indus	GULATIONS, AND FUTURE TRENDS: Environmeted evidential regulations and policies (e.g., o Protocol)-Environmental compliance and sustainability. Total I the students will be able to Understand the fundamentals of sustainability in chemical statemeters and the fundamentals of sustainability in chemical statemeters and the fundamentals of sustainability in chemical statemeters.	nental P Paris A ity repo nstructi	olicies a greemen rting for ional Ho	nd t, ours	6 30							
V On completion	POLICY, REG Regulations-Ke REACH, Kyote chemical indus	GULATIONS, AND FUTURE TRENDS: Environmental regulations and policies (e.g., o Protocol)-Environmental compliance and sustainability. Total I the students will be able to Understand the fundamentals of sustainability in chemental the sum of t	nental P Paris A ity repo nstructi nical eng	olicies a greemen rting for ional Ho gineering	nd t, ours	6 30							
V On completion Course Outcome	POLICY, REG Regulations-Ko REACH, Kyoto chemical indus n of the course, CO1 CO2	GULATIONS, AND FUTURE TRENDS: Environmeter global environmental regulations and policies (e.g., o Protocol)-Environmental compliance and sustainability tries- Emerging Technologies for Sustainability. Total I the students will be able to Understand the fundamentals of sustainability in chem Analyze energy efficiency and resource management the students of sustainability of the students of the st	nental P Paris A ity repo nstructi nical eng techniqu	olicies a greemen rting for ional Ho sineering les in cho	nd t, ours emical	6 30 processes							
V On completion Course Outcome	POLICY, REC Regulations-Ko REACH, Kyoto chemical indus nof the course, CO1 CO2 CO3	GULATIONS, AND FUTURE TRENDS: Environmeter global environmental regulations and policies (e.g., o Protocol)-Environmental compliance and sustainability. Total I the students will be able to Understand the fundamentals of sustainability in chema Analyze energy efficiency and resource management of Apply principles of green chemistry and process designs and process designs and process designs and the summer to a chemical process designs and the summer to a chemical process designs and process designs and the summer to a chemical process designs and process designs are process des	nental P Paris A ity repo nstructi nical eng techniqu	olicies a greemen rting for ional Ho gineering tes in cho stainable	emical	6 30 processes eering.							
V On completion Course Outcome	POLICY, REC Regulations-Ko REACH, Kyoto chemical indus n of the course, CO1 CO2 CO3 CO4	GULATIONS, AND FUTURE TRENDS: Environmeted evidence of the students will be able to the fundamentals of sustainability in chemical process designed by principles of green chemistry and process designed by the environmental impact of chemical process designed by the students will be able to the students of the student	nental P Paris A ity repo nstructi nical eng techniqu ses usin	olicies a greemen rting for ional Ho ineering ies in cho stainable ig Life C	nd t, ours emical e engin ycle A	6 30 processes eering. ssessment							
V On completion Course Outcome	POLICY, REC Regulations-Ke REACH, Kyote chemical indus nof the course, CO1 CO2 CO3 CO4 CO5	GULATIONS, AND FUTURE TRENDS: Environmeter evaluations and policies (e.g., o Protocol)-Environmental compliance and sustainability. Total I the students will be able to Understand the fundamentals of sustainability in chemedian Analyze energy efficiency and resource management of Apply principles of green chemistry and process designed Evaluate the environmental impact of chemical process Design sustainable manufacturing systems and circula	nental P Paris A ity repo nstructi nical eng techniqu n for su sses usin r econor	olicies a greemen rting for ional Ho gineering tes in cho stainable g Life C my mode	nd t, purs emical e engin ycle A els.	6 30 processes eering. ssessment							
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Dean - Academics Dean (Academics) HiCET

CO	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	1.	1	1	1	3	1	1	1	1	3	2	2	Ī
CO2	3	3	2	2	1	1	3	1	1	1	1	3	2	2	Ī
CO3	3	3	3	2	1	1	3	1	1	1	1	2	2	2	Ī
CO4	3	3	2	3	3	1	3	1	1	1	1	3	2	2	
C05	3	3	3	2	2	1	3	1	1	1	1	3	2	2	
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CO	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	1	1	1	1	1	3	1	1	1	1.	3	2	2	2
CO2	3	3	2	2	1	1	3	1	1	1	1	3	2	2	2
CO3	3	3	3	2	1	1	3	1	1	1	1	2	2 *	2	2
CO4	3	3	2	3	3	1	3	1	1	1	1	3	2	2	2
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Chairman, Board of Studies Chairman - BoS CHE - HiCET

Dean - Academics Dean (Academics) HiCET



Program	nme/sem	Course Code	Name of the Course	L	T	P	C				
BER	TECH/		ENVIRONMENTAL STUDIES				1				
]	II	22CY2101	(common to all branches except CSE, IT,	2	0	. 0	2				
		1 Introduc	e the basic concents of environment ecosystems an	L d biod	iversity	and em	nhasize				
		on the h	indiversity of India and its conservation	u bibu	iversity	and en	phasize				
		2 Impart k	nowledge on the causes effects and control or prev	ention	measur	es of					
· · ·		2. Impart k	newledge on the causes, enects, and control of prev	ention	measur	5 01					
		3 Facilitat	e the understanding of global and Indian scenario of	renew	able and	1 nonre	newable				
Co	Courseresources, causes of their degradation, and measures to preserve them.Objective4. Gain knowledge on the scientific, technological, economic and polit										
Obie											
		environ	nental problems.		P						
		5. Familiar	eciate th	e							
		interdep	endence of economic and social aspects of sustainab	ility, r	ecogniz	e and a	nalyze				
		climate	changes, concept of carbon credit, and the challenges	vironme	ental	-					
		manager	nent.								
Unit		L	Description			Instr	uctional				
			CONVETENC AND DIODN/CDC/TN/			H	ours				
	ENVIR Score of	d objectives	of environmental studies. Importance of environment	at n	and for						
	public a	la objectives	o-system and Energy flow, ecological succession.	n – n Structi	re and						
ларан. Т	function	of the fores	t and nonds ecosystem - Types of biodiversity	·- val	ues of		6				
	hiodiver	sity India as	a mega-diversity nation – hot-spots of biodiversity	= thr	eats to		U				
	biodiver	sity – endange	red and endemic species of India – conservation of	biodiv	ersity.						
	Insitu an	d ex-situ.		orour	ersny.						
	UNIT II	ENVIRONN	IENTAL POLLUTION								
	Definitio	n – causes, ef	fects and control measures of: Air pollution- Water	oolluti	on –						
11	Water qu	ality paramet	ers- Soil pollution - Noise pollution- Nuclear hazard	s – rol	e of an		6				
	individua	al in preventic	n of pollution.								
	UNIT II	I RENEWAI	BLE SOURCES OF ENERGY								
	Energy 1	management a	and conservation, New Energy Sources: Need of	new s	ources.		6				
Ш	Different	t types new e	nergy sources. Applications of- Hydrogen energy, C	Ocean	energy		U				
. *	resources	s, Tidal energ	y conversion. Concept, origin and power plants o	f geot	hermal						
	energy.										
	SOCIA	L ISSUES AI	ND THE ENVIRONMENT								
	From un	sustainable to	sustainable development – urban problems relate	d to e	energy-						
IV	environn	nental ethics:	Issues and possible solutions – 12 Principles of gree	en che	mistry-		6				
	Municip	al solid wast	e management. Global issues – Climatic chang	e, acı	d rain,						
	greennot	ise effect and	ozone layer depletion – Disaster Management –	Isuna	mi and						
	SUSTAT	NARILITV	AND MANACEMENT								
1	Develop	ment GDP	Sustainability, concent needs and challenges-ecor	omic	social						
	and asn	ects of sus	tainability-from unsustainability to sustainability	/-mille	mium						
V	develop	nent goals ar	ad protocols. Sustainable Development Goals-targe	ts. inc	licators		6				
- -	and inter	rvention area	s. Climate change- Global Regional and local e	nviron	mental		5				
	issues ar	id possible sc	plutions (global warming, acid rain and ozone lave	er den	letion)						
	Concept	of Carbon Fo	otprint.	p							
	- F	· · · · · · · · · · · · · · · · · · ·	Total Instruc	tional	Hours	/	45				
· · · · · · · · · · · · · · · · · · ·	11					1					

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Chairman / ECG



	CO1: Recognize and understand the functions of environment, ecosystems and biodiversity
	and their conservation.
	CO2: Identify the causes, effects of environmental pollution and natural disasters and
	contribute to the preventive measures in the society.
Course	CO3: Identify and apply the understanding of renewable and non-renewable resources and
Outcome	contribute to sustainable measures to preserve them for future generations.
	CO4: Demonstrate an appreciation for need for sustainability, management and understand
	the various social issues and solutions to solve the issues.
	CO5: Recognize the different goals of sustainable development and apply them for suitable
	technological advancement and societal development.
TEXT BOOKS	

T1 - Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.

T2 - Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016. **REFERENCES**

R1 – Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.

R2 - Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1		-	-	2	3	-	-	-	-	2
CO2	3	2	-	-	-	-3	3	-	-	-	-	2
CO3	3		1	-	-	2	2	· -	-	-	-	2
CO4	3	2	1	1	-	2	2	-		-	-	-2
C05	3	2	1	-	-	2	2		· _ ·	-	-	1
AVG	2.8	1.8	1	1	-	2.2	2.4	-	-	-	-	1.8



Dean (Academics) HiCET /



B.TECH. Course Objective Unit I I H	22CH2204 The student st 1. Underst 2. Familia exchang 3. Realize MOMENTU Hydrostatic e Bernoulli's eco variable area	PRINCIPLES OF CHEMICAL ENGINEERING should be able to tand the basic principles of fluid flow, thermodynamics, heat tra rize with key engineering processes such as pressure measurem ge, and mass transfer operations. foundational concepts of chemical reaction engineering and rea Description M TRANSFER: Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation of	3 nsfer, and ent, energ	0 d mass gy syst gn.	0 transfe ems, he Instru	r. at ctio
Course Objective Unit I I II	The student st 1. Underst 2. Familia exchang 3. Realize MOMENTU Hydrostatic e Bernoulli's ec variable area	should be able to tand the basic principles of fluid flow, thermodynamics, heat tra rize with key engineering processes such as pressure measureme ge, and mass transfer operations. foundational concepts of chemical reaction engineering and rea Description M TRANSFER: Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation of	nsfer, and ent, energ actor desi	d mass gy syst gn.	transfe ems, he Instru	r. at ctic
Objective Unit I I II I	Condersi Familia exchang Realize MOMENTU Hydrostatic e Bernoulli's ec variable area	rize with key engineering processes such as pressure measurements, near transfer operations. foundational concepts of chemical reaction engineering and rea Description M TRANSFER: Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation of	nster, and ent, energ	gy syst	Instru	r. at ctio
Unit I I I I I I I I	 rainna exchang Realize MOMENTU Hydrostatic e Bernoulli's ec variable area 	ge, and mass transfer operations. foundational concepts of chemical reaction engineering and rea Description M TRANSFER: Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation of	ictor desi	gn.	Instru Ho	ctic
Unit I I II S	Exclusive 3. Realize MOMENTU Hydrostatic ex Bernoulli's ec variable area	foundational concepts of chemical reaction engineering and rea Description M TRANSFER: Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation o	of fluids	gn.	Instru Ho	ctio
Unit I I II S	MOMENTU Hydrostatic e Bernoulli's ec variable area	Description M TRANSFER : Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation of	of fluids	511.	Instru Ho	ctio
I I I II S	MOMENTU Hydrostatic e Bernoulli's ec variable area	M TRANSFER: Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation of the second	of fluids -		He	e.c.
I I I II II t	MOMENTU Hydrostatic e Bernoulli's ec variable area	M TRANSFER : Nature of fluids - properties of fluids; Types of quilibrium; Pressure measurement – Types of flow - Equation of	f fluide		>	urs
I I II I I	Hydrostatic e Bernoulli's ec variable area	quilibrium; Pressure measurement - Types of flow - Equation o	n nunus -			9
	Bernoulli's ec variable area		of Continu	iity-		
LI S	variable area	quation and applications- and selection of flow meters; variable	head and			
II I	·	meters - Classification of fluid moving machinery - Introduction	n to valve	s and		
II S	Sipe fittings.	VNAMICS Same filling to the D.C. W.				
	THERMOD	function equilibrium reversibility energy work and heat Zer	ontroi vo	ume,		
· · · · · ·	emnerature s	cales Joule's experiment internal energy, first law -Statements	of the se	cond		9
1	aw of thermo	dynamics, heat engine and refrigerator. Carnot cycle and Carno	of theoren	is.		·
t t	hermodynam	ic temperature scale.		,		
111	HEAT TRAN	NSFER: Importance of heat transfer in Chemical Engineering o	perations	-		9
. r	Modes of hea	t transfer- thermal conductivity; Heat conduction through a seri	es of			
r i r	esistances - (Concepts of heat transfer by convection - Boiling regimes - Rad	liation - 1	laws		
	of radiation -	types of Heat exchangers	<u></u>			
IV ľ	VEASS I KAI naces Hendels	NOPER: Introduction to mass transfer operations- Molecular differences and solids- Humidification theory and types of cooling two or	Device			9
	rystallizatio	and solids- Humanication - meory and types of coording lower \mathbf{p} - Gas Absorption and Stripping - distillation - types of distillation	- Drying			
	Extraction and	d leaching				
V .	MECHANIC	CAL OPERATIONS: Particle Shape, Size, Mixed Particle Size	s and Siz	e		
4	Analysis- Prir	nciples of Comminution-Laws of Crushing-Theory of filtration,	Batch ar	d		9
k	continuous fil	ters-Concept of mixing, Homogeneous and Heterogeneous mix	tures.			
		Total Instru	uctional	Hours	4	ł5
	CO1	Describe the fundamental concepts of fluid flow, including type	es of flui	ts, pre	ssure	
Outcome	COI	measurement, and Bernoulli's equation.				
Outcome	600	Explain the basic laws of thermodynamics and their application	to energ	y tran	sformat	ion
	002	heat engines and refrigerators.				
	603	Identify the different modes of heat transfer and the principles	governin	g heat	conduct	ion
	005	convection, and radiation.	· · · · · · · · · · · · · · · · · · ·			
	604	List various mass transfer operations, such as distillation, drvie	g, and ga	s abso	rption,	and
	CO4	practical applications in chemical engineering.	- U		• •	
.		Outline the basic concents of chemical reaction kinetics and re-	actor deci	on in/	hiding	the
	CO5	different types of reactors and their performance characteristics	actor desi	50, HA	munig	are
			•			
IEXTBOOK:						
TI F	Basic princinl	es and calculations in chemical engineering by D H. Himmelbl	au. 7th F	d. PHI	2013	
	Pe.p.	succession in chomear engineering of Dirit infinition				
T2	Fundamentals	of Momentum, Heat and Mass Transfer, 3rd ed., J.R. Welty, C	.E. Wick	s and l	R.E. Wi	lsor
μ	ohn Wiley &	Sons, New York, 1984.				
T3 k	K. V. Narayar	an. Chemical Engineering Thermodynamics, PHI.2001.				
	-,			-		
REFERENCES	S:					
	Jnit Operatio	ns in Chemical Engineering by W.L. McCabe and I.C. Smith a	nd Peter	Harrio	tt. Mc (Grav
RI	Hill 7th ed. 20	001.			,	
F	Elements of C	Themical Reaction Engineering 2nd ed HS Fooler PHI Learn	ning Pvt	Ltd 1	New De	lhi
R2 2	a 10.	menter reaction Engineering, 2nd cu., 11.0. Fugier, 1711 Lean		, I		,
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CO	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	3	2	1	-	-	-			-	120	3	3	1	
CO2	3	3	2	1	-	-	-	-	-	-	0 <b>.</b>	3	3	1	
CO3	3	3	2	1	-		-	-	-	-	-	3	3	1	L
CO4	3	3	1	1	-	-	-	-	-	-	-	3	3	1	1
CO5	3	3	1	1		-	1.0	-	12	1020	120	3	3	1	
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Dean (Academics)

Program Sem	nme/	Course Code	Name of the Course	L	T	Р	С			
B.E., B.T.	ech/ II	22CY2153	CHEMISTRY FOR BIOCHEMICAL ENGINEERING (AGRI, CHEM)	2	0	2	3			
		The stud	ent should be conversant with	L	<b>I</b>		L			
		1. Soun techr 2. The contr	d understanding of water quality parame liques. principles of electrochemistry and the mech ol	ters anism	and w	vater tro rrosion	eatment and its			
Cours Object	se ive	<ol> <li>The u the u famil</li> <li>A de stude</li> <li>Acqu and a</li> </ol>	inderstanding of principles and significance of nique properties of nanoscale materials compar- iarize students with various methods for synthe- tailed understanding of the key components nts with various battery types. here the concept and working principle of spe- pplications.	nanoo ed to esizin of ba etral	chemist bulk m g nanoi tteries analyti	aterials naterials naterial and fan cal insti	uding , and s. niliarize ruments			
Unit			Description	-		Instru He	ictional ours			
I.	WATER SCIENCE Impurities in Water, Hardness of Water and Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosionSoftening Methods - Ion-Exchange Method, Desalination of Brackish Water - Reverse Osmosis. Estimation of hardness of water by EDTA. Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method.									
11	ELEC Electr Pilling galvan sacrif coatin corro	CTROCHEM ochemical ce ode potential g – Bedworth nic corrosion icial anode a gs – paints sion of mild s	ISTRY AND CORROSION Ils – reversible and irreversible cells - El – Nernst equation (derivation only). Chemical n rule – electrochemical corrosion – differe – differential aeration corrosion – corrosion and impressed cathodic current methods - - constituents and functions. Determination steel by weight loss method. Estimation of Fe	MF- corro ent ty con prot of r errou	Single sion – pes – ttrol – ective ate of s iron	6+0	6=12			
111	NAN Introd cataly precip	<b>OCHEMIST</b> luction, size- tical and the pitation met eering applica	<b>RY</b> dependent properties of nanomaterial (su rmal), synthesis of nanoparticles by sol-ge hod. Nanomaterials: Introduction, propertions of carbon nanotubes and graphene.	rface el, an erties	area, id co- and		6			
IV	engineering applications of carbon nanotubes and graphene.ENERGY SOURCESBatteries - Characteristics - types of batteries – primary battery (alkaline battery), secondary battery (lead acid, lithium-ion-battery)- emerging batteries – nickel-metal hydride battery, aluminum air battery, batteries for automobiles and satellites - Fuel cells (Types) – H ₂ -O ₂ fuel cell. Renewable Energy: Solar- solar cells, DSSC									
V	SPEC Introc Spect applic diagra	CTRAL ANA luction- UV- roscopy, pri- cations – fla am only) – est	LYSIS Visible Spectroscopy- Beer – Lambert's nciples – instrumentation (block diagran me photometry – principle – instrumenta- imation of sodium by flame photometry.	Law n on tion	/- IR- ly)and (block		6			
	1	······	Total Instructi	onal	Hours	· · · ·	45			

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	At the end of the course, the learner will be able to
	CO1: Demonstrate knowledge of water quality in various industries and develop skills in analyzing water quality parameters for domestic and industrial purposes. CO2: Apply fundamental knowledge of corrosion protection techniques and develop skills to conduct experiments for measuring and preventing corrosion.
Course Outcome	CO3: Identify and apply fundamental concepts of nanoscience and nanotechnology for
	nanomaterials.
	CO4: Study the fundamentals of energy storage devices and develop skills in constructing and experimenting with batteries.
	CO5: Extend the knowledge on the concepts of spectroscopy and its applications on
	analytical instrumentation.

#### TEXTBOOKS

TI - P.C.Jain& Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018). T2 -O.G.Palanna, "Engineering Chemistry" McGraw Hill Education India (2017). REFERENCES

R1 - Shikha Agarwal "Engineering Chemistry -Fundamentals and Applications, Cambridge University Press, Delhi, 2019

R2 - S.S.Dara "A Textbook of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2018).

PO& PSO	PO1	PO2	РОЗ	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	1	1	1	1	-	1 .	-	1	2
CO2	2	3	2	1	1	1	1	-	1	-	1	2 .
CO3	2	2	2	2	1	1	1	-	1	-	1	2
CO4	2	2	2	2	1	l	1	-	1	-	1	* 2 *
C05	2	3	2	-	-	-	3	-	·	-	-	-
AVG	2	2.6	2.2	1.5	1.	1	1.4	-	1	-	. 1	2

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<b>B.E./B.Tech/I</b> Course Objective	I 22HE2151 The learner 1. Improve 2. Enrich er	EFFECTIVE TECHNICAL COMMUNICATION (Common to all Branches)	2	0	2					
Course Objective	<b>The learner</b> 1. Improve 2. Enrich er		B.Tech/II 22HE2151 EFFECTIVE TECHNICAL COMMUNICATION (Common to all Branches) 2							
	<ul> <li>The learner should be able to</li> <li>Improve essential business communication skills.</li> <li>Enrich employability knowledge.</li> <li>Acquire the crucial organizing ability in official forum.</li> <li>Develop study skills and communication skills in formal and informal situation</li> <li>Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills</li> </ul>									
Unit Description										
I Pro We Pra	Language Proficiency: Sentence Pattern, Writing definitions Writing: Describing           I         product, work place and service (purpose, appearance, function) Vocabulary –           Words on Nature         Practical Component:									
Lis Ext Co	Listening-Watching and interpreting advertisements /short films Speaking- Extempore / Public Speaking, Difference between Extempore / Public Speaking, Communication Guidelines for Practice									
H W Pr Lis tha	riting :Formal M ords on Offense an actical Componen stening- Compreh mks& welcome ad	emos, Job application and Resume preparation Vocabulary d Ethics nt: ensions based on telephonic conversation Speaking- Vote dress	of	7	+2					
III Pre Vo Pr: Lis wit	nguage Proficien eparing a detail pl cabulary– Words actical Componer stening- Listening h preparation	<b>ncy</b> : Homophones and Homonyms, Question Tag Writin an for an official visit, Schedule and Itinerary, Spotting Erro on Society at : -paraphrasing the listened content Speaking-Group Discus	ng: ors ssion	5	+4					
IV Uri Pra List Gre	nguage Proficien iting (marketing, ir ctical Componen tening-Watching t up Discussion	cy: Idioms, Commonly Confused Words <b>Writing</b> : Report ivestigating) <b>Vocabulary</b> - words involved in business t: echnical discussions and preparing MoM <b>Speaking</b> - On the sp	potencia de la constante de la Doot	5+	4					
V Wr Wo Pra Lis Tec	iguage Proficient iting: Making/ Int rds involved in Fir ctical Component tening-Comprehen hnical topic with p	by :Relative Pronoun , Regular and Irregular verb erpreting Chart, Sequencing of Sentences Vocabulary- ance :: isions based on announcements Speaking-Presentation on pt.	a	6-	+3					
		Total Instructional H	ours	45 A	5					

COLLEGE OF

	At the end of the course, learners will be able to
Course	CO1: Use English Language effectively in spoken and written forms
Outcome	CO2: Make oral and written presentation in corporate forum.
	CO3: Acquire basic proficiency in English including reading and listening comprehension,
	Writing and speaking skills.
	CO4: Take an effective role and manage in an organizational sector.
	CO5: Prepare and demonstrate a professional presentation

## **TEXTBOOKS:**

- T1- Technical Communication by Gajendra Singh Chauhan and Et al, Cengage learning India Pvt Limited [Latest Revised Edition] - 2019
- T2-Raymond Murphy, "Essential English Grammar", 5 the Edition Cambridge University Press, 2019.
- T3-Technical Communication Principles and Practice, Third Edition by Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2017.

## **REFERENCEBOOKS:**

R1- A Course in Technical English–D Praveen Sam, KN Shoba, Cambridge University Press – 2020
 R2-English Language Communication Skills – Lab Manual cum Workbook, Cengage learning
 India Pvt Limited [Latest Revised Edition] – 2019.

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# MANDATORY COURSES FOR II SEMESTER

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Programme	<b>Course Code</b>	Name of the Course L T	Р	C
B.E.	22MC2094/2095	TAMILS AND TECHNOLOGY20	0	1
	•			
		The student should be able to		
		1. Acquiring knowledge of industry during the Sangam Period.		
		2. Collaborate learning about house design, sculpture and temples during		
	~	Sangam Period.		
	Course Course Objectives:	3. Develop Knowledge in metallurgical studies as a source of historical and archaeological evidence.		
с. 1 — Х. 2 — Х.		4. Acquiring knowledge about ancient techniques used in agriculture and agro processing	1	
		5. Knowledge of Tamil language literature.		

#### UNIT I WEAVING AND CERAMIC TECHNOLOGY

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

#### UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY

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

#### UNIT III MANUFACTURING TECHNOLOGY

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel -Copper and goldCoins 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

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

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.

After completion of the course the learner will be able to

CO1:Recognize ancient business

Course Outcome: CO2: Distinguish Sangam period building material and types of sculpture. CO3: Identify the source of historical and archaeological CO4: Demonstrate the techniques used in agriculture and agro processing. CO5:Understand the new software of Tamil language.

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PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	РО 10	PO 11	PO1 2
CO1	2	3	3	-	-	-			2			2
CO2	2	3	3	-	-		-	-	2			2
CO3	2	3	3	-	-	-	-	-	2		-	2
CO4	2	3	-	-		-	-	-	2			2
CO5	2 .	3	-	-	-	- 1	-	-	2		-	2
AVG	2	3	1.8	-	-	-	-	-	2			2

## 2MC2094/2095TAMILS AND TECHNOLOGY

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Programme	Course Code	Course Title	$\mathbf{L}_{1}$	T	Р	С	
BE/BTECH	22MC2093	SOCIAL SERVICES AND COMMUNITY DEVELOPMENT	1	0	0	1	
	The student shou	ld be able to					
	1. Acquire the developm	he knowledge and active participate in social service and commu ent activities.	nity 				
Course Objectives:	2. Understar managem	d the concept of disaster management and role of NCC cadets in ent	i disas	ster			
	<ol> <li>Understar</li> <li>Understar</li> <li>Know about</li> </ol>	d the concept thinking and reasoning process. Id about maps and use of bearing and service protector It the principles of flight and Aero foil structure and ATC proceed	lures.				
Unit		Description	Ins	truc Hot	tion rs	ıal	
	COCIAL SEDVICES A	ND COMMUNITY DEVELOPMENT					
I	Basics of social services a youth towards social well evils - Mission Indradam	and its need - Rural development programs - Contribution of fare - NGOs in social services SwachbharathAbhiyan - Social ish - BetibachoBetipado - Digital awareness - Constitution		3			
	DISASTER MANAGE!	MENT					
11	Organization of Disaster disasters - fire service an	management -Types of emergencies - Natural and manmade d fire fighting - prevention of fire.		.3			
	PERSONALITY DEVE	CLOPMENT		· .			
III .	Introduction to personali skills -self awareness - cr	y development - public speaking Intra and Inter personal itical thinking - Decision making and problem solving.		3			
IV	MAP READING Types of maps - convent gradient - cardinal points protector - Prismatic con	ional signs - scales and Grid system - relief and contour - Types of North - types of bearing and use of service apass and its uses - setting of map - finding North and own		3			
V	PRINCIPLES OF FLIG Introduction to principle Angle of incidence - New Aerofoil - Airfield layou medicine.	GHT AND AIRMANSHIP of flight - Forces acting on the aircraft - Angle of attack - vton's - law of motion - Bernauli's theorem and Venturi effect - t - ATC (Air Traffic Control) - circuit procedures - Aviation			5		
		Total Instructional Hours		1	5		
Course Outcome:	After completion CO1:Perform the so CO2:Appreciate the management CO3: Define thinkir CO4:Use of bearing CO5:Understand the	of the course the learner will be able to cial services on various occasions for better community and soc need and requirement for disaster management and NCC role activities. Ig. reasoning, critical thinking and creative thinking and service protector and locate the places and objects on the g principles of flight and Aerofoil structure	ial life in dis round	e aste			
Reference:							
1.1	JGC and AICTE circulate	d syllabus.					
Text Books : 1. N 2. N 3. /	NCC cadet Guide (SD/SW NCC cadet Guide (SD/SW NNOs Guide (SD/SW) by	() Army () Airforce. DG NCC, Ministry of Defence, New Delhi					
4. I	Digital Forum App 1.0 &	2.0, by DG NCC DG NCC, Ministry of Defence, New Defini					

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Programme/							L	T	Р	С
Sem BE/B.TECH	Course Code		Name of th	ne Course			1	0	0	1
П	22HE2072	SOF	T SKILLS A	ND APTITU	JDE					
Course	1. To develop and nurtue demonstration and pr	be able to re the soft skil actice.	ls of the stude	ents through i	nstruction, ki	nowledge	acquisit	ion		
Objective	<ol> <li>To enhance the studer</li> <li>To identify the core sl</li> <li>To develop and integr</li> </ol>	nts ability to de kills associated rate the use of	eal with nume I with critical English langu	erical and qua thinking. age skills	antitative skil	ls.				
Unit			De	scription					]	Instructional Hours
I	Lessons on excellence Skill introspection, Skill	acquisition, c	onsistent prac	tice						2
11	Logical Reasoning Problem Solving - Critic Series – Analogy - Odd Attention to detail	cal Thinking- I Man Out - Vis	ateral Think	ing - Coding g - Sudoku p	and Decodin uzzles -	g —				. 11
HI	Quantitative Aptitude Addition and Subtraction and cube roots - Vedic n Multiplication of 3 and h fractions - Shortcuts to f Algebra and functions	n of bigger nu naths techniqu nigher digit nu ind HCF and I	mbers - Squa es - Multiplic mbers – Sim LCM - Divisi	re and square ation Shortco olifications - bility tests sh	roots - Cube its - Comparing ortcuts -	S				П
	Recruitment Essentials									•
IV	Resume Building - Impr	ession Manage	ement							4
	Verbal Ability									
V	Nouns and Pronouns – V Agreement - Punctuation	/erbs - Subject is	-Verb Agree	ment - Prono	un-Anteceder	nt —				4
		Total I	nstructional	Hours					30	
	After completion of t CO1: Students will and CO2: Students will exe CO3: Students will be a	he course the alyze interpers mplify tautolo able to develop	learner will onal commun gy, contradic	<b>be able to</b> nication skills tion and cont ate integral for	s. public spea ingency by lo	king skills ogical thin	s. king.			
Course Outcome	quantitative proble CO4:Students can prod	ems. luce a resume	that describes	their educat	ion. skills, ex	periences	and mea	asurable a	n hieveme	nts with proper
	grammar, format CO5: Students will be o making optimum i	and brevity developed to a use of gramma	cquire the ab	ility to use Ei	nglish langua	ge with ar	n error w	hile	•	
REFERENCE R1 - Quantitativ R2 -Speed Math R3 -Verbal and	C BOOKS: ve Aptitude – Dr. R S Aga hematics: Secret Skills for I Non – Verbal Reasoning	urwal r Quick Calcul g – Dr. R S Ag	ation - Bill H arwał	andley						

R4- Objective General English – S.P.Bakshi

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Programme/ Sem BE/B.TECH II	<b>Course Code</b> 22HE2071	Name of the Course DESIGN THINKING	L 2	Т 0	P 0	C 2
Course Objective	The student shou1. To expose st2. To develop a3. To provide a	<b>Id be able to</b> udents to the design process and test innovative ideas through a rapid ite in authentic opportunity for students to dev	eration cycle. velop teamwor	k and leade	ership ski	lls
Unit		Description			Inst	ructional Hours
1	<b>DESIGN ABILITY</b> Asking Designers at what Designers Do - Design Sources	out what they Do – Deconstructing what I - Thinking about what Designers Do – The	Designers Do - e Natural Intell	- Watching igence of	5	6
11	<b>DESIGNING TO V</b> Formula One Design Failures – Design Pr	VIN ning – Radical Innovations – City Car Desi ocess and Working Methods	ign – Learning	From		5
III	<b>DESIGN TO PLE</b> Background – Produ Responsibilities – A	ASE AND DESIGNING TOGETHER act Innovations – Teamwork versus Individ voiding and Resolving Conflicts.	dual work – Ro	oles and		6
IV	<b>DESIGN EXPERT</b> Design Process – Cr Novice to Expert. C Isaac Newton and N	ISE eative Design - Design Intelligence – Deve ritical Thinking – Case studies: Brief histo ikola Tesla	elopment of Ex ry of Albert Ei	xpertise – instein,		6
V	<b>DESIGN THINKI</b> Purposeful Use of T Analysis - Mind Ma Thinking Applied to	NG TOOLS AND METHODS ools and Alignment with Process - Journe pping – Brainstorming - Design Thinking Product Development	y Mapping - V Application: E	alue Chair Design	)	7
Course Outcome	After completion CO1: Develop a st CO2: Learn to dev CO3: Develop tear	Instructional Hours of the course the learner will be able to ong understanding of the Design Process elop and test innovative ideas through a ra nwork and leadership skills	pid iteration cy	Tot vcle.	al	30

### **TEXT BOOKS:**

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.
REFERENCE BOOKS:
R1 - Tom Kelley, "Creative Confidence", 2013.
R2 - 3. Tim Brown, "Change by Design", 2009.

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## Course Code & Name: 22HE2071 Design Thinking

PO& PSO	POI	PO2	PO3	PO4	P05	P06	P07	P08	PO9	PO 10	PO 11	PO 12	PSO 1	PSO - 2
COI	3	3	1	3	2	1	0	0	2	0	Û	1	1	0
CO2	3	2	1	3	2	3	0	1	2	0	Ő	2	1	1 .
C03	3	3	1	3	2	1	0	1	2	0	0	1.	1	1
C04	3	2	1	. 3	0	1	0	1	0	Û	0	2	1	1
C05	3	1	1	3	2	2	0	0	2	0	0	1	1	0
Avg	3	2	1	3	2	2	0	· · · 1	2	Û	Ŏ	1	Î	1

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Valley Campus, Coimbatore - 641 032, Tamilnadu, INDIA

Tel: +91 422 4242424

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## DEPARTMENT OF CHEMICAL ENGINEERING R-2022 REVISION COURSES

SL.NO	COURSE	NAME OF	EXISTING SYLLABUS	SUGGESTIONS AND	ACTION	% OF
	CODE	THE		COMMENTS GIVEN BY	TAKEN	CHANGE
		COURSE		EXPERTS		
1.	22CH1251	Introduction	UNIT-I- Historical evolution of	Recommended to incorporate the	Incorporated	20
	Batch	to Chemical	chemical engineering; What is	following,		
	admitted	Engineering	Chemical Engineering? Origin and	UNIT-I- Personalities of Chemical		
	from 2024		growth of chemical Engineers in	Engineering; Greatest		
	- 2025		chemical process industries;Roles	achievements of Chemical		
	onwards		of the modern chemical engineer –	Engineering, ; Traditional vs.		
			UNIT-II- Role of Chemical	modern chemical engineering		
			Engineers - Food, Medical,	UNIT-II- Relation between		
			Energy, Environmental,	Chemical Engineering and other		
			Biochemical, Electronics; Portable	engineering disciplines.		
			Devices;	UNIT-IV- Waste management -		
			UNIT-IV- Chemical Engineering	Removal of color and noxious		
			in Everyday Life; Similarities in	compounds from effluent and air;		
			Dissimilar Applications; Scaling	Segregation of E-waste to recover		
		Jr*	Up or Down;	valuable products		

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## HINDUSTHAN COLLEGE OF ENGINEERING ANDTECHNOLOGY

(An Autonomous Institution)

## Coimbatore- 641032

## DEPARTMENT OF CHEMICAL ENGINEERING

## CURRICULUM

## (UNDER REGULATIONS 2022)

(Academic Council Meeting held on 19.06.2023)



## Hindusthan College of Engineering and Technology Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC (An

Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC (A Autonomous Institution, Affiliated to Anna University, Chennai) Coimbatore – 641 032

## **DEPARTMENT OF CHEMICAL ENGINEERING**

## R2022

SI. No	Course Code & Name	Existing Syllabus	Revised Content	Type of Revision (Deletion/Inser tion/Modificati	% Revision
				on)	
R202	2				
1	22CH3201- CHEMICAL PROCESS CALCULATIONS	UNIT-V- Application of energy balances; Unsteady state material and energy balances; Solving material and energy balances using process simulators.	UNIT-V- Calorific value of fuels, Flue gas analysis, Orsat analysis, theoretical and excess air requirement for solid, liquid and gaseous fuels	Insertion	20
2	22CH3202-FLUID FLOW OPERATIONS	UNIT-II- Types of flow – laminar and turbulent flow in pipes and closed channels;Equation of Continuity; shear stress distribution; friction factors; Bernoulli's equation and applications; Introduction - Boundary layer concept. Dimensional analysis: Basics of dimensional	UNIT-II- Looses in Pipes.		
		analysis: Rayleigh's method and Buckingham's- $\pi$ method. UNIT-III-Drag- types, drag coefficient, friction factor for flow through beds of solids, applications to packed and fluidized beds; packing materials; determination of pressure drop using Ergun equation, Fluidization-types, determination of minimum fluidization velocity and pressure drop; Motion of particles through fluids – calculation of terminal settling velocity.	UNIT-III- Buoyancy, Condition of Equilibrium for Submerged and Floating Bodies, Centre of Buoyancy, Metacentre- Determination of Metacentric Height.	Insertion	20

			r	1	r
		UNIT-V- Classification of			
		fluid moving machinery;	UNIT-V- performance		
		Centrifugal pump-	of multistage pumps -		
		characteristics and	Cavitation - methods of		
		applications: elementary	prevention.		
		nrinciples of	P. V. VIIII OII.		
		Paginrogating gass air			
		1:0 diankar and			
		int, diaphragm and			
		submersible pumps;			
		Introduction to valves and			
		pipe fittings.			
3	22CH3203-CHEMICAL	UNIT-II-	UNIT-II-		
	ENGINEERING	PVT behaviour	Heat effect		
	THERMODYNAMICS-	of fluids;	accompanying		
		Mathematical	chemical reaction.		
		representation of PVT		· · · ·	
		behavior; generalized			
		compressibility factor			
		correlation: generalized			
		equations of state			
		UNIT_III Statements of	UNIT III		
		the general law of	bost nume anter		
		the second law of	heat pump, entropy		
		unermouynamics, neat	balances for open		
		engine and retrigerator,	system, Clausius		
		Carnot cycle and Carnot	Inequality		
		theorems, thermodynamic		· · · · · ·	
		temperature scale, entropy			
		and its calculation, second			
		law of thermodynamics for			
		a control volume. Third			
		law of thermodynamics,			
		entropy from a		Insertion	20
		microscopic point of view.			
		UNIT-IV- Internal energy	UNIT-IV-		
		Enthalny Helmholtz free	Fugacity and activity		
		energy Gibbs free energy	Juon y und wonthey		
1		thermodynamic property			
		relations Mour-1			
		relations – Maxwell			
		relations - partial			
		derivatives and Jacobian			
		method; residual			
		properties; thermodynamic			
		property tables and			
		diagrams.			
		UNIT-V- Duct flow of	UNIT-V-		
		compressible fluids.	Gas-turbine power		
		Compression and	nlant		
		expansion processes	r		
		steam nower plant internal			
		comhistion angines ist		а. ¹¹	
		and realist angings, jet			
		and rocket engines.			

4	22CH3251-	LINIT-L General	UNIT-I- Particle		
-	MECHANICAL	characteristics of solids	Shape Size Mixed		
	ODEDATIONS	different techniques of size	Particle Sizes and Size		
	OF ERATIONS	analysis- Static - Image	Analysis – Cumulative		
		analysis and Dynamic	and Differential		
		analysis and Dynamic	Analysis		
		tachniques shape factor	Analysis.		
		aurface area determination			
		sufface area determination,			
		Advanced marticle size.			
		Advanced particle size			
		analysis techniques.			
		Screening methods and			
		equipment, screen			
		efficiency, ideal and			
	-	actualscreens: Sieve		-	· .
		analysis.			
		UNIT-II- Laws of size	UNIT-II- Principles of		
		reduction, energy	Comminution - Energy		
		relationships in size	and Power		
		reduction, methods of size	requirements		
		reduction, classification of	in Comminution -	Insertion	20
		equipments, crushers,	Mechanical Efficiency		
		grinders, disintegrators for		•	
		coarse, intermediate and			
-		fine grinding, power			
		requirement, work index;			
		Advanced size reduction			
		techniques-Nanoparticle			
		fabrication-Topdown			
		approach - Bottom-up			
		approach. Size			
		enlargement - Importance			
		of size enlargement,			
		principle of granulation,			
		briquetting, pelletisation,			
		and flocculation.			
1		Fundamentals of particle	· · · · · · · · · · · · · · · · · · ·		
	· · · · ·	generation: Reduction		100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100	
	1 - C	ratio in Jaw Crusher,		9.2	
		Ballmill, Drop Weight			
		Crusher.			

CHAIRMAN-BoS Chairman - BoS OHE - HICET







## Hindusthan College of Engineering and Technology Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC (An Autonomous Institution, Affiliated to Anna University, Chennai)



Coimbatore - 641 032

## **DEPARTMENT OF CHEMICAL ENGINEERING REGULATION-2022 B.TECH. CHEMICAL ENGINEERING I TO VIII SEMESTERS CURRICULUM**

S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
		SEMEST	ER I								
Theo	ry										
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
2.	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100
Theo	ry with Lab Cor	nponent	T	r			r			-	
3.	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
4.	22PH1151	Physics of Materials	BSC	2	0	2	3	4	50	50	100
5.	22IT1151	Python Programming and Practices	ESC	2	0	2	3	4	50	50	100
EEC	Courses (SE/AE	2)						· · · · ·			
6.	22HE1071	Universal Human Values	AEC	2	0	0	2	2	40	60	100
7.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
Mano	latory Courses		1	,			r			1	
8.	22MC1091/ 22MC1092	தமிழர்மரபு/ Heritage of Tamil	MC	2	0	0	0	2	0	0	0
			TOTAL	15	5	6	19	27	370	330	700
S.No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
		SEMESTI	ER II						•		
1	22MA2104	Fourier Analysis and Laplace Transforms	BSC	3	1	0	4	4	40	60	100
2	22PH2101	Basics of Material Science	BSC	2	0	0	2	2	40	60	100
3	22CY2101	Environmental Studies	ESC	2	0	0	2	2	40	60	100
4	22CH2201	Introduction to Chemical	PCC	3	0	0	3	3	40	60	100
		Engineering									
Theor	ry with Lab Con	nponent									i
5	22CY2151	Chemistry for Engineers	BSC	2	0	2	3	4	50	50	100
6	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
Pract	ical				- 1						
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AE	.)	1.70						100		100
8.	22HE2071	Design Thinking	AEC	1	0	2	2	3	100	0	100
9.	22HE2072	Soft Skills and Aptitude-1	SEC	1	0	0	1	1	100	0	100
Mand	latory Courses	100 +AND 100 10	MC		11	1		1.11	11		
10.	220010.2093	NCC */NSS / YRC / Sports / Clubs	MC	A		nuae	ents	snall e	nroll, o	n admi	ssion, in
		Foreliment			inye devi	alor	011	nt proc	ramme	and u	ndergo
		Enronment		training for about 80 hours							nucigo
11	22MC2091/	FIGIOGE	MC	2	0	0	0	2	0	0	0
	22MC2092		inc	-	Ŭ	Ŭ	Ů	2	Ŭ	Ŭ	Ū
		TAMILS AND TECHNOLOCY									
		TAMILO AND TECHNOLOGY	TOTAL	10	1	10	22	20	520	200	000
No	Course Code	Course Title	Catago	10 1	T	IV D	44 C	47 TCP	520	JOU	TOTAT
	Course Coue	CUUISE LIUE CEMERTE	D III		1	I.	C	ICF	CIA	LOL	IUIAL
Theor	•	SEMESTE	N 111								
1.	22MA3107	Numerical Methods	BSC	3	1	0	4	4	40	60	100

2.	22CH3201	Chemical Process Calculations	PCC	3	1	0	4	3	40	60	100
3.	22CH3202	Fluid Flow Operations	PCC	3	0	0	3	3	40	60	100
4.	22CH3203	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
		Thermodynamics – 1	1			I				1	
Theor	ry with Lab Cor	nponent	DCC	1		1	2	4	50	50	100
5.	22CH3251	Mechanical Operations	FCC	2		2	3	4	50	50	100
6. D	22ME3253	Basic Mechanical Engineering	ESC	2	0	2	3	4			100
Pract		Elvid Elow Operations Lab	AEC	0		Δ	2	Δ	60	40	100
0	22CH3001	Technical Analysis Lab	PCC	0		4	2	4	60	40	100
O.	Courses (SF/AF	Technical Analysis Lab	ice	0		1 -	2		00	1 10	100
Q	22HF3071	9 Soft Skills -2	SEC	1	0	0	1	1	100	0	100
Mand	atory Course	bort bands 2	1 520	-	L_						
10	22MC3091	Essence of Indian Traditional	AC	2	0	0	0	2	100	0	100
		Knowledge				ļ					
			TOTAL	17	2	12	25	30	480	420	900
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
		SEMESTE	R IV	,							
Theor	ry		<b>.</b>					°		T	
1.	22HE4101	IPR and Start-ups(Common)	HSC	2	0	0	2	2	40	60	100
2.	22CH4201	Mass Transfer Operations - I	PCC	3	0	0	3	- 3	40	60	100
3.	22CH4202	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
	226114202	Thermodynamics – II	DCC	-			2	2	10	60	100
4.	22CH4203	Process Heat Transfer	PCC	3			2	<u> </u>	40	60	100
5.	22CH4204	Chemical Process industries	FU		0	U	2	2	40	1 00	100
1 neoi	ry with Lab Cor	Design of Floatrical & Floatronics	ESC	1	0	2	2	3	50	50	100
0.	22EE4251	Engineering	Loc	1	V	2	2		50	50	100
7	22CH4251	Chemical Reaction Engineering - I	PCC	2	0	2	3	4	50	50	100
8.	22MA4151	Probability and statistics with R	BSC	2	0	2	3	4	50	50	100
0.		programming						14. 1			
Pract	ical										
9.	22CH4001	Heat Transfer Lab	PCC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AE							· · ·			· · · · · · · · · · · · · · · · · · ·
10.	22HE4071	Soft Skills -3(Common)	SEC3	1	0	0	1	1	100	0	100
	-		TOTAL	19	0	10	24	29	510	490	1000
5.No.	Course Code	Course Title	Category	L	T	P	C	ТСР	CIA	ESE	TOTAL
L	2	SEMESTI	CR V								
Theor		Mars Transfer Organitions II	DCC	2	0	0	2	2	40	60	100
1.	22CH5201	Mass Transfer Operations - II	PCC	3		0	3	3	40	60	100
2.	220113202	and Control									
3	22CH53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4.	22CH53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5.	22CH53XX	Professional Elective-3	PEC	3	0	0	.3	3	40	60	100
Theor	ry with Lab Cor	nponent	. <b>1</b>		<b>.</b>	4	I				
6.	22CH5251	Chemical Reaction Engineering - II	PCC	2	0	2	3	4	50	50	100
Pract	ical										
7.	22CH5001	Mass Transfer Operations Lab	PCC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AI	5)									<b>.</b>
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	17	1	6	21	24	410	390	800
S.No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
		SEMESTE	K VI								
Thoo	AX7										

### SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES										
S.No.	Course				Credits p	er Semest	er			TotalCredits
	Area	I	П	Ш	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	3	-	-	-	-	23
3	ESC	6	4	3	2	-	-	-	-	15
4	PCC	-	3	15	16	11	7	9	-	61
5	PEC	-	-	-	· _	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MC	1	1				-			
	Total	19	22	25	24	21	24	20	10	165

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES) To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	Course	Course Category Periods Per week						Credits
	Code	Course Title		L	Т	Р	Contact Periods	
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

## **OPENELECTIVE I AND II**

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL.	COURSE	COURSE TITLE CATEGORY PERIODS PERWEEK				DS EK	TOTAL CONTACT	CREDITS
NO.	CODE			L	Т	P	PERIODS	
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial	OEC	3	0	0	3	3

1.	22CH6201	Transport Phenomena	PCC	3	0	0	3	3	40	60	100	
2.	22HE6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100	
3.	22CH63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100	
4.	22CH63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100	
5.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100	
6.	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100	
Practi	ical	<b>↓</b>										
7.	22CH6001	Process Control Lab	PCC	0	0	4	2	4	60	40	100	
8.	22CH6002	Computational Chemical	PCC	0	0	4	2	4	60	40	100	
		Engineering Lab										
EEC Courses (SE/AE)												
9.	22HE6071	Soft Skills – 5(Common)	SEC	2	0	0	2	2	100	0	100	
		• • • • • • • • • • • • • • • • • • •	TOTAL	20	0	8	24	28	460	440	900	
S.No.	<b>Course Code</b>	Course Title	Category	L	Т	P	C	ТСР	CIA	ESE	TOTAL	
		SEMESTE	R VII									
		Theor	у									
1.	22CH7201	Process Economics and Engineering	PCC	3	0	0	3	3	40	60	100	
		Management										
2.	22CH7202	Process Equipment Design	PCC	3	1	0	4	4	40	60	100	
3.	22CH73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100	
4.	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100	
.5.	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100	
Practi	ical											
6.	22CH7001	Design and Simulation Lab	PCC	0	0	4	2	4	60	40	100	
		EEC Courses	(SE/AE)						-			
7.	22CH7701	Internship	SEC	_ 1	-	-	2	2	100	0	100	
		4	TOTAL	15	1	4	20	22	360	340	700	
* - Fou	ur weeks interns	hip carries 2 credit and it will be done i	n before Se	me	ster	VI	sun	nmer v	acation	/placen	nent	
trainin	g and same will	be evaluated in Semester VII.		•				-				
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	С	TCP	CIA	ESE	TOTAL	
	· ·	SEMESTER	R VIII								1	
EEC C	Courses (SE/AB	<b>E)</b>							s			
1.	22CH8901	Project Work/Granted	SEC	0	0	20	10		100	0	100	
	-	Patent(Common)										
			TOTAL	0	0	20	10	20	100	0	100	
* 1.	As per the AI	CTE guideline, in Semester I, II, III &	IV NCC	one	cre	dit	sub	ject is	added	as Valı	e Added	
Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing												
	are eligible to	undergo this subject. The earned extra	a credits p	rint	ed i	n th	e C	onsolic	lated M	fark she	eet as per	
	the regulation	L. Constant of the second s		-								
2.	NCC course	level 1 & Level 2 will be added in	the list o	foj	ben	ele	ctiv	e subj	ects in	the ap	propriate	
	semester. Fu	rther, the students' who have opted N	CC subject	ts ii	1.Se	eme	ster	1, 11, ]	Ш&Г	v are e	ligible to	
	undergo NCC	C Open Elective Subjects.						•				
1 3	The above-m	entioned NCC Courses will be offered	to the Stud	ent	C W	ho :	are	going 1	to he	admitt	ed in the	

3. The above-mentioned NCC Courses will be offered to theStudents who are going to be admitted in the Academic Year 2021 – 22.

	1	Instrumentation and Control						
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3 .	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Bio refinery	OEC	3	0	0	3	3

Note:Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

## **OPEN ELECTIVE III (Offered by Chemical Engineering)**

Students shall choose any one of the open elective courses such that the course content or title not belongs to their own programme.

SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits		
	Code	Course Title		L	Т	Р	Contact Periods			
1	22CH7401	Waste to Energy Conversion	OEC	3	0	0	3	3		
OPENELECTIVE IV										

SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits
	Code	Course Title		L	Т	Р	Contact Periods	
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	- 3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

#### PROFESSIONAL ELECTIVE COURSES: VERTICALS

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

	Sources		Analysis		
Note: Students are per	mitted to choose all	<b>Professional Elect</b>	ives from a parti	cular vertical	

	DETAILS OF VERTICAL I :PETROLEUM PROCESS TECHNOLOGY												
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL		
1.	22CH5301	Petroleum Chemistry and Refining Fundamentals	PEC	3	0	0	3	3	40	60	100		
2.	22CH5302	PrimaryRefiningTechnology	PEC	3	0	0	3	3	40	60	100		
3.	22CH5303	SecondaryRefiningTechnology	PEC	3	0	0	3	3	40	60	100		
4.	22CH6301	RefineryAdvancementsandEnviron mentalRegulations	PEC	3	0	0	3	3	40	60	100		
5.	22CH6302	PetroleumEquipmentDesign	PEC	3	0	0	3	3	40	60	100		
6.	22CH7301	PetrochemicalTechnology	PEC	3	0	0	3	3	40	60	100		

		DETAILS OF VERTICAL II :I	ENERGY	EN	GII	NEI	CRI	NG			
5.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	ТСР	CIA	ESE	TOTAL
1.	22CH5304	Bioenergy	PEC	3	0	0	3	3	40	60	100
2.	22CH5305	Renewable Energy Resources	PEC	3	0	0	3	3	40	60	100
3.	22CH5306	Pinch Technology	PEC	3	0	0	3	3	40	60	100
4.	22CH6303	Hydrogen And Fuel Cell	PEC	3	0	0	3	3	40	60	100
		Technology		-							
5.	22CH6304	Power Plant Engineering	PEC	3	0	0	3	3	40	60	100
6.	22CH7302	Non-Renewable Energy Sources	PEC	3	0	0	3	3	40	60	100

		<b>DETAILS OF VERTICAL III :BIO</b>	CHEMIC	AL	Er	IGI	NE	ERINO	3		
S.No.	<b>Course Code</b>	Course Title	Category	L	Т	P	C	ТСР	CIA	ESE	TOTAL
1.	22CH5307	Biochemistry	PEC	3	0	0	3	3	40	60	100
2.	22CH5308	Bioprocess Technology	PEC	3	0	0	3	3	40	60	100
3.	22CH5309	Fermentation & Bioprocessing	PEC	3	0	0	3	3	40	60	100
4.	22CH6305	Bio separation & Downstream	PEC	3	0	0	3	3	40	60	100
		Processing									
5.	22CH6306	Enzyme Immobilization	PEC	3	0	0	3	3	40	60	100
		Technology						·	2		
6.	22CH7303	Bioreactor Design	PEC	3	0	0	3	3	40	60	100

	DETAIL	S OF VERTICAL IV: ENVIORNM	ENTAL A	ND	SA	FE	TY	ENGL	NEER	NG	
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	ТСР	CIA	ESE	TOTAL
1.	22CH5310	Biochemistry	PEC	3	0	0	3	3	40	60	100
2.	22CH5311	Bioprocess Technology	PEC	3	0	0	3	3	40	60	100
3.	22CH5312	Fermentation & Bioprocessing	PEC	3	0	0	3	3	40	60	100
4.	22CH6307	Bio separation & Downstream	PEC	3	0	0	3	3	40	60	100
		Processing									
5.	22CH6308	Enzyme Immobilisation	PEC	3	0	0	3	3	40	60	100
		Technology									
6.	22CH7304	Bioreactor Design	PEC	3	0	0	3	3	40	60	100

	Ι	DETAILS OF VERTICAL V: COMI	UTATIO	NA	LI	ENC	IIN	EERIN	NG		
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22CH5313	Computational Techniques	PEC	3	0	0	3	3	40	60	100
2.	22CH5314	<b>Optimization of Chemical Processes</b>	PEC	3	0	0	3	- 3	40	60'	100
3.	22CH5315	Process Modeling and Simulation	PEC	3	0	0	3	3	40	60	100
4.	22CH6309	Pinch Analysis and Heat Exchange	PEC	3	0	0	3	3	40	60	100
		Network Design									
5.	22CH6310	Chemical Process Flow sheeting	PEC	3	0	0	3	3	40	60	100
6.	22CH7305	Computational Fluid Dynamics	PEC	3	0	0	3	3	40	60	100

	DETAILS OF VERTICAL VI :COMPUTATIONAL ENGINEERING											
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	С	TCP	CIA	ESE	TOTAL	
1.	22CH5316	Chemical Plant Design	PEC	3	0	0	3	3	40	60	100	
2.	22CH5317	Plant Layout	PEC	3	0	0	3	3	40	60	100	
3.	22CH5318	Design Safety	PEC	3	0	0	3	3	40	60	100	
4.	22CH6311	Material Selection	PEC	3	0	0	3	3	40	60	100	
5.	22CH6312	Statutory Requirements &	PEC	3	0	0	3	3	40	60	100	
		Customer Care										
6.	22CH7306	Process Plant Utilities	PEC	3	0	0	3	3	40	60	100	

## Enrolment for B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation.

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

## (i) B.E. / B.Tech. Honours (specialisation in the same discipline):

a. The student should have earned additionally a minimum of 18 credits from a vertical of the same programme.

b. Should have passed all the courses in the first attempt.

c. Should have earned a minimum CGPA of 7.50.

#### (ii) B.E. / B.Tech. Honours:

a. The students should have earned additional courses (minimum of 18 credits) from more than one vertical of the same programme.

b. Should have passed all the courses in the first attempt.

c. Should have earned a minimum CGPA of 7.50.

## (iii) B.E. / B.Tech. (Minor in other specialisation):

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E. / B.Tech. programmes or from any one of the following verticals

VERTICAL I: FINTECH AND BLOCK CHAIN

VERTICAL II: ENTREPRENEURSHIP

## VERTICAL III: ENVIRONMENT AND SUSTAINABILITY

- Students can earn maximum of 6 credits in online mode (SWAYAM platform), out of these 18 credits as approved by Centre for Academic Courses.
- B.E. / B. Tech. (Honours) Specialisation in the same discipline, B.E / B.Tech. Honours and B.E. / B.Tech. Minor in other specialisation degree will be optional for students.
- For the categories (i) to (ii), the students will be permitted to register the courses from V Semester onwards provided the marks earned by the students until III semester should be of CGPA 7.50 and above and cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- ✤ If a student decides not to opt for Minor, after completing certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- The Head of Department, shall forward the proposal to the Controller of Examinations after getting the approval from Head of the Institution / Dean Academics, before the commencement of the fifth semester of the programme for the students undergo optionally B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation

## VERTICALS FOR MINOR DEGREE CHEMICAL ENGINEERING OFFERING MINOR DEGREE

## Minor Specialization in Chemical Process Engineering

SL. NO.	Course		Category	Category Periods Per week				Credits
	Code	Course Title	-	L	Т	Р	Contact Periods	
1	22CH5601	Introduction to Chemical Process	MDC	3	0	0	3	3
2	22CH6601	Fluid Flow Operations in Chemical Engineering	MDC	3	0	0	3	3
3	22CH6602	Fundamentals of Chemical Thermodynamics	MDC	.3	0	0	3	3
4	22CH7601	Process Heat and Mass Transfer	MDC	3	1	0	4	4
5	22CH7602	Reaction Engineering	MDC	3	0	0	3	3
6	22CH8601	Unit Operations and Process Laboratory	MDC	0	0	4	4	2
*1 (DC	NC D	Comment						

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

		VERTICAL I: FINTEC	H AND BL	OCK CHA	IN			
c	Course			Periods	Per w	veek	Total	Credits
No	Code	Course Title	Category	L	Т	Р	Contact Periods	
1	22MBXXX	Financial Management	MDC	3	0	0	3	3
2	22MBXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MBXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MBXXX	Introduction to Block chain and its Applications	MDC	3	0	0	3	3
5	22MBXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MBXXX	Introduction to Fintech	MDC	3	0	0	3	3

	VERTICAL II: ENTREPRENEURSHIP											
s	Course	Course Title	Category	Per wee	iods l ek	Per	Total Contact	Credits				
No	Code			L	Т	Р	Periods					
1	22MBXXX	Foundations of Entrepreneurship	MDC	3	0	0	-3	3				
2	22MBXXX	Team Building & Leadership Management for Business	MDC	3	0	· 0	3	3				
3	22MBXXX	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3				
4	22MBXXX	Principles of Marketing Management For Business	MDC	3	0	0	3	3				
5	22MBXXX	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3				
6	22MBXXX	Financing New Business Ventures	MDC	3	0	0	3	3				
		VERTICAL III: ENVI	RONMENT A	ND S	UST.	AINAH	BILITY					
------	----------------------------------------------------------	------------------------------------------------------	-----------	------------	-------------	-------	------------------	---------				
S No	Course Code	Course Title	Category	Per wee	iods ] k	Per	Total Contact	Credits				
				L	Τ	Р	Periods	creatis				
1	22CEXXX	Sustainable infrastructure Development	MDC	3	0	0	3	3				
2	22AGXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3				
3	22BMXXX	Sustainable Bio Materials	MDC	3	0	0	3	2				
4	22MEXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3				
5	22CEXXX	Green Technology	MDC	.3	0	0	2	2				
6	22CEXXX Environmental Quality Monitoring and Analysis		MDC	3	0	0	3	3				

# VERTICALS FOR B Tech (Hons) and B Tech (Hons) in Chemical Engineering with Specialization

Vertical I Computer Aided Process Engineering	Vertical II Polymer Technology	Vertical III Petroleum Engineering	Vertical IV Instrumental Chemical Analysis
Process Flow Sheeting	Polymer Chemistry	Petroleum Geology	Principles of Mass Spectrometry
Transport Phenomena	Processing Technology	Petroleum Exploration	Advanced Analytical
Advanced Process Optimization	Rubber Technology	Drilling Technology	Advanced Spectrometry: ICP- MS and LC-MS
Artificial Intelligence in Process Engineering	Polymer Product Design, Blends, and Alloys	Petroleum Production Engineering	Instruments for Morphology and Structural Characterization
Digital Twin and Soft Computing in Process Modelling	Polymer Structure and property relationships	Petroleum Reservoir Engineering	Statistical Analysis and Data Processing (Lab)
Advanced Process Modelling and Simulation	Polymer Compounding Technology	Offshore Engineering	Troubleshooting Analytical Methods and Instruments

# B Tech (Hons) Chemical Engineering with Specialization in Computer Aided Process Engineering

S No Course Code		Course Title	Category	Periods Per week			Total Contact	Credits
				L	T	P	Periods	
1	22CH5205	Process Flow Sheeting	MDC	2	0	2	4	3
2	22CH6203	Transport Phenomena	MDC	3	1	0	3	4
3	22CH6204	Advanced Process Optimization	MDC	2	0	2	4	3
4	22CH7203	Artificial Intelligence in Process Engineering	MDC	2	0	2	4	3
5	22CH7204	Digital Twin and Soft Computing in Process Modelling	MDC	2	0	2	4	3
6	22CH8201	Advanced Process Modelling and Simulation	MDC	0	0	4	4	2

S No	Course	Course Title	Category	Per wee	iods I k	Per	Total Contact	Credits
5110	Code			L	T	P	Periods	
1	22CH5206	Polymer Chemistry	MDC	3	0	0	3	3
2	22CH6205	Processing Technology	MDC	3	0	0	3	3
3	22CH6206	Rubber Technology	MDC	3	0	0	3	3
4	22CH7205	Polymer Product Design, Blends and Alloys	MDC	3	0	0	3	3
5	22CH7206	Polymer Structure and	MDC	3	0	0	3	3
6	22CH8202	Polymer Compounding Technology	MDC	3	0	0	3	3

# B Tech (Hons) Chemical Engineering with Specialization in Polymer Technology

# B Tech (Hons) Chemical Engineering with Specialization in Petroleum Engineering

S No	Course	Course Title	Category	Per wee	iods I k	Per	Total Contact	Credits
5110	Code	Course may		L	Т	Р	Periods	
1	220115207	Petroleum Geology	MDC	3	0	0	3	3
2	22CH6207	Petroleum Exploration	MDC	3	0	0	3	3
2	22CH6208	Drilling Technology	MDC	3	0	0	3	3
4	22CH10208	Petroleum Production	MDC	3	0	0	3	3
5	22CH7208	Petroleum Reservoir Engineering	MDC	3	0	0	3	3
6	22CH8203	Offshore Engineering	MDC	3	0	0	3	3

# B Tech (Hons) Chemical Engineering with Specialization in Instrumental Chemical Analysis

C No	Course	Course Title	Category	Per wee	iods I k	<b>'</b> er	Total Contact	Credits
SINU	Code	Course mae	0.	L	Т	P	Periods	
1	22CH5208	Principles of Mass	MDC	3	0	0	3	3
2	22CH6209	Advanced Analytical	MDC	3	0	0	3	3
3	22CH6210	Advanced Spectrometry:	MDC	3	0	0	3	4
4	22CH7209	Instruments for Morphology and Structural	MDC	3	0	0	3	3
5	22CH7210	Statistical Analysis and Data Processing (Lab)	MDC	3	0	0	4	2
6	22CH8204	Troubleshooting Analytical Methods and Instruments	MDC	3	0	0	3	3

Dean (Academics) Chairman Board of Studies Chairman - BoS ean (Academica) CHE - HICET HICET

Principal

PRINCIPAL Hindusthan College Of Engineering & Technology COIMBATORE - 641 032:

Program	nme	Course Code	Name of the Course	L	Т	Р	С
B.E/B.TI	ECH	22MA3107	NUMERICAL METHODS	3	1	0	4
			(CHEM, FT)				
		The learner should be al	ble to		- <b>h</b> i	~~~~	
		1. Solve algebraic, tran	scendental and system of linear equations by using va	irious ie	CHIII	ques.	
C		2. Analyze various met	f numerical differentiation and numerical integra	1. tion of	the		
Cours	se	3. Explain concepts of	I numerical unreferination and numerical integra	101 01	the		
Object	Ive	4 Explain single and	multi step methods to solve Ordinary differential equ	ations			
		5. Describe various n	nethods to solve ordinary differential equations	and pa	irtial	differ	ential
		equations.		-			
<b>T</b> T •4			Description		Ir	istructi	ional
Unit			Description			Hour	'S
	SOLU	TION OF ALGEBRAIC	AND TRANSCENDENTAL EQUATIONS				
т	Soluti	on of Algebraic and Transc	cendental equations: Newton Raphson method. Solu	ition of		12	
	linear	system: Gauss Eliminati	on - Gauss Jordan method -Gauss Seidel method.	Matrix			
	invers	ion by Gauss Jordan metho	d.				
TT	INTE	RPOLATION	and backward difference formulae - Newton's divid	ed		12	
11	differe	manula and I agrandi	and backward difference formulae - Newton's divid	UU			
	NIM	FRICAL DIFFERENTIA	TION AND INTEGRATION				
	Nume	rical Differentiation: Newt	on's forward and backward interpolation formulae for	or equal		10	
Ш	interva	als -Newton's divided	difference formula for unequal intervals. Nu	merical		12	
	integra	ation: Trapezoidal and Sim	pson's 1/3 rule.				
	INITI	AL VALUE PROBLEM	S FOR ORDINARY DIFFERENTIAL EQUATIO	NS			
IV	Single	step methods for solving	first order equations: Taylor's series method – Eu	ler and		12	
	Modif	ied Euler methods – Four	th order Runge-kutta method -Multi step method:	sinne s			
	predic	tor and corrector method.	EMS IN ODDINARY AND PARTIAL				
	DIFF	EDARI VALUE FRODE	S				
	Soluti	on of second order ordin	pary differential equation by Finite difference me	thod –		13	
V	Soluti	on of partial differential e	quation: one dimensional heat equation by Bender	schmidt		12	
	metho	d – One dimensional Wa	ave equation by Explicit method- Two dimension	al heat			
	equati	on - Laplace Equation and	Poisson Equations.				
			Total Instructional	Hours		60	
		At the end of the course,	, the learner will be able to				_
		CO1: Solve the system of	of linear algebraic equations which extends its application	tions in	the	field of	
		engineering					
Cours	se	CO2: Apply various met	hods to find the intermediate values for the given data	i.			
Outco	me	CO3: Identify various me	ethods to perfrom numerical differentiation and integ	ration			
		CO4: Classify and solve	ordinary differential equations by using single and m	ulti step	met	hods.	
		CO5: Illustrate various m	nethods to find the solution of ordinary and partial di	fferentia	ıl eqi	uations	•
TEXT BO	OOKS:						
T1 -	Erwi	n Kreyszig, "Advanced En	gineering Mathematics", 10 th Edition, Wiley India	Private	Ltd.	, New	Delhi,
	2018		and the state and the state of		,	2012	
T2 -	Grew	al.B.S. "Higher Engineerin	ng Mathematics", 44 th Edition, Khanna Publications,	New De	elhi, 2	2012.	
REFERE	ENCE I	BOOKS :	in "Numerical methods for Scientific and Engineerin	a Comr	uutati	ion" Fi	fth
R1 -	M.K.	Jain, S.K.K. Iyengar, K.K. Ja	nublishers 2010	g Comp	utati	011,11	1011
R2-	Grews	IRS and Grewal IS "N	$\frac{1}{10000000000000000000000000000000000$	Edition	, Kha	inna	٨
1\2 -	nublis	shers, New Delhi 2015.	umericut methods in 229-11-120-121 ( )		•	/	1
R3 -	S.K.G	upta, Numerical Methods	for Engineers", New Age International Pvt.Ltd Publ	ishers,2	015.,	-	
	6	N			J	Y	1
	Chải	man, Board of Studies	Dean	– Acad	lemi	cs	
<b>C</b>	hair	man - BoS	Dean	(Ac	ad	emi	cs)
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			Chairman ) 韵】				
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Course Code &Name : 22MA1101/ MATRICES AND CALCULUS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
AVG	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

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Dean (Academics) HICET



Programme	Course Code		Name of the Cou	rse	L	T	Р	C
B.TECH.	22CH3201	CHEMICA	L PROCESS CAI	CULATIONS	3	1	0	4
Course Objective Unit	1. 2. 3.	Formulate ma Incorporate sin Perform mater	terial balances to so ngle and multiple re rial and energy bala <b>Descriptic</b>	olve for compositio eactions into unit op nce calculations in on	ns and flow perations wi various sys	rates of p thin chen tems	process nical pr Ins	streams ocesses tructional Hours
I	BASIC Cl Concept of Methods of – Mole frac law.	HEMICAL CA f normality, mo f expressing the ction-Volumetric	ALCULATIONS: blarity, and molali composition of mi c composition – Ide	Unit Conversion ty – Density and xtures and solution al gas law – Dalton	n; Mole co specific g ns – Weight n"s law – A	ncept – ravity – fraction magat"s		9+3
П	MATERIA conservatio drying, di extraction and dry bu calculation	AL BALANCE on of mass – Pro ssolution, disti - Humidity and ulb temperature s	E WITHOUT Clocess flow sheet – Millation, crystallize Saturation – Relative , Dew point – Us	HEMICAL REA Material balance ca ation, evaporation we and percentage s se of humidity ch	CTION: lculations in n, absorpti saturation, V art for eng	Law of nvolving on and Wet bulb ineering		9+3
Ш	MATERIA equation –	AL BALANCE stoichiometric r	WITH CHEM atio – limiting react	ICAL REACTIO	DN: Stoich nt percent	iometric		9+3
IV	EXCESS = CO ENERGY Standard h temperature Calculation	<b>BALANCE:</b> St leat of reaction es other than s	andard heat of form – Hess"s law – tandard temperature lame temperature.	nation – Standard h Determination of e using specific h	eat of comb heat of rea heat relation	ustion – ction at ships –		9+3
V	COMBUS Orsat analy	TION CALCU	<b>LATIONS:</b> Calor and excess air requ	fic value of fuels nitement for solid,	. Flue gas a liquid and	malysis. gaseous		9+3
	1008.			Total I	nstructiona	l Hours	4	5+15=60
	CO1	Understand th mixtures	ne mole concept	and ideal gas eq	uation to e	xpress th	ne com	position of
Course Outcome	CO2	Apply the met usage of psych Estimate the	thod of solving stea hometric chart extent of reaction	idy state material t	inces for s	nout cher	nical re	actions and g chemical
	CO3 CO4	reactions Inspect the en	ergy balance and he	at capacity calcula	tions.			
TEXT BOO	K:	Calculate the	calorific value of fu	iels using various n	nethous.			
T1	David M. H	immelblau, "Ba	sic Principles and C	Calculations in Che	mical Engin	eering", 8	SthEdit	ion,
T2	Bhatt B.I. ar	nd Vora S.M., "S	Stoichiometry", 2nd	Edition, Tata McC	araw Hill, N	ew Delhi	,2004	
T3	Narayanan H Hall India L	K.V., Lakshmiku imited, New De	itty B, Stoichiometr lhi, 2006.	y and Process calc	ulations, Pro	entice		
REFERENC	ES:							an a
R1	Hougen O A publishers, 2	, Watson K M a 2004.	und Ragatz R A, "Cl	hemical process pr	inciples" Pa	rt I, 2nd I	Edition	, CBS
R2	Venkatrama	ni. V, Anathara Delhi 2nd Edn	man. N and Meera S	Shariffa Begam" P	rocess Calcu	ilations"	Printic	Hall of
R3	Felder, R. M Wiley & Sor	1. and Rousseau ns, New York, 2	, R. W., "Elementar 2005	ry Principles of Ch	emical Proc	esses",3rc	l Editio	on, John
R4	Reklaitis G.	V., "Introductio	n to Material and E	nergy Balances", V	Wiley, New	York, (19	83).	1-2
Cl	airman Boar	rd of Studies			De	ean – Aca	demic	s
C	háirmai	1 - BoS	CHOEMIC	KH2	Dea	an (A	cade	emics)
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			COLLEGE	OF				

& PSO	P0 1	РО 2	РО 3	PO 4	PO 5	РО 6	РО 7	PO 8	РО 9	PO 10	P0 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3		1						2	2	1
CO2	3	3	3	3		1	1		1			2	2	1
CO3	3	3	3	3		1	1		1			2	2	1
CO4	3	3	3	3		1	1		1			2	2	1
CO5	3	3	3	3	1	1					-	1	1	1
AVG:	3	3	3	3	1	1	1	-	1	-	-	2.2	2.2	1

# Course Code & Name: 22CH3201-CHEMICAL PROCESS CALCULATIONS

14736 Chairman - BoS OHE - HICET .





Program	me (	Course	Name of the Course	L	Τ	Р	С
B.TECH	22CH	(3202	FLUID FLOW OPERATIONS	3	0	0	3
Diffen	The st	tudent sh	ould be able to				• , ,•
	1.	Develo	p an understanding of the fundamental properties	s of fluids a	nd their	behavi	or in static
Course	2	Conditio	ons.	luding lamina	ar and tu	ırbulent	flow, flow
Objective	e 2.	equatio	ns, and flow measurement techniques.				,
	3.	Enable	students to understand various flow metering ter	chniques and	their ap	oplication	ons in fluid
		transpo	rtation.	c1 1 1'			and also
	4.	Introdu	ice students to the principles and selection criteria of	of hydraulic p	umps, co	ompress	sors, and air
Unit		motors.	Description			Ī	nstructional
Umt			2000-9-00-				Hours
I	Fluid F	Properties	s and Statics: Nature of fluids - properties of	fluids; Type	es offlui	ids-	
	Newton	ian and N	on-Newtonian fluids, Compressible and incompress	sible fluids; In	ntroducti	on-	9
	Hydrost	atic equili	brium; Pressure measurement – Manometers.	a		n a d	
П	Princip	les of Flu	<b>id Flow:</b> Types of flow – laminar and turbulent	ion factors	Bernoul	seu lli's	
	channels	s;Equation	polications: Losses in pines - Introduction - B	oundary lay	er conce	ept.	9
	Dimensi	ional anal	ysis: Basics of dimensional analysis: Rayleigh's me	thod and Buc	kinghan	n's-	
	$\pi$ metho	d.		с. с. <b>п</b>		, 	
ш	Flow Pa	ast Imme	rsed Bodies: Drag- types, drag coefficient, friction	1 Iactor for fi aterials: deter	ow unro minatio	ugn 1 of	
	beas of	sonus, ap	ising Froun equation. Fluidization-types, deter	rmination of	minim	um	
	fluidizat	tion veloc	ity and pressure drop; Motion of particles throug	h fluids – ca	lculation	n of	9
	terminal	l settling v	velocity.		<u> </u>		
	Buoyan	cy, Condi	tion of Equilibrium for Submerged and Floating Boo	lies, Centre o	f Buoyar	ncy,	
TV/	Metacer	ntre-Detei	mination of Melacentric riegul.	ariable head a	and varia	able	
1 V	Meterii	ig of riu eters: ver	nus: classification and selection of now meets, w	discharge and	d discha	arge	0
	coefficie	ent; Pitot	tube; Anemometer; Introduction to notches, we	irs, turbine,	Vortex	and	9
	Magneti	ic flow me	eters.				
$\mathbf{V}_{\mathbf{u}}^{(1)}$	Transp	ortation	of Fluids: Classification of fluid moving machi	nery; Centrif	ugal pu	mp-	
	characte	eristics a	nd applications; elementary principles of Recip	fittings ner	ar, air formance	nn, e of	9
	multista	gin and so	- Cavitation - methods of prevention.	num55. por	-		
			T T	otal Instructi	ional Ho	ours	45
	CO1	Demons	trate a comprehensive understanding of the prop	perties and b	ehavior	of flui	ids in static
	001	conditio	ns. different types of flow including laminar and th	rhulent flow.	and an	nlv the	equation of
	CO2	continui	ty and Bernoulli's equation to solve flow-related pro	blems.		F-7	1
Course	CO2	Determi	ne drag coefficients and pressure drops in fluidi	zed and pacl	ked beds	s using	appropriate
Outcome	e COS	equation	is and correlations.			1.6	entos
	CO4	Select a	nd utilize different flow metering techniques for acc	uratery measu	ressors	and air	motors, and
	CO5	apply th	em in practical applications.	rampo, comp			·
TEXT BO	00K:						
T1	McCa	abe W.L.,	Smith J.C. and Harriot P., — "Unit Operations	in Chemical	Enginee	ring", '	th Edition,
T	McGi	aw Hill li	nternational Edition, New York, 2000.	blications, 20	15.		
12 REFERF	ENCES:	11 K.K., I	Tutu Mechanics & Hydraune Machines , Zaamin 2 a				
R1	Cenge	el, Yunus	and Cimbala John M, - "Fluid Mechanics Fund	amentals and	Applica	tions",	2nd Edition,
	Tata 1	McGraw I	Hill Publishing Company, New Delhi, 2006.	"Eundomont-	le of El-	id Ma	hanice" 6th
R2	Muns	on B.R.,	Young D.F., OKIISHI I.H. and Huebsch W.W., — India New Delhi 2010	runuamenta	15 01 FIL		mannes, our
R3	Noel	le Nevers	"Fluid Meethanics for Chemical Engineers", 3rd E	dition, McGra	wHill, N	New Yo	rk, 2004. 📿
	N	No -					1P
	Chairt	man, Boa	rd of Studies	D D	ean – A	cademi	cs V
C	Chair	man	- BoS	Dea	an (A	cad	emicsj
	CHE	- Hid	CET	ider	<b>-</b> H	icej	
<b>k.</b>			((a ( Charman ) #))				
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PO & 1		PO 2	PO 3	РО 4	PO 5	РО 6	<b>PO</b> 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	
C01	3	3	2	2	2	2	-	1	-	1	1 .	-	3	2	t
CO2	3	2	2	2	1	2	-	1	1	1	-	1	1	1	t
CO3	3	2	2	2	1	1	-	1	-	1	1	1	3	1	t
CO4	3	2	3	2	2	2	-	1	-	1	1	2	3	1	İ
C05	3	2	3	2	2	2	-	1	-	1	2	2	3	1	t
AVG ·	3	2.2	2.2	2	1.6	1.8	-	1	1	1	1.25	1.5	2.6	1.2	Ī

Course Code & Name: 22CH3202-FLUID MECHANICS FOR CHEMICAL ENGINEERS

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Programme	Course Code	Name of the Course	1		Т	Р	C
B.TECH.	21CH3203	CHEMICAL ENGINEERING THERMODYNAMICS - I		3	0	0	3
	The student	should be able to					
Course	1.	Calculate and analyse the P-V-T behaviour of the compressibility charts.	gases us	ing va	trious equ	uation o	f states and
Objective	2.	Determine the first and second law of thermodyn	namics ar	nd wil	l learn to	apply t	hese to the
	2.	solution of chemical engineering problems	CT .				
	3.	Assess thermodynamic potential and the concept	of Intern	al ene	rgy and e	nthalpy	
Unit		Description				Insti F	ructional Iours
	SCOPE OF	THERMODYNAMICS: Definition of system,	control	volum	ie, state		
Ι	and path fu	nction, equilibrium, reversibility, energy, work a	and heat.	Zero	th law;		9
	temperature	scales. Joule's experiment, internal energy, first la	w, energ	y bala	ance for		
	PVT BE	<b>HAVIOUR OF FLUIDS:</b> Mathematical rel	presentat	ion	of		
П	PVT beh	aviour; generalized compressibility factor con	rrelation;	gener	alized		9
	equations of	state. Heat effect accompanying chemical reaction.			1		
	SECOND I	AW OF THERMODYNAMICS : Statements	of the se	cond	law of		
	theorems the	allos, heat engine, heat pump and refrigerator, Car ermodynamic temperature scale entropy and its	rnot cycl	e and	Carnot		
Ш	balances for	open system. Clausius Inequality second law of t	thermody	nami	cs for a		9
	control volu	ne. Third law of thermodynamics, entropy from a	microsc	opic j	point of		
	view.			1 D.			
	THERMOD	YNAMIC POTENTIALS – Internal energy, Entl	halpy, Ho	elmho	ltz free		
IV	partial deriva	tives and Jacobian method: residual properties: the	- maxwe	mic n	anons -	•• •	9
	tables and di	agrams. Fugacity and activity	Jinouyne	anie p	nopenty		
	COMPRES	SIBLE FLUID FLOW& STEAM ENGIN	ES: Du	ct fl	ow of		
V	compressible internal com	fluids, Compression and expansion processes, pustion engines, Gas-turbine power plant, jet and ro	steam ocket eng	powei ines	· plant,		9
	001	Total	Instruc	tional	Hours		45
	$CO^2$	Evaluate thermodynamic properties of pure substa	nces wit	hener	ial amph	acie on	fluida
C.	002	Solve the practical thermodynamic problems by a	applying	first l	aw and s	teady fl	ow energy
Outcome	003	equation	11.5 - 8			<b>,</b>	
Outcome	CO4	Understand the fundamental thermodynamic property	erties.				
	CO5	Apply various methods of evaluating state property	ties to eq	uipme	ent comm	ionly Er	icountered
TEXT BOOK	•	in chemical engineering processes, such as turbine	s, pumps	s, engi	nes, and	reinger	ation units
T1	Smith, J.M., McGraw Hill	Van Ness, H.C and Abbot M.M "Introduction to C Publishers, VI edition, 2003.	hemical	Engin	eering T	hermod	ynamics ",
T2	Narayanan, k	V. A Textbook of Chemical Engineering Thermoo	dynamics	Pren	tice Hall	India, 2	004.
REFERENCE	ES:						
KI	kyle, B.G., edition 2004	Chemical and Process Thermodynamics III Edition	on", Pren	itice I	fall of Ir	idia Pvt	. Ltd., 3rd
R2	Elliott J.R., Edition, 2011	Lira, C.T., "Introductory Chemical Engineering	Thermod	ynam	ics", Pre	ntice H	all,Second
R3	Rao, Y.V.C.,	"Chemical Engineering Thermodynamics" University	sities Pre	ss, 20	05.		1
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
201	3	2	3	1	-				1		1		1	1
202	3	2	3	1							1		1	1
:03	3	2	3	1							1		1	1
:04	3	2	3	1					-		1		1	1
:05	3	2	3	1	-						1		1	1
VG	3	2	3	1							1		1	1

Course Code & Name: 22CH3203-CHEMICAL ENGINEERING THERMODYNAMICS-I

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Programme	Course	Name	of the Course	L	Т	Ρ	С
R TECH	22CH3251	MECHANIC	CAL OPERATIONS	2	0	2	3
<b>D</b> .TECH.	The student	should be able to				-	
G	1.	Understand the basic	information and the system	atic diagrams o	f Unit op	perations	involved in
Course		Chemical industries.	A	1 h	in ductri	loquinm	ant
Objective	2.	Apply the concepts o	f design, operation details a	nd schematic of che	mousur mical c	omnonen	ts
<b>T</b> T <b>•</b> /	3.	Choose the right sepa	Description	eparation of en	cinical c	Inst	ructional
Unit			Description			J	Hours
т	NTRODUC	TION TO DADTICI	UATE SOLIDS: Particle	Shape, Size,	Mixed		
-	Particle Sizes	and Size Analysis - Cu	mulative and Differential A	nalysis -Variou	s Mean		6+3
	Diameters –	Screen Analysis Stand	lard Screens – Various Inc	lustrial Screens	. Sieve		
	analysis.	•					
II	SIZE REDU	CTION: Principles of	f Comminution - Energy an	d Power Requi	rements		
	in Comminut	ion - Mechanical Effici	ency-Laws of Crushing-Size	e Reduction Equ	ipment		6+4
	- Crushers-	Grinders Cutting Ma	chines – Open and Clos	ed Circuit Op	eration.		
	Reduction ra	atio in Jaw Crusher, B	alimili, Drop Weight Crus	ner.	mintion		
111	PARTICLE	SEPARATION : Grav	ity settling, sedimentation,	ntrifugal senar	ration -		
	double cone	e classifier, rake class	fuges design of basket cen	trifuges: indust	ial dust		6-11
	removing e	minuges, super centri minment, cyclones a	nd hydro cyclones, electron	rostatic and n	nagnetic		0+4
	separators, h	neavy media separatio	ns, floatation, jigging: Cl	haracteristics o	f batch		
	Sedimentatio	n, Separation character	eristics of Cyclone separat	or, Air Elutriat	or.		
IV	FILTRATIC	<b>N:</b> Theory of filtration	, Batch and continuous filt	ers, Flow throu	gh filter		
	cake and fi	ilter media, compress	ible and incompressible	filter cakes, I	intration		6+4
	equipment -	selection, operation and	a design of filters and optim	late and Fram	e Filter		•
	niter alds. D	atch mitration studies	using Lear Friter and F				
V	MIXING: C	oncept of mixing, Hom	ogeneous and Heterogeneou	ıs mixtures, imp	ortance		
·	of mixing, N	fixing liquids with liqu	ids, Mixing of gases with li	quids, Mixing o	of solids		6
	with liquids,	Mixing of viscous and	plastic masses, Types of mix	cers.	1 Hours	3(	0+15=45
	CO1	Understand the gene	ral characteristics of solids	screening and s	ieve ana	lysis.	
	CO2	Examine the particle	size reduction processes an	d to operate the	size red	uction eq	uipment
Course	CO3	Illustrate the method	s of particles separation	-* -			-
Outcome	CO4	Remember the theor	y of filtration and filtration	equipment			
	CO5	Estimating the partic	le handling and the power r	equired for mix	ıng.		
TEXT BOC	<b>DK:</b>	UI Cuith IC and U	arriot P "Unit Operations i	in Chemical En	vineering	o". 7th	
11	Edn McG	v.L., Sinni, J.C., and H raw-Hill 2005	arrior, 1., Onit Operations		5 4		
Т2	Coulson, J	.M. and Richardson, J.I	F., "Chemical Engineering"	Vol. I, 5th Edn.	, Asian	Books Pv	rt. Ltd., India,
12	2006.						
T3	Patil K.D.,	Mechanical Operations	s (Fundamental Principles and	nd Applications	), 3		
	rd ed.,Nira	li Prakasam, India, 201	2				
REFEREN	CES: Brown G (	et al "Unit Operatio	ons", 1st edition., CBS Publi	sher, New Delh	i, 2005.		
R2	Badger W.	L. and Banchero J.T.,	"Introduction to Chemical	Engineering", 7	Tata Mc	Graw Hil	l, 1st Edition,
162	2002.	-		- D (D)	• •	GII '' O	······································
R3	Foust, A. S	S., Wenzel, L.A., Clump	o, C.W., Naus, L., and Ander	rson, L.B., "Prir	iciples o	f Unit Op	erations", 2nd
	Edn., John	Wiley & Sons, 2008.	C Mechanical Operations	for Chemical Er	ineers.	3rd ed.,	1
R4	K hanna Pu	iblishers India, 2011.			0		
						10	
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			OLLEGE OF ENTRY				

# Course Code & Name: 22CH3251-MECHANICAL OPERATIONS

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	PSO 1	PSO 2
CO1	3	3	3	3		1			1			2	2	1
CO2	3	3	3	3	1	1		1				2	2	1
CO3	3	3	3	3		1	1		1	1		1	2	1
CO4	3	3	3	3		1						2	1	1
CO5	3	3	3	3	1	1		1	1			1	2	1
AVG:	3	3	3	3	1	1	1	1	1	1		1.6	1.8	1

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Program me	Course Code	Name of the Course	L	Т	Р	С	
B.TECH.	22AC3191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0	
Course Objective	The student           1.           2.           3.           4.	should be able to Facilitate the students with the concepts of Indian transmake them understand the Importance of roots of knowled it to their day to day life. Impart basic principles of thought process, Itihas and and nature Uunderstand the concept of Intellectual and intellectual Reference	ditional kn owledge sy lge and an Dharma S al propert	owledge a vstem. alyze it ar chasta and y rights w	and to id apply connec ith speci	ting society	
Unit		Description			Ins	tructional Hours	
П	Introduction Define traditional of traditional knowledge vs Protection of The need for TK in global	to traditional knowledge: onal knowledge, nature and characteristics, scope and knowledge, Indigenous Knowledge (IK), characte indigenous knowledge, traditional knowledge vs weste traditional knowledge: protecting traditional knowledge, Significance of TK P	importanc ristics, tra rn knowle rotection,	e, kinds aditional dge value of		6	
Ш	Itihas and Dh Itihas: The M	Aarma-Shastra Mahabharata - The <u>Puranas</u> - The <u>Ramayana</u>				6	
IV V	Dharma-Sha Traditional k Systems of tr traditional kn protection of t Indian philos	stra: Manu Needhi - The Tirukkural– ThiruArutpa nowledge and intellectual property: aditional knowledge protection, Legal concepts for owledge, Patents and traditional knowledge, Strate raditional knowledge ophy	the prote egies to	ction of increase		6	
Course	Jain – Budo SaivaSiddhant CO1 CO2	Ihist – Charvaka – <u>Samkhya</u> - <u>Yoga</u> - <u>Nyaya</u> a Total Ins Identify the concept of Traditional knowledge and its Explain the need and importance of protecting tradition	a - <u>Vaisl</u> tructiona importance nal knowl	<u>neshika</u> - <b>l Hours</b> e. edge.		<b>6</b> 30	
Outcome	CO3 CO4 CO5	Explain the need and importance of Itihas and Dharma Interpret the concepts of Intellectual property to protect Interpret the concepts of indian philosophy to protect the	a Shastra. ct the tradi the traditic	tional know	wledge. ledge.	•	
<b>REFERENC</b> R1 R2 R3 R4 R5	CES: Traditional K Traditional K Knowledge 7 V. Sivaramak Edition, 2014 V.N.Iba (Ea	(nowledge System in India, by AmitJha, 2009 (nowledge System in India by AmitJha Atlantic publish (raditions and Practices of India" Kapil Kapoor I, Micharishna (Ed.), Cultural Heritage of India-Course Materia (a. Trans.), Tarkasangraha of Append Photos Legendric	ers, 2002. el Danino2 al, Bharati	2. yaVidya E	Bhavan, 1	Mumbai, 5th	נ
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To learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine Objectives pump characteristics. S.No. DESCRIPTION Determination of coefficient of discharge of the given Venturimeter Determination of coefficient of discharge of the given Orifice meter Find the calibration of V-notch Find the friction factor for the given straight pipe Determine the pressure drop through annular pipe Determine the critical Reynolds number and friction factor of a fluid flowing through spiral coil Determine the critical Reynolds number and friction factor of a fluid flowing through helical coil Find the performance characteristics of the given centrifugal pump and find the

- maximum efficiency of the pump 9. Find the performance characteristics of the given reciprocating pump and find the maximum efficiency of the pump
  - Determine the Pressure drop studies in packed bed using Ergun equation
- 11. Determine the velocity- pressure drop relation from the given fluidized bed

#### **Total Practical Hours**

Upon completion of the course, students can be able to

CO1: Estimate the friction and measure the frictional losses in fluid flow.

CO2: Analyze the flow behavior of fluid flow in pipelines

CO3: Determine the fluid flow pressure drop in various equipment.

CO4: Examine the efficiency of various instruments

CO5: Understand the properties of fluids in different process

#### **REFERENCE BOOKS:**

- McCabe W.L, Smith, J C and Harriot. P "Unit Operations in Chemical Engineering", McGraw Hill, VII Edition, 2005
- White, F.M., "Fluid Mechanics", McGraw-Hill Inc., VII Edition, 2011.

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Course

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B.Tech

Programme **Course Code** 22CH3001

#### Name of the Course FLUID FLOW OPERATIONS LAB

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A

# Course Code & Name: 22CH3001-FLUID MECHANICS LAB

PO&PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
	1	2	3	4	5	0	1	8	9	10	11	12	1	2
CO1	3	2	141	2	1	1	2	-	3	-	-	2	-	2
CO2	3	-	2	1	2	1	2		3	-	-	2	-	2
CO3	3	2		2	1	1	2		2	2	-	2	1	1
CO4	3	2	-	2	1	1	1	626	3	2	104	2	2	1
CO5	3	2		2	1	1	1	-	2	1	-	2	2	1
AVG	3	2	1-13	2	1	1	1.6		2.4	1.8		2	1.8	1.4

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Т С Name of the Course P L **Course Code** Programme 2 A 4 **TECHNICAL ANALYSIS LAB** A 22CH3002 **B.Tech** 

Course **Objectives** 

S.No.

# To make the student acquire practical skills in the wet chemical and instrumental methods for

.

# quantitative estimation of nitrite in water, cement, oil, coal, Petroleum products and Phenol. DESCRIPTION

Determine the Viscosity of the Given oil (Saybolt Viscometer) 1.

Determine the Viscosity of the Given oil (Redwood Viscometer) 2.

Estimation of Flash and Fire Point of the Given Sample (Pensky Martens Closed Cup Method) 3.

- Estimation of Flash and Fire Point of the Given Sample (Cleveland Open Cup Apparatus) 4.
- Estimation of Cloud and Pour Point of the Given Sample 5.
- Estimation of Acid Value of Given oil Sample (Analysis of Oil) 6.
- Estimate the Proximate Analysis of the Given Sample of Coal 7.
- Estimation of Total Fatty Matter Content in the given sample 8.
- Determination of calorific value of fuels using bomb calorimeter. 9.
- Flue gas Analysis Orsat Apparatus. 10.
- Determination of Aromatic Content in the given oil sample. 11.

#### **Total Instructional Hours**

45

# Upon completion of the course, students can be able to

- CO1: Acquire knowledge through carry out experiments about physical and chemical characterization of petrochemical products and apply knowledge in industries.
- CO2: Analyze the properties of various petroleum products.
- Course Outcomes
  - CO3: Perform the advanced qualitative and quantitative laboratory tasks, including the operation of advanced analytical instrumentation.
    - CO4: Understand the importance and quality of various petroleum products.

CO5: Apply the knowledge of Engineering principles in practice.

#### **REFERENCE BOOKS:**

- Text book of quantitative chemical analysis, J.Mendham, Pearson education 2008. 1
- Manual of environmental analysis, N.C Aery, Ane books.2010. 2
- Text book of quantitative chemical analysis, J.Mendham, Pearson education 2008. 3
- Bhaskar Rao, B.K., "A Text on Petrochemicals", Khanna Publishers, 2000. 4

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PO&PSO	PO 1	PO 2	PO 3	PO	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
COL	2	2	3	2	1	1	2	0	3	2	**	2	2	2
CO2	3	2		2	1	1	2		2	2		2	2	2
CO3	3	2		2	1	1	2		2	2		2	1	1
CO4	3	2		2	1	1	1		3	2		2	2	1
CO5	3	2		2	1	1	1		2	1		2	2	1
AVG	3	2		2	1	1	1.6		2.4	1.8		2	1.8	1.4

Course Code & Name: 22CH3002-TECHNICAL ANALYSIS LAB

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Programm	ne Name of the Course	L	Т	Р	С	ТСР
B.E	22ME3253-BASIC MECHANICAL ENGINEERING	2	0	2	3	4
Course Objective	<ol> <li>To understand the manufacturing process of metal components.</li> <li>To explore the machine tools and its operation.</li> <li>To understand the mechanisms and relative motions.</li> <li>To learn the thermodynamic process, gas power cycles and Applications.</li> <li>To learn the basic operations and working principles of Hydraulic and pneu</li> </ol>	matic	systems	•		
Unit	Description				Inst	ructional
Ι	Manufacturing Processes Casting - Sand Mould – Type of patterns - Pattern Materials – Pattern allowances -Mould Forming Processes: Hot working and cold working of metals - Forging processes. Weldin principles - Sheet Metal Forming Processes-characteristics and operations.	ling m g: Bas	achines ic types	. Metal and its		6
Ш	Machine Tools Lathe: Types, Operations, Working Principle; Nomenclature of Cutting Tool – Milling M Working Principle; Drilling machine: Operations and Working Principle - Grinding M CNC Machines. Machining operation using lathe and milling machines.	fachin achine	es - Typ - Oper	pes and rations,		6+3
III	Links - Pairs - Chain - Mechanism - Machine structure - Degrees of freedom - Four ba mechanisms - Four bar, single slider crank and double slider crank mechanisms. Vibration and Gyroscopes.	r chai n – Tyj	n. Inver pes, Gov	sion of vernors	•	6+6
IV	Understand the concepts on Governors and Gyroscope. Thermal Engineering Gas Power Cycles: Otto and Diesel cycles: Internal Combustion Engines: Classification working principle. Boilers: Classification and working principle; Refrigeration: Vapor Vapour Absorption system: Types and Applications. Performance Test on four stroke Diesel Engine and compressors.	on, Co ur Co	mponer	nts and on and		6+6
V.	Hydraulics & Pneumatics Fluid power and its Applications - Fluid power systems - Properties and selection of flu controls. Pneumatics: Properties of air – Fans and Blowers - Compressors – Accessories and contro	ids -A ls.	ccessor	ies and		6
	Total	Instru	ctional	Hours	30-	+15=45
Cours Outcor	<ul> <li>Upon completion of this course, the students will be able to,</li> <li>CO1: Understand various manufacturing process.</li> <li>CO2: Gain knowledge in various machine tools and machining process.</li> <li>CO3: Classify mechanisms and inversions and determine mobility of a mechanism.</li> <li>CO4: Learn the basics of thermal power cycles and its Applications.</li> <li>CO5: understand the basics of Hydraulic and Pneumatic tools and Equipment.</li> </ul>					

### **TEXT BOOKS:**

T1 - Hajra Choudhary S.K and Hajra Choudhury. AK, "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997.
T2 -Ratan.S.S, "Theory of Machines", Tata McGraw Hill Publishing company Ltd., 2nd Edition, 2005.
T3 -Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2000 Third edition, 2015.

### **REFERENCE BOOKS:**

R1 -Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2004. R2- Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.





Programme/s	sem Co	ourse Code	Name of the Course		L	Т	Р	С
B.Tech	22	MA4151	PROBABILITY, STATISTICS WITH PROGRAMMING ( COMMON TO AERO, CHEM)	R	2	0	1	3
Course Object	1. 2. 3. tive 4. 5.	To construc To interpret To introduc random vari To describe hypothesis. To educate	t a well-defined knowledge of Probability. measures of central tendency, dispersion, and ce Correlation concepts to understand the re iables. e some basic concepts of statistical metho the design of experiment techniques to solve va	assoc lation ods f arious	tiation. betwo for test s engin	een tw ting th eering	vo ne problem	IS.
Unit			Description				Instruct	tional rs
PI I De Ba D	ROBABI efinition aye's The ESCRIP	LITY – Axioms of orem (withou TIVE STAT	f Probability – Conditional Probability – Tot at proof). Introduction to R Studio Programm ISTICS	al Pr ning	obabili	ty –	6 +	3
II M Ra M	easures o ange – Q lean Med ORREL	of Central Te uartile Devia lian Mode, S ATION AND	endency - Mean – Median –Mode, Measures tion – Standard Deviation – Coefficient of Va tandard Deviation & Variance DREGRESSION	of D ariatic	ispersi on. <b>R I</b>	on - ∟ <b>ab:</b>	6 +	3
III Co Re <b>R</b> o	orrelation egression <b>egressio</b>	– Karl Pears lines (probl <b>n</b>	son's correlation coefficient – Spearman's Rate ems based on Raw data only). R Lab: (	nk Co C <b>orre</b>	orrelation elation	on – 1 &	6 +	3
H La IV Sn Cł F	rge samj nall samp ni – Squa - Test &	ESIS TESTI ple test - Tes ple test – t tes re test for ind Chi Squar S OF VARIA	NG st of significance for single mean and different st for single mean and difference of mean - F t dependence of attributes – Goodness of fit. R re Test	ence o est fo Lab:	of mea or varia <b>t - T</b>	ins - ince, <b>`est,</b>	6 +	3
V Int Ra	troduction	n- Assumptio	ons of Analysis of Variance- Completely Rando gn - Latin Square Design. <b>R Lab: Analysis</b>	omize of Va	d Desi arianc	gn- ce	6 +	3
Course Outc	come	CO1: Unde CO2: Unde CO3: Comj CO4: Acqu CO5: Appl	Total Instru- erstand the concepts of probability. erstand the concepts of Descriptive Statistics pute correlation and predict unknown values us irre the knowledge of statistical methods for te y Design of Experiment techniques to solve va	sing rosting	egressi the hypersi	ours on. pothes	45 + 15 is.	5=60
TEXT BOOK T1Veerar New Dell T2 Gupt T3 Med REFERENC	KS: ajan, T., 1 ai, April 1 a S C and bi J," Sto E BOOK	Probability, S 19, 2017. d kapoor V.K. ochastic Proce	y Design of Experiment techniques to solve va Statistics and Random Processes, Tata McGraw , Fundamentals of Mathematical Statistics, Sul esses", New Age International Publishers, New	rious -Hill, tan C Delh	engine , $2^{nd}$ Ec hand & ni, 2014	tition, Sons 2.	problems	<b>.</b>

- R1- O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, First Indian Reprint, 2010.
- R2 Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 10th Edition, Pearson Education, Asia, 2011.

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Progr B.	<b>amme</b> Tech	Course Code 22CH4201	Name of the Course MASS TRANSFER OPERATIONS- I	L 3	Т 0	Р 0	C 3
Ca Obj UNIT	ourse ectives Γ	<ul> <li>i. To Understand th</li> <li>ii. To Apply mass tr</li> <li>iii. To Analyze psych</li> <li>iv. To Apply materia</li> <li>v. To Apply crystall</li> </ul>	the classification of mass transfer operations. ransfer theories to calculate coefficients in various flow conditions hrometric charts for designing humidification processes. al and energy balance for analyzing drying processes. lization kinetics principles to design batch and continuous crystall <b>DESCRIPTION</b>	s. izers. <b>INST</b>	RUC	CTION	NAL
T	UNI	T I: Introduction to Ma	manufan Onanationa		но	U <b>RS</b>	
1	Intr Ope Ope Diff mol	oduction: Scope of Mas rations - Choice of Sep rations. usion in Fluids: Molecul ecular diffusion of Fluid	s Transfer Operations s Transfer Operations - Classification of Mass Transfer aration method - Methods of conducting Mass Transfer ar diffusion - The equation of continuity - Steady state ds at rest and in laminar flow - Diffusivity of gases and		9	)	
тт	liqu	ds - Applications of mo	blecular diffusion.	ł.			
11	UNI Inter liqui trans and	<b>I</b> - <b>II: Mass Transfer Co</b> Phase Mass Transfer: Eq d phase controlled situat fer coefficients in laminar Momentum Transfer Analo	efficients quilibrium – Overall mass transfer coefficients – gas phase & tions. Eddy Diffusion - Mass transfer coefficients - Mass flow and turbulent flow - mass transfer theories - Mass, Heat ogies.		9	)	
	Equ equi com	pment for gas-liquid con oment – packing for pack parison of plate and packed	ntact – Description of continuous and stage wise contact ced columns liquid distribution – NTU and NTP concepts – d columns.				
III	UNI Hun vapo Psyc pack	I – III: Humidification idification Operations: Va r gas mixtures, Air-water hrometric charts – humidi ed humidifiers, dehumidif	apor - liquid Equilibrium and Enthalpy for a pure substance - system - Adiabatic saturation curves, wet bulb temperature – ification and dehumidification – Operating lines and design of iers - cooling towers - spray chamber – Evaporative cooling.		ç	)	
IV V	Dryi thro of le	ng- Equilibrium; classific ugh circulation drying, con ngth of rotary dryer using	ation of dryers; batch drying – Mechanism and time of cross ntinuous dryers – material and energy balance; determination rate concept.		9	)	
•	Crys kine bala	tallization - Equilibrium, ics of crystallization – nu ice model and design of co	, classification of crystallizers, mass and energy balance; icleation and growth; design of batch crystallizers; population ontinuous crystallizers.		9	)	
		Unon completion of the	Total Instructional Hours		4	5	
Co Oute	urse comes	CO1: Categorize mass tr CO2: Calculate coefficie CO3: Design packed hur CO4: Determine rotary of CO5: Design continuous principles.	ansfer operations based on fundamental principles, enhancing the ents in both laminar and turbulent flows, applying mass transfer th midifiers using psychrometric charts, considering adiabatic satura dryer length using rate concepts in continuous drying operations. s crystallizers using the population balance model, incorporatir	eir unde leories. tion cu	erstan rves. etics a	ding. and ba	alance
TEXT	г воок	S:					
DEEL	<ol> <li>Treyb</li> <li>G.K.</li> <li>Mass</li> </ol>	al, R.E., "Mass Transfer C Roy, Fundamentals of Hea Transfer: Theory and Prac	Dperations", 3 rd Edition, McGraw-Hill,1981. at and Mass Transfer, Khanna Publishers, Sixth Edition, 2017. ctice. By N. Anantharaman, K. M. Meera Sheriffa Begu, PHI Lean	rning P	vt. Lt	.d., 20	17.
13171° I	1. Couls	on, J.M. and Richardsor	n, J.F., "Chemical Engineering" Vol. I and II.4 th Edition. A	sian F	Books	Pvt.	Ltd.
	India,19	98.					<i></i> ,
	2. Foust	A.S, "Principles of Unit C	Deperations", 2 nd Edition, John Wiley,2008.				
	3. Seade	r J.D & Henley E.J, "Sepa	aration Process Principles", 2 ¹¹⁴ Edition, John Wiley,2006.	neratio	ns"	л th Б	lition
	Prentice	Hall Inc., New Jersey,200	3.	peratio	, יכוו	7 EU	annoll,

5. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7thEdition., McGraw-Hill,2005.

Chairman - BoS **CHE** - HICET



Dean (Academics) HiCET

CO	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO</b> 7	PO8	PO9	PO10	POll	PO12	PSO1	PSO2
CO1	3	3	2	1			1		1				3	
CO2	3	3	3	1			1		1				3	
CO3	3	3	2	1			1		2		1		3	1
CO4	3	3	3	1			1		1				3	
CO5	3	3	2	1			1		2		1		3	1

14730 Chairman - Bos OHE - HICET

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#### • Students will be able to calculations and develop relations to phase equilibrium • To familiarize students with methods used to describe and predict the chemical reaction equilibrium. To acquire knowledge of methods of refrigeration, performance of vapour compression refrigeration system UNIT DESCRIPTION **INSTRUCTIONAL** HOURS Ι **PROPERTIES OF SOLUTIONS** 0 Partial molar properties - ideal and non-ideal solutions - standard states definition and choice - Chemical Potential - fugacity in solution - Henrys law & Dilute solution- activity in solution - Gibbs-Duhem equation - excess properties of mixtures-Π PHASE EOUILIBRIA 9 Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity - application of phase rule - duhem's theorem -Consistency test for VLE data - vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap - effect of temperature and pressure on azeotrope composition - liquid-liquid equilibrium - ternary liquidliquid. Ш **CORRELATION AND PREDICTION OF PHASE EQUILIBRIA** 9 Activity coefficient - composition models - thermodynamic consistency of phase equilibria - application of the correlation and prediction of phase equilibria in systems of engineering interest particularly to distillation and liquid extraction processes. IV **CHEMICAL REACTIONEQUILIBRIA** 9 Reaction Stoichiometry - Standard free energy change and reaction equilibrium constant evaluation of reaction equilibrium constant - effect of temperature on equilibrium constant -Vant Hoff equation- prediction of free energy data - equilibria in chemical reactors calculation of equilibrium compositions for homogeneous chemical reactors thermodynamic analysis of simultaneous reactions. V REFRIGERATION 9 Principles of refrigeration- methods of producing refrigeration, Air refrigeration cycle, Cascade refrigeration system - liquefaction process - Claude and Linde Process - co-efficient of performance - evaluation of the performance of vapour compression and gas refrigeration cycles. **Total Instructional Hours** 45 Upon completion of the course, students can be able to **CO1:** Examine the terminologies such as chemical potential, fugacity, fugacity coefficient, activity

**CHEMICAL ENGINEERING THERMODYNAMICS - II** 

• Enable the students to understand the terminologies such as chemical potential, fugacity,

• To apply equations of state and activity coefficient models to describe VLE.

fugacity coefficient, activity and activity coefficient

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Course Outcom es

**B.Tech** 

Course

Objectives

22CH4202

CO2: Apply the equations of state and activity coefficient models to describe VLE

**CO3:** Illustrate and develop the relations to phase equilibrium and to solve chemical engineering problems

**CO4:** Calculate the equilibrium constants and predict the effects of temperature, pressure, and composition on equilibrium conversion

**CO5:** Understand and solve mass, energy and entropy balances to flow processes

Ros HICE1

and activity coefficient



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CO	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO</b> 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		1	1			2	1	1	1	1	
CO2	3	2	2	1							1		1	1
CO3	3	3	2	2							1		3	
CO4	3	3	2	1	1				1	2	1		3	1
CO5	3	2	1	1	1	1			1	2	2	2	2	1

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Programme	Course Code	Ν	ame of the Course		L	Т	Р	С
B.TECH.	22CH4203	PROCI	ESS HEAT TRANS	SFER	3	0	0	3
	The student	should be able to	0					
Course	1.	Learn various he	at transfer methods	involved in chemica	al process	es.		
Objective	2.	Study the mecha	nism of heat transfe	r in unit operations	such as ev	aporatio	on, dryin	g etc.
·	3.	Apply heat trans	ter concepts in real	industry scenario				
	4. 5	Calculate the var	concept of radiation	and evaporation.	honcore			
Unit	5.	Calculate the val	Description	numbers in neat exc	mangers.		Inctu	national
om			Description				H	ours
I	CONDUCT	ION: Importance	of heat transfer in	Chemical Engineer	ng onerat	ions -		ours
	Modes of he	at transfer – Four	tier's law of heat co	onduction – one din	nensional	steady		
	state heat co	onduction equation	on for flat plate, h	ollow cylinder and	sphere -	- Heat		0
	conduction 1	through a series	of resistances - T	hermal conductivit	y measur	ement;		9
	effect of ten	nperature on ther	mal conductivity; 1	Heat transfer in ext	ended su	faces-		
	Optimum an	d economic thickr	ness of insulation.					
11	CONVECT	ION: Concepts of	of heat transfer by	convection - Nat	ural and	forced		
	convection,	analogies betweer	n transfer of momen	ntum and heat – Rey	nold's ar	alogy,		9
	Prandtl and	Coulburn analog	y. Dimensional ana	lysis in heat transf	er, heat t	ansfer		,
	coefficient fo	or flow through a	pipe, flow past flat	plate, flow through p	acked be	ls.		
III	HEAT TRA	NSFER WITH	PHASE CHANGE	Heat transfer to f	uids with	phase		
	change – ł	neat transfer from	m condensing va	oours, drop wise	and film	wise		
	condensation	n, Derivation of	Nusselt equation	for vertical and h	orizontal	tubes,		9
	condensation	n of superheated w	vapors, Heat transfe	r to boiling liquids	– mechan	ism of		
	boiling, nucl	eate boiling and fi	ilm boiling.				1	
IV	RADIATIO	N : Radiation he	at transfer – Thern	nal radiation – Law	s of radia	tion –		
	Black body	concepts- Emiss	ive power – Radia	tion shape factor –	Grav bo	dies –		
	Radiation sh	ields. EVAPORA	TION: Introduction	– Types of Evapor	ators – Ca	nacity		
	– Steam eco	onomy – Boiling	point elevation (I	Ouhring rule): Mate	rial and	energy		9
	balance of si	ingle effect evapo	rator: Theory of m	ultiple effect evapor	ators: Des	sign of		
	single and m	ultiple effect evap	orators, Vapor reco	mpression method.	,	-8		
V	HEAT EXC	CHANGERS: H	eat exchangers –	Types and practica	l applica	tion –		
	Concept of I	LMTD & Overall	heat transfer coeffi	cient: Effectiveness	– NTU r	nethod		
	for heat exc	hanger design: F	ouling factor and	estimation of Over	all heat t	ansfer		9
	coefficient: S	Special type of he	at exchangers		an nout t	unster		
		opeenar type of net	at entertaingers.	Total Instr	uctional	Hours		45
	CO1	Ability to unders	stand and solve con	duction problems.	actional	livuis		15
C	CO2	Ability to analyz	e and solve probler	ns on convection.				
Outcome	CO3	Ability to apply	analogies and corre	lations to solve indu	strial prol	olems.		
Outcome	CO4	Ability to analyz	e and solve probler	ns on radiation and	Evaporati	on.		
TEVT DOOL	CO5	Ability to design	and analyze the pe	rformance of heat ex	changers	•		
TEXT BOOK	: Binay K Du	tta "Heat Trancfa	r: Principles and Ar	plications" PHI Le	ornina nri	vata lim	ited	
T2	Coulson, J.N	A. and Richardson	. J.F., "Chemical Er	gineering" Vol. I. V	Edition.	Asian B	ooks Pvi	. Ltd.
	India, 2006		,,	.g,,,	,			,
Т3	McCabe, W.	L., Smith, J.C., an	d Harriot, P., "Unit	Operations in Chem	ical Engi	neering'	', XII Ed	lition.,
	McGraw-Hil	11, 2017						
REFERENCI	ES:							
RI DO	Kern, D.Q.,	"Process Heat Tra	nster", McGraw-H	II, 2001				
r∠ R3	Dzisik M N	., fileat fransfer.	A Basic Approach'	w 1111, 2009. ? McGraw-Hill 109	4			
R4	Frank Kreith	n. Rai M Manglik	Principles of Heat	Transfer. 8 th ed Co	engage Le	arning	USA. 20	)16. _A
R5	Analysis of l	heat and mass tran	sfer by Eckercand	Rrake, McGraw-Hil	1		, 20	V
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CO2	3	3	3	1			1		1				3	
CO3	3	3	2	1			1		1		1		3	1
CO4	3	3	3	1			1		1				3	1
CO5	3	3	2	1			1		1		2		3	2

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Programme	<b>Course Code</b>	Name of the Course	T	T	D					
B.Tech	22CH4204	CHEMICAL PROCESS INDUSTRIES	2	-	1 0					
	Identify Ir	dustrial Processes for Sulfur. Sulfuric Acid and Cement	4	U		4				
Course	Explain th	e Ecological Aspects of Nitrogen-Based Fertilizer Production								
Course	Apply Kn	owledge to Optimize Paper Production Methods								
Objectives	Identify C	omponents of Crude Petroleum								
	Explain th	e Applications of Industries in Hydrogen Production								
UNIT		DESCRIPTION		UOI	IDC	y				
	SULFUR, SUI	FURIC ACID AND CEMENT: Sulfur Raw materials Sources Mining and		по	JKS	,				
	Production of	Sulfur – Sulfuric acid Methods of Production of Sulfuric acid Contact								
	process – Cha	mber process. Cement – Properties of Cement – Methods of production		9	)					
	Overall factors	for Cement industry								
	FERTILIZER	AND ELECTROCHEMICAL INDUSTRIES : Major Components of			-					
	Fertilizer Indu	stries –Nitrogen Industries - Ammonia Nitrig agid Urage Dhaghama								
11	Industries - Pl	nosphorus Phosphoric acid Super Dhosphoto Electrochemical Induction		9	)					
	Electrolytic Pro	cess Fuel Cells Arc Process								
	PULP. PAPEI	SUGAR AND STARCH INDUSTRIES: Dulp Methods of Destaution								
	Comparison of	Pulning Processes Paper - Types of Paper Draducts Pay meterials Mathed								
	of Production	Sugar – Methods of Production by Draducts of the Sugar induction of the		9	1					
	Methods of Pro	duction Starch Derivations								
· · · · · · · · · · · · · · · · · · ·	PETROCHEN	IICAL INDUSTRIES: Patroloum Chamical Composition Chariffy the								
	Crude Petrolem	n Petroleum Refinery Products Detroleum Conversion Descusion D								
IV	and Cracking	Reforming Polymerization Isomorization and Alladetica Data 1		9	)					
	Methanol Chlo	ro Methanol Acetulano and Ethylono								
	HYDROGEN	PRODUCTION INDUSTRIES. Eurodementale of Hulener Aller								
V	Technologies	Evaluration of Emerging Technologies Such as Electric L. St. Mathematical								
	Reforming an	d Biomass Conversion for Efficient U.1. D.1.		_						
	Applications of	f Hydrogen in Various Industrias and Implementing 6 for D to 1		9						
	Handling and S	toring Hydrogen								
	Thundring and 5	toring riyulogen								
		I otal Instructional Hours		4	5					
		Y: Explain the Role of Dhoenhome in Eastilling Rev 1. di								
Course Ou	tcomes CC	32. Discuss the Significance of Pay Materials in Parce Production.								
course ou		M: List Common Products Derived from Cruck Detrol								
		5: Illustrate the Applications of Industries in IL down D. 1 with								
CO4: List Common Products Derived from Crude Petroleum. CO5: Illustrate the Applications of Industries in Hydrogen Production.										
CO4: List Common Products Derived from Crude Petroleum. CO5: Illustrate the Applications of Industries in Hydrogen Production. TEXT BOOKS: 1.Dryden's Outline of Chemical Technology by M.Gopala Rao Marshall Sittig										
2 Shreve's Che										
<ol> <li>Shreve's Chemical Process Industries by George T. Austin and Randolph Norris Shreve McGraw-Hill Education</li> <li>Chemical Process Technology and Simulation by S. Pushpavanam.</li> </ol>										
3. Chemical Process Technology and Simulation by S. Pushpavanam. <b>REFERENCE BOOKS:</b> 1. Chemical Technology: Volume 1 by Anil Kumar & M. Gonala Rao										
REFERENCE BOOKS: 1. Chemical Technology: Volume 1 by Anil Kumar & M. Gopala Rao 2. Industrial Chemistry, by B. K. Sharma										
1. Chemical Technology: Volume 1 by Anil Kumar & M. Gopala Rao 2. Industrial Chemistry by B. K. Sharma										
<ol> <li>Chemical Technology: Volume 1 by Anil Kumar &amp; M. Gopala Rao</li> <li>Industrial Chemistry by B. K. Sharma</li> <li>Unit Operations of Chemical Engineering by Warren L. McCabe, Ernest Thiele, Warren L. McCabe</li> </ol>										
4. Chemical En	gineering Design	and Analysis: An Introduction by T. Michael Duncon and Inffrare A. Dutant								

5. Chemical Process Equipment: Selection and Design" by James R. Couper, W. Roy Penney, James R. Fair

PO & PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1			1		1				3		
CO2	3	3	3	1			1	1	1				3		2
CO3	3	3	2	1			1		2		1		3	1	3
CO4	3	3	3	1			1		1	1			3		2
CO5	<u>م</u>	3	2				1		2	1	1		3 /	1	3
Chair Chair CH	man man E -	Board an - HiC	of Stu Bos ET	idies		STOWIN+ AC405	Chair Chair	han NUESE	FNGC 8 TEV		De D	an - Å ean	cademi (Aca HiC	cs Ident ET	lics

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CO1	3	3	2	1			1		1				3	
CO2	3	3	3	1			1		1				3	
CO3	3	3	2	1			1		2		1		3	1
CO4	3	3	3	1			1		1				3	
CO5	3	3	2	1			1		2		1		3	1

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Progi S	ramme/ bem	Course Code	Name of the Course	L	T	Р	C
B.F Ca Obj	C. / IV ourse jective	22EE4205 1. To introd 2. To impar 3. To impar 4. To introd 5. To impar	BASICSOF ELECTRICAL AND ELECTRONICS ENGINEERING (Chemical Engineering) uce the basics of electrical quantities. t knowledge in the basics of AC fundamentals and circuits t knowledge in the Electrical Instrumentation luce the basics of power supply and wiring. t knowledge in the basics of Electrical Machines.	2	0	0	2
Unit			Description			Inst	ructional
I	DC CIR Sources- Circuit –	CUITS-Electrical Electrical Power-E Source Transforma	Quantities-Circuit Components-Types of Electrical Netwo nergy -Ohm's Law - Kirchhoff's Laws - Resistors in Se tion	orks - 1 eries F	Energy Parallel	J	9
II	AC CIR Voltage circuits –	CUITS – Introduce And Current in Re Power – Power fac	ction to AC Circuits- Phasor Representation – Relations sistor - Inductor and Capacitor – Simple AC Series & Pa tor	ship Bo arallel	etween Circuit		9
III	BASIC Operating Ammeter	ELECTRICAL IN g principles - Mo - Moving Iron Amr	NSTRUMENTATION–Introduction - Classification of ving coil - Permanent Magnet (PMMC) Instruments V neters and Voltmeters - Energy meter – Wattmeter.	Instrum oltmet	ents - er and		9
IV	BASICS circuits: 1 application	<b>OF POWER SUP</b> Half wave, Full wav ons Brief discussion	PLY AND ELECTRICAL WIRING Introduction to Power re Rectifier – SMPS, UPS (online & offline). Wiring types a on on concealed conduit wiring. One way and two way cont	er supp nd rol.	ly		9
V	Squirrel phase ind DOL & S	Cage & Slip Ring th duction motors – ty Star Delta Selection	bree phase induction motor (Construction & Working Principes – Capacitor Start & Run – Universal Motor - AC Moon of Motors for Chemical Industries	ples) - otor Sta	Single arters -		9
		At the end of the c	Total Instruct ourse, the learner will be able to	ional ]	Hours		45
Cou Outc	urse come	CO1: Analyze bas CO2:Classify the CO3:Familiarize o CO4:Ability to ana	ic DC electric circuits. AC circuits waveforms and its quantities n fundamentals of electrical measurementation alyze basics of power supply and wiring				

CO5: Understand the operations of Electrical Machines.

### **TEXT BOOKS:**

T1 - D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

T2 - D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010..

T3 - Wayne Tomasi and Neil Storey, A Textbook On Basic Communication and Information Engineering, Pearson, 2010. **REFERENCE BOOKS:** 

R1 - . Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.

R2 - T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education

R3 - A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.





Dean Academics HICET -

Progra B.Te	amme ech	Course Code 22CH4251	N CHEMICAL I	Name of the Course REACTION ENGINEERING - I	L 2	Т 0	Р 2	C 3
		<ul> <li>Impart the knowle and material and e</li> </ul>	edge of calculus, mergy balances to	differential equations, thermodynamics solve reactor design problems.	, gene	ral cł	nemis	try,
Сол	rse	<ul> <li>Simulate several t need</li> </ul>	types of reactors	in order to choose the most appropriate	e react	or for	a gi	ven
Objec	tives	<ul> <li>Examine the prob vield</li> </ul>	lems related to m	ultiple reactions and evaluate the selec	tivity,	react	ivity	and
		• Apply the effect of	of temperature in	reactor design				
		• Analyze the non-	DESCRIPT		INST	RUC	CTIO	NAL
UNII			DESCRIPT			HOI	URS	
I	FUNDA Classifi Design experin Analysi	AMENTAL CONC cation of reactions at equation for constant mental kinetics data, it is of data for Reversible moder)	<b>CEPTS AND</b> t equilibrium, the nt and variable integral and diffe e and Irreversible	<b>DEFINITIONS:</b> Rate equation, cories of reaction rate and prediction; volume batch reactors, analysis of crential analysis. Method of half-life; Reactions Kinetic studies in CSTR		01		
II	CHEM flow re PFRs in reactor	ICAL KINETICS: I actor, recycle reactors a series and parallel, si Kinetic studies CSTI	Design of continu , Equal sized CS ize comparison of <b>R in series</b>	tous reactors - stirred tank and tubular TRs in series and parallel, Equal sized Freactors, Semi batch reactor - Recycle		6+	-3	
III	DESIG - conse and co	N FOR MULTIPLE cutive, parallel and m nversion, selectivity, ad by PFD	<b>REACTIONS:</b> I fixed reactions- f reactivity and	Design of reactors for multiple reactions actors affecting choice, optimum yield yield. <b>Kinetic studies in MFR</b>		6-	+3	
IV	NON-I adiabat rate inj	SOTHERMAL REAGES ic reactors, rates of hout and constant heat so optimum temperature	<b>CTORS:</b> Non-iso eat exchanges for transfer coefficient re progression. <b>E</b>	othermal homogeneous reactor systems, r different reactors, design for constant ent, operation of batch and continuous ffect of temperature on reaction		6+	+3	-
	rate c	onstant and conve	rsion					
V	NON perform Relatio	<b>IDEAL REACTOR</b> nance; residence time nship between C, E an pal reactors <b>RTD Stu</b>	S: The residence functions and d F curves basic n dies in MFR	ce time distribution as a factor of relationship between them in reactor; nodels for non-ideal flow; conversion in		6-	+3	
	11011-100			<b>Total Instructional Hours</b>		30-	+15	
Cour: Outcor	se n mes C C	<b>pon completion of the</b> O1- Understand the co O2- Evaluate the choic multiple reaction O3- Analyze the desig O4- Determine the non O5- Estimate the conc	e course, student oncept of rate equice of right reactor gn and working o n-isothermal effect ept of RTD in and	s can be able to nation and batch reactors. among single, multiple, recycle reactor f multiple reactors. ct on reactors. alyzing reactor performances.	, etc. v	vith o	or wit	hout
TEXT	BOOKS	:	(to Fusta anima)	Wiley Foston Ltd. II Edition 2000				
1. 2. 3. <b>REFER</b>	Fogler Scott I	H.S., Elements of Che Fogler, H., "Elements of S BOOKS:	mical Reaction E of Chemical React	ngineering, 5th ed., Prentice Hall India lition Engineering", 4th Edition, Prentice	Pvt. Lt Hall o	d., In f Indi	dia, 2 a.200	016 )9
1.	Fromer	tt. G.F. & K.B.Bischoff	, "Chemical React	tor Analysis and Design", John Wiley and	d Sons	, 1979	€.	
2.	Smith .	J.M., Chemical Engine	ering Kinetics, 8t	h ed., McGraw-Hill, USA, 2008 al Repotions, Second Edition, Oxford Un	ivercit	v		
3.	Lanny	D. Schmidth The Engin	neering of Chemic	al reactions, second Edition, Oxford On	aver sit	7		
	Press	,2005 Doraiswamy, DenizUne	r, Chemical React	ion Engineering Beyond the fundamental	s, CRC	Pres	s ,201	14



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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1						1	1			3	3
CO2	3	3	3	1					1	1			2	3
CO3	2	3	2	1					1	1				3
CO4	2	2	3	1					2	1			2	2
CO5	3	2	2	1					2	1				3

140.00 Chairman - BoS OHE - HICET

Dean (Academics)



Progran	nme Course Code	Name of the Course	L	Т	Р	С
B.Tec	h 22CH4001	HEAT TRANSFER LAB	0	0	3	2
Cours Objecti	• To enable the students t transfer equipment.	o develop a sound working knowledge on differen	t types c	of hea	at	
<b>S.No.</b> 1.	Heat Transfer in Agitated Vesse	<b>DESCRIPTION</b> el and Helical Coil				
2.	Heat transfer through natural con	nvection				
3.	Heat transfer through forced con	nvection				
4.	Heat transfer in a shell and tube	heat exchanger				
5.	Heat transfer in a double pipe he	eat exchanger				
6.	Heat transfer in a bare and finne	d tube heat exchanger				
7.	Heat transfer in helical coils					
8.	Heat transfer through packed be	d				
9.	Heat transfer in agitated vessels					
10.	Heat transfer in a Vertical Conde	enser				
11.	Heat transfer in a Horizontal Co	ndenser				
12.	Heat transfer in Open Pan Evapo	orator				
13.	Stefan Boltzmann experiment					
14.	Emissivity measurement					
		Total Instructional Hours	5	4	5	

#### Upon completion of the course, students can be able to

• Apply the concepts of heat transfer and fluid dynamics to the operation of heat transfer equipment's

Course Outcomes

- Estimate the heat transfer rate and heat transfer co-efficient
- Evaluate the performance/calculate the parameters in heat transfer equipments.
- Understand the applications of heat transfer equipment in various operating process plants.
- Evaluate the performance/calculate the parameters in heat transfer equipments.

### **REFERENCE BOOKS:**

- 1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.
- 2. Holman, J. P., 'Heat Transfer', 8th Edn., Tata McGraw Hill, 1997.
- 3. Y.A. Cengel and A.J. Ghajar. Heat and Mass Transfer: Fundamentals and Applications. McGraw-Hill, 4/e, 2011.
- 4. Bergman, Theodore L., Adrienne S. Lavine, Frank P. Incropera, et al. *Introduction to Heat Transfer*. Wiley, 2011
- 5. Lienhard, John H., and John H. Lienhard. A Heat Transfer Textbook. Dover Publications, 2011





cademics) Dean HiCET -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1				1	2		1	3	1
CO2	3	2	2	3	1	2			2	3			3	1
CO3	3	3	3	3	1				2				3	2
CO4	3	3	3	2		2			2	2		1	3	2
CO5	3	3	2	1					1				3	1

11730 Chairman - BoS OHE - HICET

Dean (Academics)



Programme	Course Code	Course Title	L	т	Ρ	С
<b>BE/BTECH</b>	<b>22HE4071</b>	Soft Skills and Aptitude III	0	0	0	1
Course Objectives:	<ol> <li>Solve Logical Reasoning</li> <li>Solve Quantitative Apti</li> <li>Solve Verbal Ability que</li> <li>Display good writing sk</li> </ol>	g questions of easy to intermediate level tude questions of easy to intermediate level estions of easy to intermediate level ills while dealing with essays				
Unit		Description	Ins	struct Hou	iona rs	1 -

#### **Logical Reasoning**

Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency - Syllogism

#### **Quantitative Aptitude**

Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages - Time, Speed and Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, Problems based on races - Profit and loss, Partnerships and averages: Basic terminologies in profit and loss -Partnership - Averages - Weighted average Permutation, Combination: Fundamental Counting Principle, Permutation and Combination, Computation of Permutation, Circular Permutations, Computation of Combination - Probability

#### **Verbal Ability**

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Sentence Correction: Subject-Verb Agreement, Modifiers, Parallelism, Pronoun-Antecedent Agreement, Verb Time Sequences, Comparisons, - Sentence Completion and Para-jumbles-Critical Reasoning: Argument – Identifying the Different Parts (Premise, assumption, conclusion), Strengthening statement, Weakening statement, Mimic the pattern

#### **Recruitment Essentials**

Cracking interviews - demonstration through a few mocks - Sample mock interviews to demonstrate how to crack the: HR interview, MR interview, Technical interview - Cracking other kinds of interviews: Skype/ Telephonic interviews, Panel interviews, Stress interviews - Resume building – workshop: A workshop to make students write an accurate resume- Essay Writing

#### **Total Instructional Hours**

CO1: Students will avoid the various fallacies that can arise through the misuse of logic.

- CO2: Students would opt for alternate methods to solve the problems rather than conventional methods.
- Course Outcome:
- CO3: Students will heighten their awareness of correct usage of English grammar in writing and speaking
- CO4: Students will be concise and clear, using professional language for placements.

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Hindusthan College of Engineering and Technology Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC (An Autonomous Institution, Affiliated to Anna University, Chennai) Coimbatore – 641 032



# DEPARTMENT OF CHEMICAL ENGINEERING REGULATION-2022 B.TECH. CHEMICAL ENGINEERING

# I TO VIII SEMESTERS CURRICULUM

S.No.	Course Code	Course Title	Category		T	P	C	TCP	CIA	LESE	TOTAL
		SEMEST	ERI								
Theo	ry										
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
2.	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100
Theo	ry with Lab Cor	nponent									
3.	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
4.	22PH1151	Physics of Materials	BSC	2	0	2	3	4	50	50	100
5.	22IT1151	Python Programming and Practices	ESC	2	0	2	3	4	50	50	100
EEC	Courses (SE/AF	E)							-		
6.	22HE1071	Universal Human Values	AEC	2	0	0	2	2	40	60	100
7.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	. 0	1	1	100	0	100
Man	datory Courses										
8.	22MC1091/		мс	2	0	0	0	. 2	0	0	0
	22MC1092		MIC	Ľ	Ŭ	Ŭ	Ŭ	2	Ŭ	ļ	
			TOTAL	15	5	6	19	27	370	330	700
S.No.	Course Code	Course Title	Category	L	<b>T</b>	P	С	ТСР	CIA	ESE	TOTAL
		SEMEST	ER II								
1	22MA2104	Fourier Analysis and Laplace	BSC	3	1	0	4	4	40	60	100
• •		Transforms						1.1			1.11
2	22PH2101	Basics of Material Science	BSC	2	0	0	2	2	40	60	100
3	22CY2101	Environmental Studies	ESC	2	0	0	2	2	40	60	100
4	22CH2201	Introduction to Chemical	PCC	3	0	0	3	3	40	60	100
		Engineering						•			-
Theo	ry with Lab Co	mponent									
5	22CY2151	Chemistry for Engineers	BSC	2	0	2	3	4	50	50	100
6	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
Prac	tical										
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AI	E)									
8.	22HE2071	Design Thinking	AEC	1	0	2	2	3	100	0	100
9.	22HE2072	Soft Skills and Aptitude-I	SEC	1	0	0	1	1	100	0	100
Man	datory Courses										
10.	22MC2093	NCC */NSS / YRC / Sports / Clubs	MC	A	All s	tud	ents	s shall e	enroll, c	m admi	ssion, in
		/ Society Service -			any	one	of	the per	sonality	/ and ch	aracter
		Enrollment	1		dev	eloj	ome	ent prog	gramme	s and u	ndergo
L						tr	aini	ing for	about 1	<u>00 hou</u>	rs
11.	22MC2091/	Heritage of	MC	2	0	0	0	2	0	0	0
	22MC2092	lamil									
		·	TOTAL	18	1	10	22	29	520	380	900
<u>5.No.</u>	Course Code	Course Title	Category		T	P	C	TCP	CIA	ESE	TOTAL
		SEMESTE	ER III								
Theo	ry							r	i		
1.	22MA3107	Numerical Methods	BSC	3	1	0	4	4	40	60	100
2.	22CH3201	Chemical Process Calculations	PCC	3	1	0	4	3	40	60	100

3.	22CH3202	Fluid Flow Operations	PCC	3	0	0	3	3	40	60	100
4.	22CH3203	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
		Thermodynamics – I									
Theory with Lab Component											
5.	22CH3251	Mechanical Operations	PCC	2	0	2	3	4	50	50	100
6.	22ME3253	Basic Mechanical Engineering	ESC	2	0	2	3	4	50	50	100
Practical											
7.	22CH3001	Fluid Flow Operations Lab	AEC	0	0	4	2	4	60	40	100
8.	22CH3002	Technical Analysis Lab	PCC	0	0	4	2	4	60	40	100
EEC Courses (SE/AE)											
9.	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100
Mand	atory Course			1.5		`					<b>.</b>
10	22MC3091	Essence of Indian Traditional	AC	2	0	0	0	2	100	0	100
	· · ·	Knowledge									
	. ·		TOTAL	17	2	12	25	30	480	420	900
S.No.	<b>Course Code</b>	Course Title	Category	L	Т	Р	С	ТСР	CIA	ESE	TOTAL
		SEMESTE		Į							
Theory											
1.	22HE4101	IPR and Start-ups(Common)	HSC	2	0	0	2	2	40	60	100
2.	22CH4201	Mass Transfer Operations - I	PCC	3	0	0	3	3	40	60	100
3.	22CH4202	Chemical Engineering	PCC	3	0	0	3	3	40	60	100
5.		Thermodynamics – II			Ŭ	Ů	Ū				
4	22CH4203	Process Heat Transfer	PCC	3	0	0	3	3	40	60	100
5	22CH4204	Chemical Process Industries	PCC	2	0	0	2	2	40	60	100
$\begin{array}{c c c c c c c c c c c c c c c c c c c $											
6	22EE4251	Basics of Electrical & Electronics	FSC	1	0	2	2	3	50	50	100
0.		Engineering	LbC			2	2	5			100
7	22CH4251	Chemical Reaction Engineering - I	PCC	2	0	2	3	4	50	50	100
8	220114251 22MA4151	Probability and statistics with R	BSC	$\frac{2}{2}$	0	2	3	4	50	50	100
0.	2201111111	nrogramming		2	v	2	5	т	50	50	100
0	22014001	Heat Transfer I ab	PCC	0	0	4	2	4	60	40	100
FFC	Courses (SF/AF			<u> </u>	0		2				100
10	22HE4071	Soft Skills -3(Common)	SEC3	1	0	0	1	1	100		100
Mand	atory Courses				0	0	1	1	100		100
11	22MC4001	Indian Constitution		2	0	0	0	2	100		100
	2210104091	Indian Constitution	TOTAL	21	0	10	24	21	510	400	100
E No	Course Code	Course Title	Cotogomy	<u>21</u> T	T	D	24	TCP		FSF	TOTAL
<b>D.1NO.</b>	Course Coue	Course The	TCategory		I	r		ICF		LOL	IUIAL
Theor		SEMIES I I					.,				
1 neor	22045201	Mass Transfor Operations II	DCC	2	0	0	2	2	10	60	100
1.	22CH5201	Process Instrumentation Demonster		2	0	0	2	3	40	60	100
2.	22CH5202	and Control	PCC	3	0	0	3	3	40	00	100
2	220115222	Drefereienel Fleeting 1	DEC	-	-		2	2	10		100
3.	22CH53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4.	22CH53XX	Professional Elective-2	PEC	3	0	0	3	. 3	40	60	100
5.	22CH53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
Theor	y with Lab Cor	mponent		1 -		-				T	
6.	22CH5251	Chemical Reaction Engineering - II	PCC	2	0	2	3	4	50	50	100
Practical											
7.	22CH5001	Mass Transfer Operations Lab	PCC	0	0	4	2	4	60	40	100
EEC	Courses (SE/AF	E)									
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
		7	TOTAL	17	1	6	21	24	410	390	800
				ŀ.	1						
									1	1	

S.No.	<b>Course Code</b>	Course Title	Category	L	T	Р	С	ТСР	CIA	ESE	TOTAL
		SEMESTE	R VI			-					
Theo	rv										
1.	22CH6201	Transport Phenomena	PCC	3	0	0	3	3	40	60	100
2.	22CH6202	Instrumental Method of Analysis	PCC	3	0	0	3	3	40	60	100
3.	22HE6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
4.	22CH63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
5.	22CH63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
Practical											
7.	22CH6001	Process Control Lab	PCC	0	0	4	2	4	60	40	100
8.	22CH6002	Computational Chemical	PCC	0	0	4	2	4	60	40	100
		Engineering Lab									
EEC Courses (SE/AE)											
9.	22HE6071	Soft Skills – 5(Common)	SEC	2	0	0	2	2	100	0	100
			TOTAL	20	0	8	24	28	460	440	900
											1
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
		SEMESTE	R VII								
		Theor	у								
1.	22CH7201	Process Economics and Engineering	PCC	3	0	0	3	3	40	60	100
2	22017202	Process Equipment Design	PCC	3	1	0	4	4	40	60	100
2.	22CH7202	Bio Chemical Engineering	PCC	3	0	0	3	3	40	60	100
<u> </u>	22CH73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
<del>.</del> 5	22XX74XX	Open Elective $-2^*$	OFC	3	0	0	3	3	40	60	100
Draci	tical	Open Elective 2		<u> </u>		v			10	1 00	100
6	22017001	Design and Simulation Lab	PCC	0	0	4	2	4	60	40	100
	22011/001	EEC Courses	(SE/AE)	l •			7	•		1 10	100
7	22CH7701	Internship	SEC.	-	-	-	2	2	100	0	100
/. 	22011/101	Internetity	TOTAL	15	1	4	20	22	360	340	700
* - F(	our weeks interns	hip carries 2 credit and it will be done i	n before Se	eme	ster	VI	sur	nmer v	acation	/nlacem	ent
traini	ng and same will	be evaluated in Semester VII.			500	• •	Jui		acation	, placen	lont
S.No.	Course Code	Course Title	Category	L	Т	Р	Ċ	ТСР	CIA	ESE	TOTAL
	Course cours	SEMESTEI	R VIII			-	<u> </u>			1	
EEC	Courses (SE/AF	(5)									
1	22CH8901	Project Work/Granted	SEC	0	0	20	10		100	0	100
		Patent(Common)									
		1	TOTAL	0	0	20	10	20	100	0	100
* 1	As per the Al	CTE guideline, in Semester I, II, III &	LIV NCC	one	cre	dit	sub	ject is	added	as Valu	e Added
	Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing										Air Wing
	are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per										
	the regulation.										
2.	NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate										
	semester. Fu	semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to									
1	undergo NCC	undergo NCC Open Elective Subjects.									
3.	The above-m	entioned NCC Courses will be offered	to theStuc	ient	s w	ho	are	going t	to be	e admitt	ed in the
Academic Year 2021 – 22.											
				B.E. / B.T	ECH.PR	OGRAM	MES		1. A.		
-------	--------	-----	----	------------	-----------	-----------	-----	-----	-------------------------------------------	--------------	
S.No.	Course				Credits p	er Semest	er			TotalCredits	
	Area	Ι	II	III	IV	V	VI	VII	VIII		
1	HSC	3	3	-	2	-	3		-	11	
2	BSC	7	9	4	3		-	-	-	23	
3	ESC	6	4	3	2	-	-	-	-	15	
4	PCC	-	3	15	16	11	10	12	-	67	
5	PEC	· _	-	-	-	9	6	3	-	18	
6	OEC	-	-		- 1	- '''	3	3	· _	6	
7	EEC	3	3	3	1	1	2	2	10	25	
8	MC	1	1								
	Total	19	22	25	24	21	24	20	10	165	

# SEMESTER WISE CREDIT DISTRIBUTION

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES) To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits
	Code	Course Title		L	Т	Р	Contact	
							Periods	
1	22AI6451	Artificial Intelligence and Machine	OEC	2	0	2	4	3
		Learning Fundamentals						-
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
. 3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

#### OPENELECTIVE I AND II To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. COURSE NO CODE		COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT	CREDITS	
NO.	CODE			L	Т	Р	PERIODS		
1	22AE6401	Space Science	OEC	3	0	0	3	3	
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3	
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3	
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3	
5 .	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3	

6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	• 0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	. 3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Bio refinery	OEC	3	0	0	3 .	3

Note:Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III (Offered by Chemical Engineering) Students shall choose any one of the open elective courses such that the course content or title not belongs to their own programme.

SL. NO	. Course		Category	Perio	ds Per	week	Total	Credits
	Code	Course Title		L	Т	P	Contact	
							Periods	
1	22CH7401	Waste to Energy Conversion	OEC	3	0	0	3	3
		OPENELECTI	VE IV				· · · ·	
SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits
	Code	<b>Course Title</b>		L	Т	Р	Contact	•
			1. A.				Periods	
1	22LS7401	General studies for competitive	OEC	3	0	0	3	3
		examinations						
2	22LS7402	Human Rights, Women Rights and	OEC	3	0	0	3	3
*		Gender equity			/			
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and	050	3	0	-0	3	3
		management	UEC					
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3.	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS												
Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI							
Petroleum	Energy	Biochemical	Environmental	Computation	<b>Chemical Plant</b>							
Process	Engineering	Engineering	and Safety	al Chemical	Design							
Technology			Engineering	Engineering								
Petroleum												
Chemistry and Refining	Bioenergy	Biochemistry	Membrane	Computational	Chemical Plant							
Fundamentals			Separation Process	Techniques	Design							
Primary	RenewableEnergy	Bioprocess	Waste Water	Optimization of								
RefiningTechnology	Resources	Technology	Treatment	Chemical	Plant Layout							
				Processes	· · · · · ·							
Secondary Refining	Pinch Technology	Fermentation &	Solid waste	Process								
Technology		Bioprocessing	Management	Modeling and	Design Safety							
				Simulation								
Refinery	Hydrogen and	Bio separation	Environmental	Pinch Analysis								
Advancements and	Fuel Cell	& Downstream	Impact Assessment	and Heat	Material Selection							
Environmental	Technology	Processing		Exchange								
Regulations	Э			Network Design								
Petroleum Equipment		Enzyme	Process Safety	Chemical	Statutory							
Design	Power Plant	Immobilisation	Management	Process	Requirements&Cus							
	Engineering	Technology		Flowsheeting	tomer Care							
Petrochemical	Non-Renewable	Bioreactor	Risk and HAZOP	Computational	Process Plant							
Technology	Energy	Design	Analysis	Fluid Dynamics	Utilities							
	Sources											
Note: Students are per	mitted to choose all	<b>Professional Ele</b>	ectives from a particu	lar vertical	•.							

## PROFESSIONAL ELECTIVE COURSES: VERTICALS

	DE	TAILS OF VERTICAL I :PETROL	EUM PRO	C	ESS	TI	ECH	INOLO	DGY		
S.No.	<b>Course Code</b>	Course Title	Category	L	Т	P	C	TCP	CIA	ESE	TOTAL
1.	22CH5301	Petroleum Chemistry and Refining Fundamentals	PEC	3	0	0	3	3	40	60	100
2.	22CH5302	Primary Refining Technology	PEC	3	0	0	3	3	40	60	100
3.	22CH5303	Secondary Refining Technology	PEC	3	0	0	3	3	40	60	100
4.	22CH5310	Refinery Advancements and Environmental Regulations	PEC	3	0	0	3	3	40	60	100
5.	22CH5311	Petroleum Equipment Design	PEC	3	0	0	3	3	40	60	100
6.	22CH5312	Petrochemical Technology	PEC	3	0	0	3	3	40	60	100

	DETAILS OF VERTICAL II :ENERGY ENGINEERINGNo.Course CodeCourse TitleCategoryLTPCTCPCIAESETOTAL.22CH5304BioenergyPEC300334060100.22CH5305Renewable Energy ResourcesPEC300334060100.22CH5306Pinch TechnologyPEC300334060100.22CH5313Hydrogen And Fuel Cell TechnologyPEC300334060100										
S.No.	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22CH5304	Bioenergy	PEC	3	0	0	3	3	40	60	100
2.	22CH5305	Renewable Energy Resources	PEC	3	0	0	3	3	40	60	100
3.	22CH5306	Pinch Technology	PEC	3	0	0	3	3	40	60	100
4.	22CH5313	Hydrogen And Fuel Cell	PEC	3	0	0	3	3	40	60	100
		Technology									
5.	22CH5314	Power Plant Engineering	PEC	3	0	0	3	3	40	60	100
6.	22CH5315	Non-Renewable Energy Sources	PEC	3	0	0	3	3	40	60	100

		<b>DETAILS OF VERTICAL III :BIO</b>	CHEMIC	AL	EN	<b>IGI</b>	NE	ERING	3		
S.No.	<b>Course Code</b>	Course Title	Category	L	Τ	P	C	TCP	CIA	ESE	TOTAL
1.	22CH5307	Biochemistry	PEC	3	.0	0	3	3	40	60	100
2.	22CH5308	Bioprocess Technology	PEC	3	0	0	3	3	40	60	100
3.	22CH5309	Fermentation & Bioprocessing	PEC	3	0	0	3	3	40	60	100
4.	22CH5316	Bio separation & Downstream	PEC	3	0	0	3	3	40	60	100
		Processing									
5.	22CH5317	Enzyme Immobilization	PEC	3	0	0	3	3	40	60	100
		Technology									
6.	22CH5318	Bioreactor Design	PEC	3	0	0	3	3	40	60	100

	DETAIL	S OF VERTICAL IV: ENVIORNMI	ENTAL A	ND	SA	FE	ΤY	ENGI	NEER	ING	
S.No.	<b>Course Code</b>	Course Title	Category	L	T	P	C	TCP	CIA	ESE	TOTAL
1.	22CH6301	Membrane Separation Process	PEC	3	0	0	3	3	40	60	100
2.	22CH6302	Waste Water Treatment	PEC	3	0	0	3	3	40	60	100
3.	22CH6303	Solid waste Management	PEC	3	0	0	3	3	40	60	100
4.	22CH6304	Environmental Impact Assessment	PEC	3	0	0	3	3	40	60	100
5.	22CH6305	Process Safety Management	PEC	3	0	0	3	3	40	60	100
6.	22CH6306	Risk and HAZOP Analysis	PEC	3	0	0	3	3	40	60	100

	Ι	DETAILS OF VERTICAL V: COMP	UTATIO	NA	LE	ENC	GIN	EERI	NG		*
S.No.	<b>Course Code</b>	Course Title	Category	L	Т	P	C	TCP	CIA	ESE	TOTAL
1.	22CH6307	Computational Techniques	PEC	3	0	0	3	3	40	60	100
2.	22CH6308	Optimization of Chemical Processes	PEC	3	0	0	3	3	40	60	100
3.	22CH6309	Process Modeling and Simulation	PEC	3	0	0	3	3	40	60	100
4.	22CH6310	Pinch Analysis and Heat Exchange Network Design	PEC	3	0	0	3	3	40	60	100
5.	22CH6311	Chemical Process Flow sheeting	PEC	3	0	0	3	3	40	60	100
6.	22CH6312	Computational Fluid Dynamics	PEC	3	0	0	3	3	40	60	100

	D	<b>ETAILS OF VERTICAL VI :COMI</b>	PUTATIO	NA	<b>L</b> ]	EN	GIN	EERI	NG		
S.No.	<b>Course Code</b>	Course Title	Category	L	Т	P	C	TCP	CIA	ESE	TOTAL
1.	22CH7301	Chemical Plant Design	PEC	3	0	0	3	3	40	60	100
2.	22CH7302	Plant Layout	PEC	3	0	0	3	3	40	60	100
3.	22CH7303	Design Safety	PEC	3	0	0	3	3	40	60	100
4.	22CH7304	Material Selection	PEC	3	0	0	3	3	40	60	100
5.	22CH7305	Statutory Requirements & Customer Care	PEC	3	0	0	3	3	40	60	100
6.	22CH7306	Process Plant Utilities	PEC	3	0	0	3	3	40	60	100

# Enrolment for B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation.

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student

shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

#### (i) B.E. / B.Tech. Honours (specialisation in the same discipline):

a. The student should have earned additionally a minimum of 18 credits from a vertical of the same programme.

b. Should have passed all the courses in the first attempt.

c. Should have earned a minimum CGPA of 7.50.

#### (ii) B.E. / B.Tech. Honours:

a. The students should have earned additional courses (minimum of 18 credits) from more than one vertical of the same programme.

b. Should have passed all the courses in the first attempt.

c. Should have earned a minimum CGPA of 7.50.

#### (iii) B.E. / B.Tech. (Minor in other specialisation):

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E. / B.Tech. programmes or from any one of the following verticals

VERTICAL I: FINTECH AND BLOCK CHAIN

VERTICAL II: ENTREPRENEURSHIP

VERTICAL III: ENVIRONMENT AND SUSTAINABILITY

- Students can earn maximum of 6 credits in online mode (SWAYAM platform), out of these 18 credits as approved by Centre for Academic Courses.
- B.E. / B. Tech. (Honours) Specialisation in the same discipline, B.E / B.Tech. Honours and B.E. / B.Tech. Minor in other specialisation degree will be optional for students.
- For the categories (i) to (ii), the students will be permitted to register the courses from V Semester onwards provided the marks earned by the students until III semester should be of CGPA 7.50 and above and cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining

courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

- If a student decides not to opt for Minor, after completing certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- The Head of Department, shall forward the proposal to the Controller of Examinations after getting the approval from Head of the Institution / Dean Academics, before the commencement of the fifth semester of the programme for the students undergo optionally B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation

## VERTICALS FOR MINOR DEGREE CHEMICAL ENGINEERING OFFERING MINOR DEGREE

SL. NO.	Course		Category	Perio	ds Per	week	Total	Credits
	Code	Course Title		L	•• <b>T</b>	P	Contact Periods	
1	22CH5471	Introduction to Chemical Process	MDC	3	0	0	3	3
2	22CH6471	Fluid Flow Operations in Chemical Engineering	MDC	3	0	0	3	3
3	22CH6472	Fundamentals of Chemical Thermodynamics	MDC	3	0	0	3	3
4	22CH7471	Process Heat and Mass Transfer	MDC	3	1	0	4	4
5	22CH7472	Reaction Engineering	MDC	3	0	0	3	3
6	22CH8471	Unit Operations and Process Laboratory	MDC	0	0	4	4	2

#### Minor Specialization in Chemical Process Engineering

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

		VERTICAL I: FINTEC	H AND BL	OCK CHA	IN		·	
S	Course			Periods I	Per w	eek	Total	
No	Code	Course Title	Category	L	T	P	Contact Periods	Credits
1	22MB5231	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Block chain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

		VERTICAL II: ENT	REPRENEU	JRSH	IP			
S	Course	Course Title	Category	Periods Per week			Total Contact	Credits
No	Code		0.1	L	Т	P	Periods	Credits 3 3 3 3 2
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5 .	22MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

		VERTICAL III: ENVIE	RONMENT A	ND S	UST	AINAB	BILITY	
S No	Course	Course Title	Category	Per wee	iods F k	Per	Total Contact	Credits
	Code			L	T	P	Periods	
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	. 3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

# VERTICALS FOR B Tech (Hons) and B Tech (Hons) in Chemical Engineering with Specialization

	· · · · · · · · · · · · · · · · · · ·		• · · · · · · · · · · · · · · · · · · ·
Vertical I Computer Aided Process Engineering	Vertical II Polymer Technology	Vertical III Petroleum Engineering	Vertical IV ANALYTICAL INSTRUMENTATION
Process Flow Sheeting	Polymer Chemistry	Petroleum Geology	Principles of Mass Spectrometry
Transport Phenomena	Processing Technology	Petroleum Exploration	Advanced Analytical Separation Techniques
Advanced Process Optimization	Rubber Technology	Drilling Technology	Advanced Spectrometry: ICP- MS and LC-MS
Artificial Intelligence in Process Engineering	Polymer Product Design, Blends, and Alloys	Petroleum Production Engineering	Instruments for Morphology and Structural Characterization
Digital Twin and Soft Computing in Process Modelling	Polymer Structure and property relationships	Petroleum Reservoir Engineering	Statistical Analysis and Data Processing (Lab)
Advanced Process Modelling and Simulation	Polymer Compounding Technology	Offshore Engineering	Troubleshooting Analytical Methods and Instruments

S No	Course	Course Title	Category	Peri wee	ods P k	er	Total Contact	Credits
	Code			L	T	Р	Periods	
1	22CH5371	Process Flow Sheeting	MDC	2	0	2	4	3
2	22CH6371	Transport Phenomena	MDC	3	1	0	3	4
3	22CH6372	Advanced Process Optimization	MDC	2	0	2	4	3
4	22CH7371	Artificial Intelligence in Process Engineering	MDC	2	0	2	4	3
5	22CH7372	Digital Twin and Soft Computing in Process Modelling	MDC	2.	0	2	4	3
6 .	22CH8371	Advanced Process Modelling and Simulation	MDC	0	0	4	4	2

B Tech (Hons) Chemical Engineering with Specialization in Computer Aided Process Engineering

# B Tech (Hons) Chemical Engineering with Specialization in Polymer Technology

S No	Course	Course Title	Category	Peri wee	i <mark>ods F</mark> k	Per	Total Contact	Credits
	Code			L	T	P	Periods	
1	22CH5372	Polymer Chemistry	MDC	3	0	0	3	3
2	22CH6373	Processing Technology	MDC	3	0	0	3	3
3	22CH6374	Rubber Technology	MDC	3	0	0	3	3
4	22CH7373	Polymer Product Design, Blends, and Alloys	MDC	3	0	0	3	3
5	22CH7374	Polymer Structure and property relationships	MDC	3	0	0	3	3
6	22CH8372	Polymer Compounding Technology	MDC	3	0	0	3	3

### B Tech (Hons) Chemical Engineering with Specialization in Petroleum Engineering

S No	Course	e Course Title		Peri wee	iods F k	er	Total Contact	Credits
	Code			L	T	P	Periods	· · ·
1	22CH5373	Petroleum Geology	MDC	3	0	0	3	3
2.	22CH6375	Petroleum Exploration	MDC	3	0	0	3	3
3	22CH6376	Drilling Technology	MDC	3	0	0	3	3
4 :	22CH7375	Petroleum Production Engineering	MDC	3	0	0	3	3
5	22CH7376	Petroleum Reservoir Engineering	MDC	3	0	0	3	3
6	22CH8373	Offshore Engineering	MDC	3	0	0	3	3

# B Tech (Hons) Chemical Engineering with Specialization in ANALYTICAL INSTRUMENTATION

S No	Course	Course Title	Cotogory	Periods Per	Total	Cradita
	Code		Category	week	Contact	Creuits

			I .	L	Т	P	Periods	
1	22CH5374	Principles of Mass Spectrometry	MDC	3	0	0	3	3
2	22CH6377	Advanced Analytical Separation Techniques	MDC	3	0	0	3	3
3	22CH6378	Advanced Spectrometry: ICP-MS and LC-MS	MDC	3	0	0	3	4
4	22CH7377	Instruments for Morphology and Structural Characterization	MDC	3	0	0	3	3
5	22CH7378	Statistical Analysis and Data Processing (Lab)	MDC	3	0	0	4	2
6	22CH8374	Troubleshooting Analytical Methods and Instruments	MDC	3	0	0	3	3

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in

PRINCIPAL Hindusthan College Of Engineering & Technology COIMBATORE - 641 032.



Programme	Course Code	Name of the Course	L	Т	Р	С						
B.TECH.	22CH5201	MASS TRANSFER OPERATIONS- II	3	0	0	3						
	The student	should be able to	C (	c :.1								
Course	1.	Examine the physical and thermodynamic principles these principles affect the design of equipment and re- capacity	esult in specifi	ic requiren	an empha nents for	quality and						
Objective	2.	Illustrate the process aspects and equipment used in and leaching.	the operation	s like ion	exchange	e, extraction						
	3.	Analyze the separation of chemical components in dis	tillation colum	ins and ads	sorbers.							
Unit		Description			Insti F	ructional Iours						
Ι	ABSORPTIC gas-liquid rate efficiency, to height of pack	<b>ON:</b> Gas Absorption and Stripping – Equilibrium; ma tio; tray tower absorber - calculation of number of over diameter; packed tower absorber – rate based appr king using HTU and NTU calculations.	tterial balance; theoretical sta roach; determi	; limiting ges, tray nation of		9						
Π	<ul> <li>DISTILLATION: Vapour liquid equilibria - Raoult's law, vapor-liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Introduction to multi-component distillation, azeotropic and extractive distillation.</li> <li>LIQUID-LIQUID EXTRACTION: Liquid - liquid extraction - solvent characteristics-equilibrium stage wise contact calculations for batch and continuous extractors- differential contact equipment-spray, packed and mechanically agitated contactors and their design calculations-packed bed extraction with reflux. Pulsed extractors, centrifugal extractors-Supercritical extraction</li> </ul>											
Ш												
IV	Supercritical extraction.         LEACHING: Solid-liquid equilibria- leaching equipment for batch and continuous operations- calculation of number of stages - Leaching - Leaching by percolation through stationary solid beds, moving bed leaching, counter current multiple contact (shank's system), equipments for leaching operation, multi stage continuous cross current and counter current leaching stage calculations stage efficiency.											
V	ADSORPTIO Adsorption - pressure and operations, st curves. Princ concept of os	ON AND ION EXCHANGE & MEMBRANE SEPA Types of adsorption, nature of adsorbents, adsorption temperature on adsorption isotherms, Adsorption of teady state moving bed and unsteady state fixed bed ad iple of Ion exchange, techniques and applications. Solid mosis; reverse osmosis; electro dialysis; ultrafiltration.	ARATION PR on equilibria, perations - st dsorbers, breal and liquid me	effect of age wise k through embranes;		9						
		Tot	al Instruction	al Hours		45						
	CO1	Evaluate the theoretical stages, number of transfer uni absorption process	ts and height r	equiremen	ts for a ga	15						
~	CO2	Apply the number of trays for stage wise contact and o	determine the l	neight of th	ne packed	tower.						
Course Outcome	CO3	Illustrate the equilibrium stages and understand the wo	orking of extra	ctor.								
	CO4	Evaluate the number of stages and the working of lead	ching equipment	nt.								
	CO5	Understand the concept of adsorption, ion exchange &	k membrane se	paration p	rocesses.							
<b>TEXT BOOK:</b> T1 T2	Treybal, R.E. Geankoplis, G	., "Mass Transfer Operations ", 3rd Edn., McGraw-Hill, C.J., "Transport Processes and Unit Operations", 4th Edit	1981. tion, Prentice I	Hall Inc., N	Jew Jerse	у, 2003.						
T3	Geankoplis C New Delhi, 2	C.J., "Transport Processes and Separation Process Princip 005.	oles", 4 th Editi	on, Prentic	e-Hall of	f India,						
REFERENCES: R1 R2 R3	McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-H 2005. Seader, J.D. and E.J. Henley, "Separation Process Principles", 2nd Ed., John Wiley,2006. King,C.J., "SeparationProcesses",2ndEdn.,TataMcGraw-Hill1980.											
K4	Wankat, P., " Chaire	Equilibrium Stage Separations", Prentice Hall, 1993.	Dean	(Acad	emics	1						



CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1						1	1			3	3	1
CO2	3	3	3	1					1	1			2	3	
CO3	2	3	2	1					1	1				3	2
<b>CO4</b>	2	2	3	1					2	1			2	2	3
C05	3	2	2	1					2	1				3	3

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PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
2	3	1						1	1			3	3
3	3	3	1					1	1			2	3
2	3	2	1					1	1			<u>.</u>	3
2	2	3	1					2	1			2	2
3	2	2	1					2	1				3
	PO1 2 3 2 2 3	PO1         PO2           2         3           3         3           2         3           2         2           3         2           3         2           3         2	PO1         PO2         PO3           2         3         1           3         3         3           2         3         2           2         3         2           2         2         3           3         2         2           3         2         2           3         2         2           3         2         2	PO1         PO2         PO3         PO4           2         3         1         1           3         3         3         1           2         3         2         1           2         3         2         1           2         2         3         1           3         2         2         1           3         2         2         3         1	PO1         PO2         PO3         PO4         PO5           2         3         1             3         3         3         1            2         3         2         1            2         3         2         1            2         2         3         1            3         2         2         1            3         2         2         1	PO1         PO2         PO3         PO4         PO5         PO6           2         3         1 <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7           2         3         1</td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8           2         3         1        </td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9           2         3         1            1         1           3         3         3         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            2           3         2         2         1            2           3         2         2         1            2</td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10           2         3         1             1         1           3         3         3         1             1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         2         3         1            2         1           3         2         2         1           2         1</td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11           2         3         1            1         1         1           3         3         3         1            1         1         1           2         3         2         1            1         1            2         3         2         1            1         1            2         3         2         1            1         1            2         3         1            2         1            3         2         2         1           2         1            3         2         2         1          2         1        </td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12           2         3         1            1         1         1             3         3         3         1            1         1             2         3         2         1             1         1             2         3         2         1             1         1             2         3         2         1            1         1                                   </td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01           2         3         1            1         1         1          3           3         3         3         1            1         1           2           2         3         3         1            1         1           2           2         3         2         1             1         1           2           2         3         2         1            2         1           2         1           2           2            2                   </td>	PO1         PO2         PO3         PO4         PO5         PO6         PO7           2         3         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8           2         3         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9           2         3         1            1         1           3         3         3         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            2           3         2         2         1            2           3         2         2         1            2	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10           2         3         1             1         1           3         3         3         1             1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         2         3         1            2         1           3         2         2         1           2         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11           2         3         1            1         1         1           3         3         3         1            1         1         1           2         3         2         1            1         1            2         3         2         1            1         1            2         3         2         1            1         1            2         3         1            2         1            3         2         2         1           2         1            3         2         2         1          2         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12           2         3         1            1         1         1             3         3         3         1            1         1             2         3         2         1             1         1             2         3         2         1             1         1             2         3         2         1            1         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01           2         3         1            1         1         1          3           3         3         3         1            1         1           2           2         3         3         1            1         1           2           2         3         2         1             1         1           2           2         3         2         1            2         1           2         1           2           2            2

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Programme	Course	Name of the Course	$\mathbf{L}^{*}$	Т	Р	С
В.ТЕСН.	22CH5202	PROCESS INSTRUMENTATION DYNAMICS AND CONTROL	3	0	0	3
Course Objective Unit	The studen1.Learn2.To intof con3.Apply	t should be able to the principles and measurement of Instrumentations and its elem roduce open and closed loop systems and its responses, control h trol systems along with instrumentation. the knowledge of process control in chemical process industries <b>Description</b>	nents. loop coi s.	nponent	s and st Instru I Ho	ability ctiona
I	<b>PRINCIPI</b> Introduction Static and Dy pressure, flui electrical and	LES OF MEASUREMENT: to measurement and its hardware element - Transducer function namic characteristics of measuring device - Types and principles d flow, liquid weight and weight flow rate, viscosity, pH, thermal conductivity, humidity of gases transmitter.	on and of temp concen	types – erature, tration,	ç	)
м. П	<b>OPEN LOO</b> Transform of loop system - First order sy systems in set and their dyna	<b>P SYSTEMS:</b> Laplace transformation and its application in p standard functions - derivatives and integrals - inversion the Transfer functions - Forcing functions - step, pulse, impulse a externs, and their transient response for standard input function ries, linearization, and its application in process control, second amics; transportation lag.	rocess o corems and sinu ons, firs order s	control. - Open soidal- t order systems	Ş	) 
и 1. село село село село село село село село	CLOSED LC for feed-back controllers an transient res calculation.	<b>DOP SYSTEMS:</b> Closed loop control systems, development of a control systems, servo and regulatory problems, transfer ad final control element, principles of pneumatic and electron ponse of closed-loop control systems and their stabilit	block d functi nic cont y- OF	iagram on for rollers, FSET	9	)
IV	FREQUENC control system Process react tuning.	Y RESPONSE: Introduction to frequency response of closed n design by frequency response techniques, bode diagram, stab ion curve, tuning of controllers Z-N tuning rules, C-C tunir	-loop sy pility cr ng rules	vstems, iterion, s, IMC	9	- 
V	ADVANCED inverse respon forward b) ra distillation tow	<b>CONTROL SCHEMES</b> : Feedback control of systems with nse. Control systems with multiple loops. Advanced Control Sclatio control c) Cascade control d) Adaptive control. Control wers and heat exchangers.	dead tir hemes a bl of R	ne and ı) Feed eactor,	9	
Course Outcome TEXT BOOI	CO1 CO2 CO3 CO4 CO5 K:	<b>Total Instruc</b> Understand the classification of various process instruments. Examine the open loop systems in process control. Illustrate the closed loop systems in process control. Determine the frequency response of control systems and tune Execute the advanced control schemes and to control the equip	tional H the PID ment in	Hours control chemic	4 lers al indus	5 stries
T1	Coughnowr, I	D., "Process Systems Analysis and Control ", 3rd Edn., McGraw	/ Hill, N	lew Yor	k, 2008	
T2	Stephanopoul	os, G., "Chemical Process Control", Prentice Hall of India, 2003	•			
REFERENC	ES:					

Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Process dynamics and control I - 2nd ed. John Wiley & Sons, Inc.



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- R2 Marlin, T. E., " Process Control ". 2nd Edn, McGraw Hill, New York, 2000.
- R3 Ogunnaike, B. A., & Ray, W. H. (1994). Process dynamics, modeling, and control (Vol. 1). New York: Oxford University Press.
- R4 Seborg, D. E., Mellichamp, D. A., Edgar, T. F., & Doyle III, F. J. (2010). Process dynamics and control. John Wiley & Sons.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-		-	-	3	1
CO2	3	3	1	1		-	-	-	-	-	-	-	3	1
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	1
CO4	3	3	2	2	-	-	- 22	<u>19</u>	-	-	-	-	3	1
CO5	3	3	2	1	2	-	-	-	1.75	-	-		3	1

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++·	Commo	Name of the Course		т	р	c
	Code	Name of the Course	L	1	r	C
Programme B.TECH.	e 22CH5251 The student she	CHEMICAL REACTION ENGINEERING- II	2	0	2	3
Course Objective	1. Design and 2. Understan 3. To enable 4. Analyze th 5. Construct:	d characterize catalyst surface properties for better activa d the heterogeneous reaction systems and design the reac the students to learn the gas-solid catalytic reactors. le mechanism of non-catalytic solid-fluid reactions and apply a general problem solving approach to design l	tion of the tors for flu neterogene	catalys iid-solid eous an	st I system d multip	is ohase
Unit	reactors	Description			Instru	ctiona
I	CATALYSTS: G catalysts, Preparation Supported catalysts in batch reactor	eneral definition of catalysts, Solid catalysts, Components of o on of solid catalysts, Precipitation and co-precipitation methods . Nature of catalysts, surface area and pore-volume distribution	atalyst, Ind , Sol gel m . <b>Kinetic s</b>	lustrial ethod, t <b>udies</b>	6	+3
п	HETEROGENEO isotherms, rates of controlling steps. K	US REACTORS: Rate equations for heterogeneous reac adsorption and desorption, surface reaction analysis of rate inetic studies in a PFR (Equimolar)	tions, adso equation ar	orption nd rate	6-	+3
ш	GAS-SOLID CAT conductivity, mass fixed bed reactors. ]	TALYTIC REACTORS: Diffusion within catalyst particle, and heat transfer within catalyst pellets, effectiveness factor, RTD Studies in PFR	effective th Thiele Mo	iermal odulus,	6-	+3
IV	GAS-SOLID NON Ash layer controllin reaction volume ar Studies CSTR (No	N-CATALYTIC REACTORS: Shrinking core model – Gas ig controlling – Shrinking spherical particles – Fluidized bed re id surface models; controlling resistances and rate controllin on-Equimolar)	film control actor – Cha 1g steps; K	lling – emical <b>linetic</b>	6	+3
v	GAS-LIQUID RI coefficients and ki Hatta number and straight tube PFR	EACTORS: Absorption combined with chemical reaction netic constants; application of film, penetration and surface enhancement factor for first order reaction, tower reactor de (Equimolar)	s; mass tr renewal the sign. Kine	ransfer eories; tics of	6-	+3
	Upon completion	Total Instr of the course, students can be able to	uctional I	Hours	30+1	5=45
Course	CO1 Uno	derstand the nature, preparation and required properties o	fcatalyst.			
Outcome	CO2 App	bly the rate and isotherms studies of heterogeneous react	ors.			
CO3	Analyze tl	he heat and mass transfer in gas-solid catalytic reacto	ors.			
CO4	Evaluatet	he rate kinetics and controlling steps in gas-solid nor	n-catalytic	reacto	ors.	
CO5	Understar	id the mass transfer effects on gas-liquid reactors.				
TEXT BOOK: T1 Lever	nspiel O, "Chemic	al Reaction Engineering", Wiley Eastern Ltd., II Edit	ion,2000.			
T2 Smith	ı, J.M, "Chemical l	Engineering Kinetics", McGraw Hill, III Edition,198	l.			
REFERENCES: R1 Fro	ment. G.F. & K.B	Bischoff, "Chemical Reactor Analysis and Design",	John Wile	ey and	Sons, 1	979.
R2 For	gler H.S., "Eleme	nts of Chemical Reaction Engineering", Prentice	Hall of	India	Ltd.,	3rd
R3 La Pre	any D. Schmidth ss, 2005	The Engineering of Chemical Reactions, Second E	dition, Oz	xford U	Jniversi	ty

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PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
2	3	1						1	1			3	3
3	3	3	1					1	1			2	3
2	3	2	1					1	1			<u>.</u>	3
2	2	3	1					2	1			2	2
3	2	2	1					2	1				3
	PO1 2 3 2 2 3	PO1         PO2           2         3           3         3           2         3           2         2           3         2           3         2           3         2	PO1         PO2         PO3           2         3         1           3         3         3           2         3         2           2         3         2           2         2         3           3         2         2           3         2         2           3         2         2           3         2         2	PO1         PO2         PO3         PO4           2         3         1         1           3         3         3         1           2         3         2         1           2         3         2         1           2         2         3         1           3         2         2         1           3         2         2         3         1	PO1         PO2         PO3         PO4         PO5           2         3         1             3         3         3         1            2         3         2         1            2         3         2         1            2         2         3         1            3         2         2         1            3         2         2         1	PO1         PO2         PO3         PO4         PO5         PO6           2         3         1 <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7           2         3         1</td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8           2         3         1        </td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9           2         3         1            1         1           3         3         3         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            2           3         2         2         1            2           3         2         2         1            2</td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10           2         3         1             1         1           3         3         3         1             1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         2         3         1            2         1           3         2         2         1           2         1</td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11           2         3         1            1         1         1           3         3         3         1            1         1         1           2         3         2         1            1         1            2         3         2         1            1         1            2         3         2         1            1         1            2         3         1            2         1            3         2         2         1           2         1            3         2         2         1          2         1        </td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12           2         3         1            1         1         1             3         3         3         1            1         1             2         3         2         1             1         1             2         3         2         1             1         1             2         3         2         1            1         1                                   </td> <td>PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01           2         3         1            1         1         1          3           3         3         3         1            1         1           2           2         3         3         1            1         1           2           2         3         2         1             1         1           2           2         3         2         1            2         1           2         1           2           2            2                   </td>	PO1         PO2         PO3         PO4         PO5         PO6         PO7           2         3         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8           2         3         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9           2         3         1            1         1           3         3         3         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            1           2         3         2         1            2           3         2         2         1            2           3         2         2         1            2	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10           2         3         1             1         1           3         3         3         1             1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         3         2         1            1         1           2         2         3         1            2         1           3         2         2         1           2         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11           2         3         1            1         1         1           3         3         3         1            1         1         1           2         3         2         1            1         1            2         3         2         1            1         1            2         3         2         1            1         1            2         3         1            2         1            3         2         2         1           2         1            3         2         2         1          2         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12           2         3         1            1         1         1             3         3         3         1            1         1             2         3         2         1             1         1             2         3         2         1             1         1             2         3         2         1            1         1	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12         PS01           2         3         1            1         1         1          3           3         3         3         1            1         1           2           2         3         3         1            1         1           2           2         3         2         1             1         1           2           2         3         2         1            2         1           2         1           2           2            2

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Cours Objecti	<ul> <li>Develop sound practical knowledge for students on d equipment's</li> </ul>	ifferent types of 1	nass transfer
<b>S.No.</b> 1 2	<b>DESCRIPTION</b> Separation of binary mixture using Simple distillation Separation of binary mixture using Steam distillation		
3	Separation of binary mixture using Packed column distillation		
4	Drying characteristics of Rotary dryer		
5	Water purification using ion exchange columns		
6	Mass transfer characteristics of Rotating disc contactor		
7	Estimation of mass/heat transfer coefficient for cooling tower		
8	Adsorption studies		•
9	Liquid-liquid extraction		
10	Leaching studies		
11	Gas – Liquid absorption Column		
12	Vapor liquid equilibrium		
13	Mass transfer characteristics of Bollman Extractor		
	Total	<b>Practical Hours</b>	45
	On the completion of the course students are expected to		

MASS TRANSFER OPERATIONS LAB

CO1: Determine the diffusivity practically and compare the results with the empirical correlations.

- CO2: Estimate the mass transfer rate and mass transfer co-efficient
  - CO3: Evaluate the performance/calculate the parameters in different distillation processes
- CO4: Evaluate the performance/calculate the parameters in leaching and extraction operations
- CO5: Estimate the drying characteristics

#### **REFERENCE BOOKS:**

Course

Outcomes

B.Tech

22CH5001

- McCabe W.L, Smith, J C and Harriot. P "Unit Operations in Chemical Engineering", McGraw Hill, VII Edition, 2005
- White, F.M., "Fluid Mechanics", McGraw-Hill Inc., VII Edition, 2011.



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# Course Code & Name: 22CH3001-FLUID MECHANICS LAB

PO&PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
	1	2	3	4	5	0	1	8	9	10	11	12	1	2
CO1	3	2	141	2	1	1	2	-	3	-	-	2	-	2
CO2	3	-	2	1	2	1	2		3	-	-	2	-	2
CO3	3	2		2	1	1	2		2	2	-	2	1	1
CO4	3	2	-	2	1	1	1	626	3	2	104	2	2	1
CO5	3	2	1.0	2	1	1	1	-	2	1	-	2	2	1
AVG	3	2	1-13	2	1	1	1.6		2.4	1.8		2	1.8	1.4

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Programme	Course Code	Name of the Course	L	Т	Р	С					
B.TECH.	22CH5301	PETROLEUM CHEMISTRY AND REFINING FUNDAMENTALS	3	0	0	3					
	The stude	nt should be able to									
Course	1. Learı	the fundamental and methodologies in the petroleum refining I	processes		~						
Objective	2. Expr	ess the objectives of petroleum refining and classify the process	es used in	n petroleu	m refin	ing					
Objective	3. Anal	yze how physical and chemical principles are applied to achieve	the obje	ctives of e	each rei	inery					
Unit	proce	Description	í		Instru Ho	uctional urs					
I	CRUDE CH	IEMISTRY AND PRODUCTS: Origin, Formation and Evaluation	ation of (	Crude Oil		0					
	-Indian petro	bleum industries- types of Hydrocarbon -composition of crude	oil (PO	NA,S,N2		9					
	etc) -Therm	p-physical and physical properties of crude oil petroleum sta	indards-	chemical							
	analysis data	- Testing methods of petroleum products-Chemical quality of p	products-	Types of							
	crude-Crude	assay- selection of crude based on product yield.									
II	BASICS FO gravity-dens flow resista	y-Properties of liquid viscosity and index-boiling point-pressure of fluid at rest- ice-static/induced pressure specific/latent heat/condensation-modes of heat sion mass transfer-properties of solid									
	transfer-diffu										
ш	PETROLEI	JM THERMODYNAMICS AND CALCULATION: H	·irst/secc	nd law-		9					
	behavior of g	gas and liquid – PVT relationship- equation of state-VLE- equ	librium	constant-							
	Multi comp	onent liquid vapor composition calculation-specific gravity	calcula	tion-IBP							
	distillation-A	SIM-conversion to pseudo-components-Molecular weight ca	iculation	-pseudo-							
	thormo physic	entres-calculation of entralpy of petroleum fractions-General	ized equ	ation for							
		cal properties of perforentia.									
IV	REFINERY	UNIT OPERATIONSAND CALCULATION: Distillat	ion-type	s-column		9					
I	internals-mul	ti component distillation-relative volatility- azeotropic mix	ture- ab	sorption-							
e e e e e e e e e e e e e e e e e e e	desorption-	adsorption- refrigeration - extraction- drying curve-humfid	cation p	principle-							
	crystallizatio	n-stripping operationboiling curve- application of all operation	on in ren	nery and							
	its basic desig	In CAICULATIONS.	oting pr	2622620		0					
v	REFINERY	aduots Thermal/catalutic/bydo cracking-reforming/ isomeriz	ation /a	lkylation		2:					
ļ	principles and	d reactions. Catalyst phenomenon and theory. surface area/voi	d volum	e/norosit							
	ratalyst clas	sification and prenaration/selectivity/vield/reactivity heterog	eneous	reaction		.*					
	catalyst clas	tor types (nacked bed/moving bed/fluidized bed)- residence ti	me-spac	e velocit							
	Catalyst loadi	ng techniques	<b>r</b>	1							
		Total Inst	ructiona	l Hours		45					
n completion	of the course	, the students will be able to									
	COl	Understand the classification, composition and testing method products.	ls of cru	de petrole	um and	l its					
Course	CO2	Illustrate the insights of primary treatment processes to produ	ce the pr	ecursors.							
Outcome	CO3	Apply the secondary treatment processes cracking, vis-breaking	ng and c	oking to p	oroduce	more					
-	<u>CO4</u>	Appreciate the need of treatment techniques for the removal of	fsulphu	r and othe	r impu	rities					
	04	from petroleum products.	i suipiiu	i und ouit	n nnpu	inico					
F	CO5	Analyze the societal impact of petrochemicals and learn their	manufac	turing pro	ocesses	and					
		Learn the importance of optimization of process parameters for	or the hig	gh yield o	f petrol	eum					
FEVT DOOK		products.									
IEXT BOOK			Lilani, El	leavier Co	iomaa a						
	Fundamenta	is of Petroleum Refining, M.A. Fanim, I.A. Al-sannal, A.S. El	kilani; E	isevier Sc	lence a	nu					
	The Chemist	ry and technology of Patroleum James G. Speight CRC Press to	avlor& F	rancis Gro	 מוור	·					
12	The Chemist	ry and technology of Fetroleum, James G. Speight, CKC (1688, 6	aylor& r		Jup						
r3	Jean vidal. T	hermodynamics Application in chemical Engineering and the p	etroleun	n industry	, Institu	ite					
-	Francaisbu p	etrolepublications, France 2003.									
REFERENCE	S:	· · · · · · · · · · · · · · · · · · ·									
81	W. L. Nelson	n, Petroleum Refinery Engineering,, McGraw-Hill Book Co, 19	969.								
R2	R.N. Watkin	"Petroleum Refinery Distillation", Gulf Publishing Co, Houst	an, Texa	s, USA, 2	nd edit	ion, 1981					
3	McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7thEdit McGraw-Hill 2005.										
<u>.</u>	Wayne C. Ec	Imister, "Applied Hydrocarbon Thermodynamics", Gulf Publis	hing Co.	, 2nd edi	tion, 19	88					
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	Р	С
B.TECH.	22CH5302	PRIMARY REFINING TECHNOLOGY	3	0	0	3
	The stude	it should be able to				
Course	1. learn and v	the methodologies in the primary petroleum refining processes acuum distillation, Lube, asphalt and wax processing.	like crud	e prepara	tion, atı	nospheric
Objective	2. Exam	ine now each refinery process works.	of each r	afinary pr	000000	
	3. Appl	veach operating variables are applied to achieve the objectives		ennery pr	Instru	uctional
Unit		Description	<u> </u>		Ho	urs
I	FEED PRE	PARATION: Pipelines from port to tank farm -safety and regu	ilations -	storage		9
	techniques in	crude oil-impurities removal- measuring by dipping -spiking to	echnique	s -types		
	of salts in cru	ide - desalting process – electric desalter- preheating train and c	lesign- fu	irnace		
	and its opera	tion.	CADU 4	acian		0
11	AIMOSPH	<b>ERIC DISTILLATION:</b> Operation and process description of	I ADU-0	esign		9
	and averbasi	s of ADU lower-culpoints-degree of nactionation-over hash-cu	termedia	te numn	, į	
	and overhead	aflux systems. Refinery off gas - I PG treatment. Nanhtha stabil	izer and	snlitter-		
	side strinning	sections-operating variables	izer und	opinioi		
III	VACUUM I	<b>DISTILLATION:</b> Operation of VDU- Need of vacuum- ejector	ors and its	3		9
	types/princip	le- Overhead ejector system flash zone- draw off temperature- i	nternal f	low in		
	VDU- light/r	niddle/heavy cuts- routing to secondary units- lube based treatm	nents-pac	king		
	section tower	loading of VDU.	-			
IV ·	LUBE OIL	BASE STOCKS: Viscosity index calculation and pour point -	LOBS p	ocessing		9
	by solvent tre	atment and hydro treatment- solvent selection-solvent extraction	n by	č		
	NMP, furfura	I,- MEK solvent dewaxing/- refrigerating and filtration -hydro f	inishing-	types of		
	LOBS based	on VI- types or groups of lube processing-spindle/LN/IN/HN/E	3N proces	ssing		
	and blending	· · · · · · · · · · · · · · · · · · ·				
V	ASPHALT A	ND WAX TECHNOLOGY: Vacuum residue properties- pro	pane dea	sphalting		9
	asphalt proce	ssing and types-chemical structure-air blowing of bitumen- slac	k wax pi	ocessing		
	wax and type	s/properties- wax deciling unit operations in wax plants- refrige	erating ar	id		
	filtration/ hyd	ro treating of wax- molding and storage.				
		Total Inst	ructiona	l Hours		45
On completion	of the course	e, the students will be able to		,		
	CO1	Understand the methodologies in the primary petroleum refin	ing proce	esses like	crude	
Course	<u> </u>	preparation, atmospheric and vacuum distillation, Lube, asph	an and w	ax proces	sing.	
Outcome	<u>CO2</u>	I come the operating variables which are applied to achieve the	e objectiv	ies of eac	h refine	rv
	005	process	e objecti	05 01 040	ii ronne	· · · J
	CO4	Analyze the methodologies of processing and blending.	**********			
İ	CO5	Apply the concepts in asphalt processing and wax treatment t	echnolog	çy.		
TEXT BOOK	:					
T1	Modern Petr	oleum Refining Processes, BK BhaskaraRao, Oxford & IBH P	ublishinn	g Co. Pvt	. Ltd.	
T2	Prasad, R., "	Petroleum Refining Technology", Khanna Publishers, New Delh	i, 2000.		0 0 D	
T3	J. H. Gary, H Edition, 200	I. Hanwerk and M. J. Kaiser, Petroleum Refining Technology a 7.	and Econ	omics, Cl	RC Pres	ss, 5th
REFERENCE	ES:					
R1	J.G. Speight	and B. Ozum, "Petroleum Refining Processes", Marcel Dekker	Inc, Ne	w York, 2	2002 .	
R2	David.S.J."S	TAN"Jones and Peter R.Pujado "Handbook of Petroleum Proc	essing,Sp	oringer,20	006.	
R3	Smalheer, C USA, 1987.	V and R.Kennedy Smith Lubricant Additives. The Lezius – Hi	II Compa	any, Clev	eland, (	Jhio.
R4	Wayne C. Ec	Imister, "Applied Hydrocarbon Thermodynamics", Gulf Publis	hing Co.	, 2nd edi	tion, 19	88 A

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Cours	se	Name of the Course	L	T	Р	С				
B.TECH.	22CH53	303	SECONDARY REFINING TECHNOLOGY	3	0	0	3				
	The stu	dent	should be able to	L							
Course Objective	1. Le cra all	earn t ackir kylat	he methodologies in the secondary petroleum refining or upgr ng, coking, catalytic cracking, hydro cracking ,hydro treating, ion and sulfur finishing processes	ading pr reformin	ocesses g, isome	like the rizatio	ermal n,				
	2. Ex	xamii eam,	ne refinery operation on FCC, Vis breaker, DCU, Reformer, e cooling water, instrument air, H2, N2 etc	tc. and op	peration	on util	ities like				
Unit	3.   Ar	pply	Description		ennery	Instr Ho	uctional ours				
I	THERM. thermal cr process- c delayed co of crackin	AL C racki coil v oking ng an	<b>CRACKING AND COKING :</b> Resid up gradation technolo ng-mechanism/principle/reactions process variables- Visbreak risbreaker-Disadvantages-Coking thermodynamics and mecha g-operation-fluid coking-flexicoking types of coke and proper d coking.	gies- cra cing- soa nism of c ties- yiel	cking- ker coking- d patter		9				
Ш	CATALY reaction o Kinetics a reaction/re senarator/	<b>CATALYTIC CRACKING</b> : Principles of catalytic cracking-mechanisms- FCC- main eaction of FCC- role of FCC in refinery Fluidization- feedstocks/products/yield patterm- inetics and thermodynamics of FCC reactions FCC catalyst and licensor technologies- eaction/regeneration/fractionation sections-slide valves and its importance- riser/cyclone eparator/reactor internals-RFCC/MSCC/Petro FCC (YDROGEN AND HYDROCONVERSION : H2 requirements-steam reforming and hift conversion-operation and thermodynamics of reformer and NI catalyst-Hydro									
111	HYDROO shift conv treatment hydro trea	GEN ersio proc	AND HYDROCONVERSION : H2 requirements-steam rom-operation and thermodynamics of reformer and NI catalyst esses- catalyst and reaction chemistry Naphtha/Diesel/lube/watht-Hydrocracking process.	eforming -Hydro ax/gasoli	; and ne		9				
IV	REFORM reactions- Isomerizat	Oper tion t	G/ISOMERISATION/ALKYLATION : thermodynamics of tration in Straight Run and Continuous Run mode yield calcula techniques- reactions and kinetics.	of Pt cata tion-	ılyst		9				
V	FINISHI compound properties and O2 pro	NG I ds in and oduc	<b>PROCESSES AND UTILITIES :</b> Sources of sulfur in refine crude-sweetening processes- various sulfur treatment process removal by physical and chemical process- Cryogenic distillation- tion- Instrument air operation.	ery-types in produ ation of a	of sulf cts-H2S air to N2		9				
			Total Instru	uctional	Hours		45				
n completion	of the cou	urse.	the students will be able to	enederation in clinical at 65.99	t						
1	CQ1		Acquires knowledge on different methodologies in the secon like thermal cracking, coking, catalytic cracking, hydro crack	dary petr	oleum r	efining	processe				
Course	CO2		Understand the operation on FCC, Vis breaker, DCU, Reform	ner.		10					
Outcome	CO3		Illustrate the operation on utilities like steam, cooling water, N2	instrume	ent air, F	12,					
	CO4		Analyze the isomerisation, alkylation and reforming process.		· · · 1						
	<u>CO5</u>		Apply the concepts of finishing processes and their operation	s in refir	iing indi	istries.					
TEXT BOOK	:	D	Lun D. Cuine Durange DK DL - Lun Dag Auford & IDU D	ubliching		vt T ta					
11	Modern	Petro	neum kenning Processes, BK Bhaskarakao, Oxford & IBH P		ig CO. P	vi. Liu	•				
Т2 Т3	Prasad, R J. H. Gar Edition, 2	<u>е., "Р</u> у, Н. 2007	etroleum Refining Technology", Khanna Publishers, New Dell Hanwerk and M. J. Kaiser, Petroleum Refining Technology	n, 2000. and Ecor	nomics,	CRC P	ress , 5th				
REFERENCE	ES:										
R1	J.G. Spei	ght a	nd B. Ozum, "Petroleum Refining Processes", Marcel Dekke	r Inc, Ne	w York	, 2002	·				
R2	David.S.J	J."ST	AN"Jones and Peter R.Pujado "Handbook of Petroleum Proc	essing,S	pringer,	2006.					
R3	Smalheer USA, 198	r, C.\ 87 .	/ and R.Kennedy Smith Lubricant Additives. The Lezius – H	III Comp	any, Cle	velanc	1088				
R4	Wayne C	: Edı	nister, "Applied Hydrocarbon Thermodynamics", Gulf Publi	sning Co	., 2nd e	uition,	1988				

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	Р	с
B.TECH.	22CH5304	BIO ENERGY	3	0	0	3
	The studen	should be able to				
Caunaa	1. Learn	the Biomass characteristics & preparation.				
Objective	2. Exami	ne Feedstock for producing biogas	*****	, , , , , , , , , , , , , , , , , , ,		
Objective	3. Apply	the Pyrolysis, Gasfication and Combustion of biomass.				
Unit		Description			Inst F	tructional Iours
I	BIOMASS S Chemical con	DURCES AND CLASSIFICATION: Biomass chara position and properties of biomass; Size reduction, Brid	cteristics & pre quetting of loos	eparation e bioma	; 55	9
	Drying, Stora	ge and handling of biomass.			ants.	an in the second
11	<b>BIOGAS TE</b>	CHNOLOGY: Feedstock for producing biogas; Micr	obial and biocl	nemical		9
	aspects and op wet fermentat treatment.	erating parameters for biogas production, Kinetics and on, Digestors for rural application-High rate digesters f	mechanism. Di or industrial wa	ry and aste wate	r	
III	PYROLYSIS conversion of Biomass proce of particle size	AND THERMO-CHEMICAL CONVERSION: The lignocellulosic biomass. Incineration for safe disposal of ssing for liquid fuel production, Pyrolysis of biomass-p , temperature, and products obtained.	termo-chemica f hazardous wa yrolysis regime	l iste, e, effect		9
IV	GASIFICAT temperature ar Bed Gasifies,	<b>ON OF BIOMASS:</b> Thermo chemical principles: Ef d introducing steam and oxygen. Design and operation Safety aspects.	fect of pressure of Fixed and I	e, Fluidizec		9
V	COMBUSTIC woody biomas processing ind	N OF BIOMASS AND COGENERATION SYSTE s-theory, calculations and design of equipment, Cogene astries. Case studies: Combustion of rice husk, Use of b	MS: Combust ration in bioma agasse for cog	tion of ass eneration	n.	9
			al Instructions	Hours		45
On completion	of the course.	the students will be able to	in mon uction			
	CO1	Understand the fundamental knowledge on classification biomass	on, characteriza	ition and	source	es of
Course	CO2	Learn the production of biogas.				
Outcome	CO3	Gather knowledge on the operations of incineration, py	rolysis			
	CO4	Illustrate the process in gasification of biomass				
	CO5	Analyze the types of combustion of biomass.				
TEXT BOOK	:					
T1	Anju Dahiya,	Bioenergy: Biomass to biofuels First Edition, Academi	c Press, 2014			
T2	Li, Yebo, and	Samir Kumar Khanal. Bioenergy: principles and applic	ations. John W	ilev & S	ons, 20	016.
T3 H	Biomass for Re	newable Energy, Fuels, and Chemicals, Donald L. Klas	s,1998		.,	
REFERENCE	CS:					
R1	Vaughn C Ne	son, Kenneth L. Starcher. Introduction to bioenergy. C	RC Press, 2017	7		
R2	Wall, Judy D.	Caroline S. Harwood, and Arnold Demain. "Bioenergy	y." Bioenergy	ASM P	ess. 20	08.
R3	Biomass to Bi	ofuels, Alain Vertes, Nasib Oureshi, Hideaki Yukawa H	Hans P. Blasch	ek.Wiley	. 15 De	ec 2009
R4	Biomass Com	pustion Science, Technology and Engineering,Lasse Ro	osendahl,Elsevi	ier, 4 Ap	r 2013.	

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	Р	С
B.TECH.	22CH5305	RENEWABLE ENERGY RESOURCES	3	0	0	3
	The studen	t should be able to				
6	1. Learn th	ne fundamental of today's energy and its history.				
Course	2. Express	the objectives of Solar, Bio and Geothermal energy.				
Objective	3. Illustrat	e the applications of Wind and Tidal energy.				
Unit		Description		à	Ins I	tructional Iours
I	INTRODUC	TION: Energy: Past, Today, and Future. A brief history of ene	ergy cons	umption.		0
	Energy & Env limitations	vironment. Renewable Energy – Quality, quantity, availability,	advanta	geous and		,
п	SOLAR ENE Solar Therma	<b>CRGY:</b> Sun and its Energy: Basics of Solar Energy. Solar Energy Solar Photovoltaic.	gy in the	e Past.		9
III	<b>BIO ENERG</b> generation. Fu Technologies.	Y & GEOTHERMAL ENERGY: Conversion. Bio degrada nel properties. Biomass gasifier. Geothermal Resources, Geoth	tion. Bio ermal	gas		9
IV	WIND ENER estimation. Co	<b>RGY:</b> Wind Resources. Wind Turbines. Environmental Impact provension. Wind mill Performance and applications.	. Data an	d energy		9
V	TIDAL ENE Statistics. Wa Osmotic Powe	<b>RGY:</b> Ocean Energy Potential against Wind and Solar. Wave ve Energy Devices. Tide Energy Technologies. Ocean Therma er.	Characte I Energy	ristics and		9
		Total In	struction	nal Hours		45
On completion	of the course.	the students will be able to				
	CO1	Understand the fundamental knowledge on history, consumpti-	on of ene	ergy.		
	CO2	Learn the production of solar energy.				
Course	CO3	Apply the knowledge on the geothermal and bio energy.				
Outcome	CO4	Appreciate the production of wind energy and their utilization				
	CO5	Analyze the production and utilization of tidal energy.				
TEXT BOOK	K:					
T1	Mukherjee, D.	, and S. Chakrabarti. Fundamentals of renewable energy syste	ms. New	Age Inte	nation	al, 2004.
T2 .	Jenkins, Nicho	las, and Janaka Ekanayake. Renewable energy engineering. Can	nbridge l	University	Press,	2017.
Т3	Jean vidal, Th	ermodynamics Application in chemical Engineering and the pe	etroleum	industry,	Institu	te
	Francaisbu pet	rolepublications, France 2003.				
REFERENC	ES:					
R1	Kishore, V. V.	N., ed. Renewable energy engineering and technology: prince	iples and	practice.	The E	nergy and
	Resources Inst	itute (TERI), 2010.				
R2	Tiwari, Gopal	Nath, and Rajeev Kumar Mishra. Advanced renewable energy	sources	. Royal So	ciety o	of
	Chemistry, 20	12.				
R3	Renewable En	ergy Resources, John Twidell, Tony Weir, Routledge, 26 Jan 2	2015.			
R4	Introduction to	Renewable Energy, Vaughn C. Nelson, CRC Press, 14 Jun 20	011.			

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	Р	С
B.TECH.	22CH5311	WASTE WATER TREATMENT	3	0	0	3
	The student	should be able to				
6	1. Focus o	n the wastewater transport system				
Course	2. Express	the theory and design technique for the wastewater treatment	process			
Objective	3. Illustrat	e the applications of advanced waste water treatment.				
Unit		Description			Ins I	tructional Iours
1	WASTE WA	TER TREATMENT AN OVERVIEW: Terminology - R	egulatior	ns – Heal	th	9
	and Environr	nent Concerns in waste water management – Constituen	ts in wa	aste wate	r;	,
	inorganic, Org	ganic and heavy metal constituents.				0
П	CHEMICAL	UNIT PROCESSES: Role of unit processes in wast	e water	treatmen	t-	9
	Principles of	Chemical treatment – Coagulation - flocculation– Preci	pitation-	notation	-	
	solidification	and stabilization –disinfection.	t sign	ificance		0
111	BIOLOGICA	L IREATMENT: Objectives of biological treatment	h = Sign	rs affectir	σ	,
	principles of a	shed and suspended growth - Determination of Kinetic coeff	ficients fo	or organi	S	
	growin – alla	thed and suspended growth - Determination of Renetic coeff	iterentis it	or organi		
IV	TREATMEN	T METHODS : Activated Sludge process and variations.	Sequen	cing Bate	h	9
1.	reactors. Me	nbrane Biological Reactors-Trickling Filters- RBC-Movi	ng Bed	Reactor	s-	
	fluidized bed	reactors, aerated lagoons, waste stabilization ponds- Design o	of units –	UASB, ι	ıр	
	flow filters, Fl	uidized beds MBR, septic tank and disposal				
V	ADVANCED	WASTE WATER TREATMENT: Technologies used in a	dvanced	treatment	-	9
	Classification	of technologies- Removal of Colloids and suspended particles	– Membi	rane		
	Filtration – Io	1 Exchange – Advanced oxidation process – Zero liquid Disch	arge S	oftware		
	Applications	Total In	struction	al Hour		45
	- C 4)	10(a) In	sti uctioi		<u> </u>	75
On completion	of the course,	Inderstand the Dhysical and chemical Characteristics of waste	water an	d their m	easurer	nent
	$\frac{CO1}{CO2}$	Inderstand the various pollutant treatment techniques	water un	a men m		
Course	$CO_2$	Apply the concepts using biological treatment methods				
Outcome	$CO_4$	Analyze the reactors used for various treatment techniques.				
	CO5	Inderstand the membrane based electrochemical process for p	ollutant	treatment		
TEXT BOOK	<u> </u>					
TI	Waste water E	ngineering Treatment and Reuse: McGraw Hill, G. Tchobano	glous, FI	Biston, 2	002.	
T2	Industrial Was	e Water Management Treatment and Disposal by Waste Water	McGraw	/ Hill III I	dition	2008.
T3	S.P. Mahajan,	Pollution control in process industries, 27th Ed. Tata McGraw	Hill Pul	olishing C	ompan	ıy Ltd.,
	2012.	-				
REFERENCI	ES:					<u>.</u>
R1	Casey, T.J., U	nit Treatment Processes in Water and Wastewater Engineering	g, John W	/iley & S	ons, 20	06
R2	Metcalf & Edd Hill, 1995	y, Inc. Wastewater Engineering - Treatment, Disposal, and Ro	euse, Fou	irth Editio	on, Tata	a McGraw-
R3	Spellman, R.F. Publications. 2	, Handbook of water and wastewater treatment plant operatio	ns, CRC	Press/Tay	lor & l	Francis
R4	C.S. Rao, Envi	ronmental Pollution Control Engineering, New Age Internation	onal, 200	7.		

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	P.	С
B.TECH.	22CH5312	SOLID WASTE MANAGEMENT	3	0	0	3
	The studen	t should be able to				
	1. Conver	sant with the types, sources, generation of MSW.				
Course	2. Express	the storage, collection, transport, processing and disposal of n	nunicipal	solid was	ste.	
Objective	3. Illustrat	e the applications of advanced disposal of MSW.				
Unit		Description			Inst	tructional
	•				ŀ	lours
· I	SOURCES A	ND CHARACTERISTICS : Sources and types of municipal	l solid wa	istes-		0
	Public health	and environmental impacts of improper disposal of solid waste	es- sampl	ing and		,
	characterizati	on of wastes - factors affecting waste generation rate and chara	acteristics	. Elemen	ts	
	of Municipal	Solid Waste Management Plan.				
П	SOURCE RI	EDUCTION, WASTE STORAGE AND RECYCLING :	Waste M	anageme	nt	9
	Hierarchy - I	Reduction, Reuse and Recycling - source reduction of wast	e - On-s	ite storag	ge	
	methods - Ef	fect of storage, materials used for containers – segregation of s	olid wast	es – Publ	ic	
	health and eco	onomic aspects of open storage				
111	COLLECTI	ON AND TRANSFER OF WASTES : Methods of Residen	tial and c	ommerci	al	9
	waste collecti	on – Collection vehicles – Manpower – Collection routes -	- Analysi	s of was	te	
	collection sys	stems; Transfer stations –location, operation and maintena	nce; opt	ions unde	er	
	Indian conditi	ons	<u></u>	<b>D</b>		0
IV	PROCESSIN	G OF WASTES: Objectives of waste processing – F	nysical	Processin	g	9
	techniques ar	d Equipment; Resource recovery from solid waste compo	sting and	bio met	n ·	
*7	nation; Therm	al processing options – case studies under Indian conditions.	a calacti	n dacion		0
v	WASTE DIS	POSAL: Land disposal of solid waste- Sanitary landing - su	e selection	dfill age-		9
	and operation	of samary families – Landin mers – Management of reachan	c and fan	um gas-		
		Total In	struction	al Hours		45
On completion	of the course	the students will be able to	isti uctioi	iui iiouii		·••
on compiction	COl	State solid waste characteristics and its sources				
	$\frac{cor}{cor}$	Identify and analyze different methods of treatment of solid w	aste			
Course	$CO_2$	Illustrate Industrial practices in solid waste management				
Outcome	CO4	Discuss the significance of recycling reuse and reclamation of	solid wa	stes		
<i>x</i>	C05	Assess the relationships between environmental guidelines, hu	man acti	vities and	quality	of
	005	mnacted soil water and air			-15	
TEXT BOOK	[]					
T1	William A W	orrell, P. AarneVesilind (2012) Solid Waste Engineering, Cen	gage Lea	rning, 20	12.	
T2	John Pitchel (2	014). Waste Management Practices-Municipal, Hazardous and	industria	- CRC P	ress, Ta	aylor and
	Francis. New	/ork				
T3	Vesilind, P.A.	and Rimer, A.E., "Unit Operations in Resource Recovery Eng	ineering	', Prentice	e Hall,	Inc., 1981
REFERENCE	ES:	, , , , , , , , , , , , , , , , , , ,	·			
R1	Government o	f India, "Manual on Municipal Solid Waste Management", CF	HEEO, I	Ministry o	f Urba	n
	Development,	New Delhi, 2000.	· · · ·	-		
R2	Manser A.G.R	and Keeling A.A.," Practical Handbook of Processing and R	ecycling	of Munic	ipal sol	id Wastes",
	Lewis Publish	ers, CRC Press, 1996				
R3 .	Spellman, R.F	, Handbook of water and wastewater treatment plant operation	ns, CRC	Press/Tay	lor & F	Francis
þ	Publications, 2	009				
R4	Tchobanoglou	s, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engine	ering Pri	nciples ar	d Man	agement
	lssues". McGr	aw Hill, New York, 1993.	-	-		

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	Р	C
B.TECH.	22CH5313	COMPUTATIONAL TECHNIQUES	3	0	0	3
	The student	should be able to				
	1. Underst	and the Principles of Numerical Methods and Analysis.				
Course	2. Develor	Proficiency in Algorithmic Problem Solving				
Objective	3. Master	Programming Languages and Tools for Computation				
Unit	E	Description			] ]	Instructiona I Hours
I	NUMERICA	L METHODS FOR SYSTEM OF LINEAR ALGEBR	AIC EQ	UATIO	NS:	0
	Gauss elimina	ation, LU decomposition, matrix inversion, Tri-diagonal mat	rix algor	ithm, Ga	uss-	9
	Seidel method	l, Chemical Engineering problems involving solution of linear	algebrai	e équation	15	*
П	NUMERICA	L METHODS FOR NON LINEAR ALGEBRAIC	C EQU	ATIONS		9
	Introduction,	Root finding methods for solution on non-linear algebraic	equation	s: Bisect	ion,	1 1 2 1
	Newton-Raph	son and Secant methods, System of Non-linear Equations, C	Chemical	Enginee	ring	
	problems invo	lving solution of non-linear equations				
III	INTERPOLA	ATION AND NUMERICAL INTEGRATIO: Interpolation	1 and Ap	proximat	10n,	9
	Newton's po	lynomials and Lagrange polynomials, spline interpolatio	n, lineai	regress	ion,	
	polynomial 1	egression, least square regression, Numerical integration	n: Trape	ezoidai r	uie,	
	Simpson's ru	e, integration with unequal segments, Chemical engineering	g problei	ns invoiv	/ing	
	numerical diff	erentiation and integration.	1	Dungo V		0
IV	NUMERICA	L METHODS FOR ODES: Euler method – explicit and	implicit,	d Cham	ical	,
	method $-2$	nd and 4 th order, Boundary value problems – shootin	g memo	u, chem	icai	
	engineering p	-oblems involving single and system of ODEs.	implicit	Runge-	Kut	9
V	NUMERICA	L METHODS FOR PDES: Euler method – expired and	l Chemic	al engine	erir	
	method – 2 nd	I and 4 in order, Boundary value problems – shooting method	i, enenin	ar engine		
	problems inve	Total	Instruct	ional Hor	irs	45
	of the commo	the students will be able to	monuet			
On completion	CO1	Understand the numerical methods for linear algebraic equation	ms			
	$\frac{col}{col}$	Identify numerical methods for non-linear algebraic equations		2		
Course	$CO_2$	Identify different methods for interpolation and numerical inte	egration.	400 ⁰⁶		
Outcome	<u>CO4</u>	Illustrate the numerical methods for ordinary differential equa	tions			
	C05	Assess the basic methods for partial differential equations				
TEXT BOOK	<u>()</u>					
TI	Chapra S C	& Canale R P. "Numerical Methods for Engineers", Eighth	Edition, 1	McGraw	Hill, 2	2021.
T2	Gupta S K	'Numerical Methods for Engineers, New Academic Science, 2	2012.			
T3	Ahuia P "In	roduction to Numerical methods in Chemical Engineering" 2	nd Editio	n, PHI le	arning	g Private Ltd,
	2019.					
REFERENC	ES:					
RI	R.L. Burden &	z J. D. Faires, "Numerical Analysis", 7th Ed., Brooks Coles, 2	000.			
R2	Reklaitis G.V.	, Ravindran A., Ragsdell, K.M., Engineering Optimization, W	/iley, Ne	w York,	980.	
R3	Luvben, W.L.	Process Modeling, Simulation and Control for Chemical Eng	gineers, N	AcGraw I	Hill, Ir	nternational
	Student Editio	n, Second Edition, 1996.			z	
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	Р	C						
B.TECH.	22CH5314	OPTIMIZATION OF CHEMICAL PROCESSES	3	0	0	3						
	The student should be able to											
Course	1. Understanding Optimization Theory and Techniques											
	2. Integration of Computational Tools and Software for Process Optimization											
Objective	3. Application of Optimization Techniques to Chemical Processes											
Unit	Description         Instructiona           I Hours         I											
I	PROBLEM	FORMULATION & CLASSIFCATION: Introduction; for	mulation	of objec	tive	0						
	functions; fitting models to data; classification of functions; necessary and sufficient conditions											
	for optimum;	unimodal, multimodal functions; analytical methods.		~ ·								
Ш	LINEAR PR	OGRAMMING: Review on basic concepts of LP for	ormulatio	ns; Simp	lex	9						
	methods; Big-	M method, two phase method and Duality in linear programm	ing.									
ш	NON-LINEA	R PROGRAMMING: The Lagrange multiplier method	l, Intege	r, quadra	tic,	9						
	geometric and dynamic programming											
IV	NUMERICAL METHODS: Unimodal functions; Newton, quasi Newton, secant methods;											
	region elimin	ation methods, polynomial approximation; quadratic and	cubic	interpolat	ion							
	techniques fo	r optimum. Multimodal functions; direct methods; Powell	s tecnnic	que; man	ect							
*7	methods; grad	ient and conjugate gradient methods; secant method.	access fl	uid flow		0						
V	APPLICATIO	or design and operation: large scale systems		ulu now		,						
	systems, react	Total	Instructi	onal Hou	rs	45						
On completion	of the course	the students will be able to	motracti	onai nou								
On completion	CO1	Inderstand the basic problem formulation and optimization										
	CO2 Identify mathematical characteristics of Linear programming											
Course	CO3 Identify matternatical characteristics of Effect programming.											
Outcome	CO4 Illustrate various techniques used in constrained ontimization.											
	CO5 Apply the optimal and dynamic optimization.											
TEXT BOOP	<b>ζ</b> :											
T1	Edgar T.F., Himmelblau D.M., Lasdon, L.S., Optimization of Chemical Processes, Second Edition, McGraw-Hill,											
	New York, 2001.											
T2	Rao, S. S., Engineering Optimization: Theory and Practice, Fifth Edition, Wiley, New York, 2019.											
T3	Ahuja, P., "Introduction to Numerical methods in Chemical Engineering" 2nd Edition, PHI learning Privat											
	2019.											
REFERENC	ES:											
R1	R.L. Burden & J. D. Faires, "Numerical Analysis", 7th Ed., Brooks Coles, 2000.											
R2	Reklaitis G.V.	Ravindran A., Ragsdell, K.M., Engineering Optimization, W	iley, Nev	v York, l	980.							
R3	Luyben, W.L.:	Process Modeling, Simulation and Control for Chemical Eng	ineers, M	lcGraw H	III, In	ternational						
	Student Edition, Second Edition, 1996.											

Chairman, Board of Studies Chairman - BoS OHE - HICET i k

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

Chairman

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Programme	Course	Name of the Course	L	Т	Р	С							
P TECH	Code	PROCESS MODELING AND SIMULATION	3	0	0	3							
D.IECH.	The student	should be able to		0									
	1 Davalar	Profigionou in Process Modeling Techniques											
Course	1. Develop	Simulation Software for Process Analysis and Design	alata an de la 1917 de la composition de la composition de la composition de la composition de la composition d										
Objective	2. Waster	and the Bole of Process Simulation in Engineering Decision N	laking										
	3. Underst	and the Role of Process Simulation in Engineering Decision w	laking		T	netruationa							
Unit		Description				I Hours							
1	INTRODUC	TION AND FIRST PRINCIPLES: Definition, Uses of M	lathemati	cal Mode	els -	0							
	Principles of :	formulation, Classification of Process Models, Fundamental l	aws: Tota	al Contin	uity	,							
	equation- M	acroscopic and Microscopic Examples, Component Con	ntinuity	Equatior	I								
	Macroscopic	and Microscopic Examples, Energy equation, Equations	of motio	n, Transj	port								
	equations, Eq	lations of State, Equilibrium and Chemical Kinetics. Simple E	xamples	•									
П	LUMPED SY	<b>STEMS:</b> Simple Hydraulic Tank, Variable flow hyd	raulic tai	nk, Enclo	sed	9							
	tank, Adiabat	ic compression in gas space, Mixing vessel, Mixing with	reaction	, Revers	ible								
	reaction, Stean	n jacketed vessel, Continuous flow boiling system											
111	STAGED OF	PERATIONS AND DISTRIBUTED SYSTEMS: Staged	Operation	ons: Cou	nter	9							
	current extract	tion, Distillation columns - Binary distillation. Distributed sys	tems: Co	unter cur	rent								
	Heat exchange	er, Membrane separation process, tubular reactor and evaporat	ors.										
IV	FITTING M	ODEL TO DATA: Fitting Linear Model, Multi-Li	near Mo	dels, Ma	trix	9							
	representation	of Multi Linear Model, Fitting Quadratic Model, Cubic M	odel and	l Polynor	nial								
	model using I	Regression, Power Law models. Performance Criteria to che	eck quali	ty of mo	del,								
	Co-efficient of	f Determination (R2)											
V	SIMULATIO	N OF BASIC MODELS: MATLAB/Simulink - Introduct	ion, Basi	c compor	nent	9							
	Operational B	locks, Examples - Gravity flow tank, Three CSTR's in series,	Numerica	al solution	n of								
	model using RK4, Euler's explicit and implicit techniques, Introduction to ODE 45 solver,												
	Dynamic simu	lation of simple tank, variable flow tank, enclosed tank with i	sotherma	.1									
	compression, 1	nixing vessel, mixing vessel with reaction using ODE 45 solv	er.										
		Total	Instructi	onal Hoi	irs	45							
On completion	of the course,	the students will be able to	. 1	<u>. 21 - 6</u>	1 1 200	<u>er e ser é</u>							
	CO1	Understand the fundamentals of modeling and their application	ns to tran	sport/ene	rgy eq	uations,							
Comme		chemical and phase equilibria kinetics		4 di .		1. 1998) 							
Course	CO2	Associate the model with constitutive relations such as phenor	nenologi	cal laws,	rate eq	uations,							
Outcome	e	equations of state, property estimation methods											
	CO3	Create the mathematical models for different unit operations e	quipmen	ts.	analogo a contra contra contra								
	CO4	Analyze the principles of steady state/unsteady state lumped s	ystems ai	nd steady	state/ ı	unsteady							
	S	tate distributed systems											
	CO5	Apply relevant solution methods for the mathematical models	with rele	vant initi	al and/	or boundary							
	c	conditions.											
TEXT BOOK	:												
T1	Bequette, B. W	7., Process Dynamics: Modeling, Analysis, and Simulation. Pr	entice-H	all, 2002									
T2	Babu, B V., Pr	ocess Plant Simulation, Oxford University Press, 2004.											
T3	Jana, A. K., Cl 2011	nemical Process Modeling and Computer Simulation, Second	Edition,	Prentice I	Hall Ine	dıa Pvt. Ltd,							
REFERENCI	2011. 2 <b>S</b> :												
RI	Luvben WI.	Process Modeling Simulatio5n and Control for Chemical Fn	gineers	McGraw	Hill. Ir	iternational							
111	Student Edition	1 Second Edition 1996	,		,								
R2	Ramirez W D	Computational Methods for Process Simulation Second Ed	lition, Els	sevier Sci	ence. 1	997.							
R3	1 $1$ $1$ $1$ $1$ $1$ $1$ $1$ $1$ $1$	Process Modeling, Simulation and Control for Chemical Fra	ineers M	IcGraw F	Iill. Int	ernational							
ю.	Luyben, W.L.: Student Edition	Process Modeling, Simulation and Condon for Chemical Ling		10014101	,								
	Suuch Eution	i, Second Edition, 1770.											

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course	Name of the Course	L	Т	Р	С				
B TECH	Code 22CH5316	CHEMICAL PLANT DESIGN	3	0	0	3				
D.TECH.	The student	should be able to	1		4	l				
	1. Underst	anding the Fundamentals of Chemical Process Design								
Course	2. Masterii	ng the Design and Integration of Unit Operations								
Objective	3. Applyin	g Engineering Economics and Risk Assessment in Plant Desig	gn							
Unit		Description				Instructiona l Hours				
I	ROTARY E	QUIPMENT : Pumps: Various types: Centrifugal, F	Reciproca	ting& O	ther	9				
	Positive displ	acement types – Plunger, Piston, Diaphragm, Gear, Scre	w, Lobe	Vane,	etc.;					
	Compressors	: Various types: Axial, Centrifugal, Reciprocating,	and other	ner posi	two					
	displacement	type such as Rotary Screw, Scroll, etc. Further, compressors	are classi Axial fan	s (inclue	ting					
	Propeller Tu	be-axial and Vane-axial) and Centrifugal fans. Further f	ans are	classified	l as					
	Induced draft	and Forced draft types.								
П	STATIC EO	UIPMENT - HEAT TRANSFER EQUIPMENT : He	at Excha	ngers– S	heli	9				
	and Tube, Do	uble Pipe, Plate &Frame type, Tube in tube Scraped surface,	and Fin t	ube, Cool	lers,					
	Condensers,	Fin Fan Coolers; Fired Heaters& Boilers- With or wi	thout ai	r prehea	ters,					
	Balanced draf	t or simply natural draft or even only forced draft, With an	id withou	it waste	neat					
~~~	generation.	LIDMENT MACO TRANCEED . More Transfe	r Onera	tions: M	Inlti	9				
111	STATIC EQ	Distillation columns Extractive distillation Reactive Dis	stillation.	Azeotro	opic	,				
	distillation. D	ivided wall columns, Drvers, Adsorption Isotherm, Pressur	e Swing	Adsorpt	ion,					
	Importance of	f recycles and Optimization needs, Absorption processes &	c operati	ng variat	oles,					
	Liquid – Lio	quid Solvent Extraction ; Humidification & dehumidif	ication,	Evaporat	ion,					
	Precipitation,	Crystallizers, Membrane filtration.		1						
IV	EQUIPMEN	FANCILLARIES : Special equipment – Static Mixer,	Agitators	sters Vo	ing, rtev	у У				
	Ejectors, Educ	cators, Structured Packing, Grid Packing and Random Packing	senarato	sicis, vo	age					
	units – Inert gas generators, Feed stream filters (Mechanical, Chemical), Scrubbers, Spray									
	Nozzles Guar	rd beds. Flare stack, Ground Flare, Flame arrestors, Strain	ers, Spri	ing suppo	orts,					
	Expansion joints, Electrostatic Precipitators									
V	STATIC EQUIPMENT - PRESSURE VESSELS, INTERNALS & SAFETY VALVES :									
	Pressure Vess	sels – Vertical / Horizontal, Knock Out Drums, Steam and Blo	ow down	drum, Co	bld a					
	Hot Separators	s, Surge drum, Deaerators, Water Seal Pot, Molecular seals, S	nock Abs	flow Mu	lti					
	Internals -Co	Tumn internais such as Trays (Sieve, Vaive, Bubble Cap, Ban	ic, Duai	11010, 1010						
	Safety Valves	Normal balanced bellows, pilot operated, etc., Rupture Disc	s, and De	esign cod	es					
	governing Safe	ety valve design, .								
	00	Total	Instructi	ional Ho	ırs	45				
On completion	of the course,	the students will be able to								
	CO1 I	Understand the basic on designing chemical process unit for re-	otary equ	ipment						
Course	CO2 1	Learn the operations of boilers, heat exchangers, refrigeration	and air c	onations	ers.					
Outcome	CO3 1	Illustrate the operations of reactors, numidiners and mass train	sier oper	ations						
	CO4 /	Analyze the different types of equipments in process industrie	s. ssure sa	fetv and i	ntern	al.				
TEXT BOOK	. (COS /	Appry the knowledge on usage of unrefere values such as pre-								
TI	Robert H. Perr	y: Don W. Green and James O. Maloney, Chemical Engineer	ing Hand	lbook						
T2	James R. Cou	per, W. Roy Penney, James R. Fair, Stanley M. Walas, Chem	ical Proc	ess Equip	ment	: Selection				
-	and Design (T	hird Edition).								
T3	Richard Turton	n, Richard C. Bailie, Wallace B. Whiting, Joseph A. Shaeiwit	z - "Anal	ysis, Syn	thesis	and Design				
	of Chemical Pr	rocesses" (5th Edition).								
REFERENCI	ES:	DIV Of the HOLE of T. D. Standard Devices Devices	Dractica	and Feer	omic	s of Plant and				
RI	Gavin P. Towl	er, K.K. Sinnott - "Chemical Engineering Design: Principles,	Tractice	and ECOL	onne	o or r rain and				
P2	rrocess Design	Klaus D. Timmerhaus, Ronald F. West - "Plant Design and F	Economic	s for Che	emica	l Engineers.				
N2	Second Edition	1. 1997.				,				
R3	Luvben, W.L.:	Process Modeling, Simulation and Control for Chemical Eng	gineers, N	AcGraw I	Hill, I	nternational				
	Student Edition	n, Second Edition, 1996.				A				
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Code	Name of the Course	L	Т	Р	C					
B.TECH.	22CH5317	PLANT LAYOUT	3	0	0	3					
	The student	should be able to									
6	1. Underst	and the importance of plant layout in mitigating risk on people	e, plant								
Course	2. Apply k	nowledge in placing equipment for ease of operability & mair	itainabilit	у							
Objective	3. Analyze	the risk assessment and Engineering package.									
Unit		Description			I	nstructiona					
						I Hours					
I	STANDARD	S FOR AREA CLASSIFICATION : Standards for	r area cl	assificatio	on-	9					
	Electrical Ar	ea classifications, OSHA (Occupational Safety and He	alth Ad	ministrati	on)						
	regulations, N	lational Fire Protection Association (NFPA), Petroleum H	(Oil Ind)	ustry Saf	etv						
	Directorate)	A PL Codes (American Petroleum Institute) PESO (Petro	eum and	l Exnlosi	ves						
	Directorate), Safety Organi	zation) guidelines Investigations Reports & Best practices	data Che	mical Saf	etv						
	Board USA	zation) guidennes, investigations reports to Dest praeties	aan oni								
	INTER UNIT	DISTANCES : Distance between plants, substation, cen	tralized c	ontrol roo	m,	9					
п	utilities section	ns / captive power plants; Inter-distance between adjacent Co	lumns, S	torage tan	ks,						
	Tank dykes; Flare stack location (based on Prevailing up-wind direction), Design to keep it										
	smokeless, Sterile zone/area – Governing API /OISD Standards, Field cabins. Access to										
	firefighting fa	cilities, Fire tank capacity, Foam need assessment, Design t	o tackle s	simultaneo	ous						
	fire incidents, Protection of fire network and ensuring availability on demand.										
III	STORAGE T	ANKS: Fixed or Floating roof, Mounded Bullet tanks, Cu	yogenic s	storage ta	ıks	9					
	& their specia	I design requirements, Special designs along with breather	systems	, Lighten	ing						
	arrestors, Eart	h pits, other appurtenances – Manways for roots or tank side	Valls, Ca Alumini	um geode	sic						
	vents, Root ha	itches, Nozzies, Roois (flat-style, knuckie-style, of pitched),	Alumin ration of	floating r	ont						
	domes, Laddel	s, etc. Comfort factors vs inventory carrying cost, sale ope		inoating r							
IV	RISK SVSTE	MS AND FOUIPMENT : Fuel gas systems. Fuel oil no	etwork. H	lydrogen	zas	9					
IV	for generator	cooling in power plants: Plant hattery systems, Ammonia sy	stems, So	olid handl	ing	- ,					
	of coal and co	ke dust, Sulphur yard, Toxic gas loss of containment, etc, N	SDS of e	every stre	am						
	being handled	/ processed, Spent catalyst safe disposal ;Safe at Risk Ass	essment:	Overall r	isk						
	assessment usi	ng credible scenario along with preventive measures &syst	ems to be	e in place	to						
	eliminate / mir	imize loss of containment.									
V	ENGINEERING DESIGN PACKAGE : First document to be prepared and approved										
	between Process Engineering Team and Owner's representative. It shall cover not limited to - Si										
	Conditions (weather, wind rose, seismic activity, water table, etc.); System of measurement (in										
	FPS or MKS for flow of gas / liquid / steam, temperature, pressure, heat duty, interential										
	properties, etc.), Design considerations and margins, Design philosophies se	en us op	eraning ce							
	Control philos	Total	Instructi	onal Hou	rs	45					
n completion	of the course.	the students will be able to									
	CO1 t	Inderstand the importance of plant layout in mitigating risk o	n people,								
-	CO2 A	apply the placing equipment for ease of operability & maintain	nability								
Course	CO3 I	llustrate the storage tanks operation and usage at safety level.									
Outcome	CO4 A	analyze the usage of equipment at safety levels and their risk	assessme	nt.							
	CO5 A	apply the basic engineering design package.									
ГЕХТ ВООК	:										
ГІ]	Richard Muthe	r - "Facility Layout and Location: An Analytical Approach" (4th Editi	on, 2015)		1' "					
Г2	James M. Moo	re, John A. White - "Introduction to Facility Layout and Loca	tion: Fro	m Design	to Re	alization"					
(Ist Edition, 20	11).	An An-	lutical and	Suct	m					
13	lack Greene, C	harles Petrie, Joseph Ballard - "Facility Layout and Location	An Ana	iyucai and	i Syste						
DEFEDENCE	Approach" (1st	Edition, 1991).									
NEFERENCE	No:	Diaz "Plant I avout and Material Handling" (1st Edition 2))18)								
$\frac{1}{22}$	Sundersch S U	eram - "Facilities Design" (4th Edition 2010)									
22 II	when WI.	Process Modeling Simulation and Control for Chemical Eng	ineers N	IcGraw H	ill. Int	ernational					
	Student Edition	Second Edition 1996			,	A					
	Statem Danio					V					
No				TP	1						
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CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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B.TECH. Course Objective Unit I S C A E P II E g c c a ; ;	22CH5318 The student 1. Understa 2. Apply th 3. Analyze SAFETY SYS critical location Assembly point Early Event I process units, ELECTRICA generation an- control centre Emergency Point and plant sa Uninterrupted and maintenan FLARE SYS'	DESIGN SAFETY should be able to and the process safety systems both to prevent incident & to me principles 'safe at risk' to assess likely unsafe conditions in the risk mitigation measures. Description STEMS : Safety systems: Deployment of sensors (Toxicons, Fire network including elevated fire monitors, Egress systemt, Water curtain, eye wash requirement, Clean and cooler work of the curtain, eye wash requirement, Clean and cooler work of the curtain, eye wash requirement, Clean and cooler work of the curtain, Alarm rationalization, Partial or Total LSYSTEMS : Power systems – KV level, 3 phase and distribution network systems, MCC / PCC (motor control) substations, Electrical Energy Audits, Exergy analysis, Coower needs based on process criticalities (including power befe shut down), Load shedding, Essential and Non- et Power System (UPS), Load assessment for UPS, Battery bece aspects.	3 unit open unit open e, HC and teem, Esca vater supp nditions al Plant T single ph rol centre ogen desi pack up f sssential pank ;Ear	0 loss ration. I Thermal pe route oly ;Dove emerging rips revie mase, LT, e and po ign aspec or fire wa power 1	0) at and ctail g in ew. HT wer ts ;	3 nstructiona 1 Hours 9 9				
Course Objective Unit I S A E p II E g c c i i	The student 1. Understa 2. Apply th 3. Analyze SAFETY SYS critical location Assembly point Early Event I process units, ELECTRICA generation an- control centre Emergency Point and plant sa Uninterrupted and maintenant FLARE SYS'	should be able to and the process safety systems both to prevent incident & to m ne principles 'safe at risk' to assess likely unsafe conditions in the risk mitigation measures. Description STEMS : Safety systems: Deployment of sensors (Toxic ns, Fire network including elevated fire monitors, Egress syst nt, Water curtain, eye wash requirement, Clean and cooler w Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tot. L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contu-) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	inimize l unit oper tunit oper tem, Esca vater supp nditions al Plant T single ph rol centre ogen desi pack up f sssential pank ;Ear	loss ation. I Thermal upe route oly ;Dove emerging rips revie nase, LT, e and po ign aspec for fire wa	I and tail g in ew. HT wer ts ;	nstruction: 1 Hours 9 9				
Course Objective Unit I S A F D D T B g C C S C S C C S C C S C C C C C S C C C C S C C C S C C S C C S C C S S C S S C S S C S S C S	1. Understa 2. Apply th 3. Analyze SAFETY SYS critical locatio Assembly poir Early Event I process units, ELECTRICA generation an- control centre Emergency Point and plant sa Uninterrupted and maintenan FLARE SYS'	and the process safety systems both to prevent incident & to m ne principles 'safe at risk' to assess likely unsafe conditions in the risk mitigation measures. Description STEMS : Safety systems: Deployment of sensors (Toxic ns, Fire network including elevated fire monitors, Egress syst nt, Water curtain, eye wash requirement, Clean and cooler w Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tot L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contu-) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	, HC and tem, Esca vater supp nditions al Plant T single ph rol centre ogen desi pack up f sssential pank ;Ear	I Thermal ppe route oly ;Dove emerging `rips revie hase, LT, e and po ign aspec or fire wa	I and tail g in ew. HT wer ts ;	nstruction: <u>1 Hours</u> 9 9				
Course Objective Unit I S A F E P II E g c c F a i	2. Apply th 3. Analyze SAFETY SYS critical locatio Assembly point Early Event I process units, ELECTRICA generation an- control centre Emergency Point and plant sa Uninterrupted and maintenan FLARE SYS'	the principles 'safe at risk' to assess likely unsafe conditions in the risk mitigation measures. Description STEMS : Safety systems: Deployment of sensors (Toxic ns, Fire network including elevated fire monitors, Egress syst nt, Water curtain, eye wash requirement, Clean and cooler w Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tot L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contu) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	unit oper , HC and tem, Esca /ater supp nditions al Plant T single ph rol centre ogen desi pack up f ssential pank ;Ear	Thermal type route oly ;Dove emerging rips revie hase, LT, e and po ign aspec or fire was	I) at and tail g in ew. HT wer ts ;	nstruction <u>1 Hours</u> 9 9				
Unit I S A E D I E E E E E E E E E E E E E E E E E	3. Analyze SAFETY SYS critical locatio Assembly poir Early Event I process units, ELECTRICA generation an- control centre Emergency Point and plant sa Uninterrupted and maintenan FLARE SYS	Description Safety systems: Deployment of sensors (Toxic ons, Fire network including elevated fire monitors, Egress system, Water curtain, eye wash requirement, Clean and cooler we Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tota IL SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contrul) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power be fe shut down), Load shedding, Essential and Non- et I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	, HC and tem, Esca vater supp nditions al Plant T single ph ol centre ogen desi pack up f ssential pank ;Ear	Thermal type route oly ;Dove emerging rips revie hase, LT, e and po ign aspec or fire was	I) at and tail g in ew. HT wer ts ;	nstruction: <u>1 Hours</u> 9 9				
Unit I S C A E P TI E S C C S C S S S S S S S S S S S S S S	SAFETY SYS critical locatio Assembly point Early Event I process units, ELECTRICA generation and control centre Emergency Point und plant sa Uninterrupted and maintenan FLARE SYS	Description STEMS : Safety systems: Deployment of sensors (Toxic ns, Fire network including elevated fire monitors, Egress syst nt, Water curtain, eye wash requirement, Clean and cooler w Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tota L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contr) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	e, HC and tem, Esca vater supp nditions al Plant T single ph ol centre ogen desi oack up f ssential oack ;Ear	I Thermal ape route oly ;Dove emerging rips revie hase, LT, e and po ign aspec or fire was power 1	I) at and tail g in two HT wer ts ;	nstruction: <u>1 Hours</u> 9 <u>9</u>				
I S A E P TI E S C S S	SAFETY SYS critical locatio Assembly poir Early Event I process units, ELECTRICA generation an- control centre Emergency Point and plant sa Uninterrupted and maintenan FLARE SYS	STEMS : Safety systems: Deployment of sensors (Toxic ns, Fire network including elevated fire monitors, Egress syst nt, Water curtain, eye wash requirement, Clean and cooler w Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tot L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contu-) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	r, HC and tem, Esca vater supp nditions al Plant T single ph rol centre ogen desi pack up f ssential pank ;Ear	I Thermal upe route oly ;Dove emerging rips revie hase, LT, e and po ign aspec or fire was) at and tail g in tw. HT wer ts ;	9				
c # E p TI E g c E E a ; ;	critical locatio Assembly poin Early Event I process units, ELECTRICA generation and control centre Emergency Point and plant sa Uninterrupted and maintenan FLARE SYS ⁷	ns, Fire network including elevated fire monitors, Egress system nt, Water curtain, eye wash requirement, Clean and cooler wo Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tota L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contral) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power be fe shut down), Load shedding, Essential and Non- end I Power System (UPS), Load assessment for UPS, Battery be ce aspects.	tem, Esca vater supp nditions al Plant T single ph rol centre ogen desi ack up f ssential bank ;Ear	pe route oby ;Dove emerging rips revie hase, LT, e and po ign aspec or fire was	and etail g in ew. HT wer ts ;	9				
μ E TT E g c E a i J	Assembly point Early Event I process units, ELECTRICA generation and control centre Emergency Point and plant sa Uninterrupted and maintenan FLARE SYS	nt, Water curtain, eye wash requirement, Clean and cooler w Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tota L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contr) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	vater supp nditions al Plant T single ph rol centre ogen desi back up f ssential bank ;Ear	emerging rips revie hase, LT, e and po ign aspec for fire wa	tail ; in w. HT wer ts ;	9				
F p Π F g c c F a ;'	Early Event I process units, ELECTRICA generation and control centre Emergency Po und plant sa Uninterrupted and maintenan FLARE SYS	Detections system to forecast and forewarn on 'unsafe' co Cause & Effect diagram, Alarm rationalization, Partial or Tot. L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contr) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e l Power System (UPS), Load assessment for UPS, Battery b ce aspects.	nditions al Plant T single ph ool centre ogen desi ack up f ssential pank ;Ear	rips revie rips revie hase, LT, e and por ign aspector fire was power 1	ts;	9				
<u>р</u> П F g c с E а ; г	process units, ELECTRICA generation and control centre Emergency Po und plant sa Uninterrupted and maintenan FLARE SYS	Cause & Effect diagram, Alarm rationalization, Partial or 1 of L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contr) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e l Power System (UPS), Load assessment for UPS, Battery b ce aspects.	al Plant I single ph rol centre ogen desi ack up f ssential bank ;Ear	ase, LT, ase, LT, and po ign aspector fire wa	W. HT wer ts ;	9				
П F g c E a ; ; ; ;	ELECTRICA generation and control centre Emergency Po und plant sa Uninterrupted und maintenan FLARE SYS	L SYSTEMS : Power systems – KV level, 3 phase and d distribution network systems, MCC / PCC (motor contr) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e l Power System (UPS), Load assessment for UPS, Battery b ce aspects.	single pr ol centre ogen desi pack up f sssential pank ;Ear	ase, L1, e and po ign aspec or fire wa	HI wer ts;	У				
일 c E a ;1	generation and control centre Emergency Po and plant sa Uninterrupted and maintenan FLARE SYS	d distribution network systems, MCC / PCC (motor control) substations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e I Power System (UPS), Load assessment for UPS, Battery b ce aspects.	of centre ogen desi pack up f ssential pank ;Ear	ign aspection fire wa	ts ;					
c E a ;!	Emergency Po Emergency Po and plant sa Uninterrupted and maintenan FLARE SYS'	buostations, Electrical Energy Audits, Exergy analysis, Co ower needs based on process criticalities (including power b fe shut down), Load shedding, Essential and Non- e Power System (UPS), Load assessment for UPS, Battery b ce aspects.	back up f essential bank ;Ear	or fire wa	15,					
E a ;I	Uninterrupted and maintenan and maintenan	fe shut down), Load shedding, Essential and Non- e Power System (UPS), Load assessment for UPS, Battery b ce aspects.	ssential ank ;Ear	nower 1	ater					
a ;l	Uninterrupted and maintenan	Power System (UPS), Load assessment for UPS, Battery b ce aspects.	ank ;Ear		oad					
2	Ind maintenan	ce aspects.	unik ,Bui	th nit des	ign					
¥1	FLARE SYS			in pit dec						
<u>я</u> III	LINE DID	TEM: IP HP LIP and H2S flares Types - Single F	oint Flar	es (Sonio	: &	9				
s in s	Subsonic) Mr	Iti Point Flares Coanda Flares. Vent Tips, Enclosed Flares	and Air A	Assisted (Gas					
F	Flares :Pilot g	as system. Electronic ignition, Flare tip design, Flare noise	e reductio	on, Fire I	Ball					
р	revention, Sr	nokeless flare at worst weather conditions, Radiation impact	et zone, l	Flare rele	ase					
S	cenarios (fire	, blocked mode, partial and total power failure), Nitroger	1 purge,	flare hea	der					
n	etwork desig	n; Safety margins in design, Assessing flare loss in a multi	units con	nplex wh	iere					
n	netering indiv	idual headers is near impossible ;Flare gas recovery and Zero	Flare rel	ease.						
IV R	risk mitig	ATION MEASURES : HAZOP (Hazard and Operal	bility Stu	dy), HAZ	ZID	9				
(H	Hazard identi	fication), HAZAN (Hazard Analysis), EERA (Emergency e	scape rou	ite analys	15),					
S	SIL (Safety Integrity levels) study, QRA (Quantitative Risk Assessment) and Dispersion studies.									
ç'i	Trip reset (Field and Control Room) and MSDS (Material Safety Data Sheet) for all streams being handled Bow Tie Analysis Risk Evaluation using & x & Matrix EMEA (Failure Modes									
b	being handled, Bow Tie Analysis, Risk Evaluation using 8 x 8 Matrix, FMEA (Failure Modes And Effects Analysis) Insurance premium assessment and measures to minimize Best practices									
A	Undeted dog	marysis), insurance premium assessment and measures to imm	iiiiize ,D	est practi						
VP	POCESS CO	NTPOL & INSTRUMENTATION: Granbic design	& groupi	ng to		9				
, in	ninimize user	latency in process control :Designed for safety through redun	dancy rig	tht from						
de	edicated impu	ilse lines to card level, PLC (Programmable Logic Controls),	Cascadeo	l Control,						
P	rocess Histori	an, Online reporting by exception, Inferential predictions ;Us	e of AI /	ML in						
ca	ontrolling pla	nt within best operating zone,								
		Total	Instructi	onal Hou	rs	45				
n completion o	of the course,	the students will be able to								
	CO1 [Inderstand the safety systems both to prevent incident & to m	inimize l	oss.						
Course	CO2	Apply the safety in electrical systems.								
Outcome	CO3 I	Ilustrate the flare systems and their safety.								
L	$\begin{array}{c} CO4 \\ CO5 \end{array}$	Analyze the risk analysis and mitigation.		ductaire						
	CO5 A	apply the control systems and their safety usage in different	process in	idustries.						
TEXT BOOK:	4 771	IID DI (A II II - 1 for Laborate Cafee Decise	Second	Edition" (1008)					
	revor A. Klet	z - "Process Plants: A Handbook for Inherently Safer Design,	Second I	th Applic	1990).	Fourth				
12 D	aniel A. Crov	vI and Joseph F. Louvar - "Chemical Process Safety: Fundam	entais wi	in Applie	ations.	, routh				
	dition (2019). III - Crta Danian fan Smaan Santamall (2000)								
	rinen Hauptm	anns - Safety Design for Space Systems (2009).								
	5: Annia D. Mala	n "Handbook of Fire and Explosion Protection Engineering	Principle	s: for Oil	Gas	Chemical				
	omis r. Nola ad Related Fa	n - nanuoook of File and Explosion Frotection Engineering cilities" - 2nd Edition (2011)	imeipt		, 043,	Unonnoul				
27 Er	rank P Lees	"I oss Prevention in the Process Industries: Hazard Identific:	ation Ass	sessment	and Co	ontrol" - 3rd				
۲۱ کے ۱۲	dition (2005)	Loss i revention in the i rocess industries. mazara identified								
	CPS (Center 1	for Chemical Process Safety) - "Guidelines for Engineering D	Design for	Process	Safetv					
E E	dition (2012)	for enclinear rocess care(j) Guidennes for Engineering E			j	-				
pro					1)				







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DEPARTMENT OF CHEMICAL ENGINEERING R-2022 REVISION COURSES

SL.NO	COURSE	NAME OF	EXISTING SYLLABUS	SUGGESTIONS AND	ACTION	% OF
	CODE	THE		COMMENTS GIVEN BY	TAKEN	CHANGE
		COURSE		EXPERTS		
1.	22CH5251	Chemical	UNIT-I- catalyst preparation.	Recommended to incorporate the	Incorporated	20
	Batch	Reaction	Nature of catalysts, surface area	following,		
	admitted	Engineering	and pore-volume distribution.	UNIT-I- General definition of		
	from 2022	- I	Kinetic studies in batch reactor.	catalysts, Solid catalysts,		
	- 2023		UNIT-IV-Models for explaining	Components of catalyst, Industrial		
	onwards		kinetics; Chemical reaction	catalysts, Preparation of solid		
			volume and surface models;	catalysts, Precipitation and co-		
			controlling resistances and rate	precipitation methods, Sol gel		
			controlling steps; time for	method, Supported catalysts.		
			complete conversion for single and	UNIT-IV- Shrinking core model –		
			mixed sizes, fluidized and static	Gas film controlling – Ash layer		
			reactors	controlling controlling – Shrinking		
				spherical particles – Fluidized bed		
				reactor		
2	22CH5001	Mass	Separation of binary mixture using	Recommended to incorporate the	Incorporated	20
	Batch	Transfer	Steam distillation	following,		
	admitted	Operations	Separation of binary mixture using	• Separation of binary		
	from 2022	Lab	Packed column distillation	mixture using Simple distillation		•
	- 2023	-	Measurement of diffusivity			
	onwards		Drying characteristics of Tray	Mass transfer		
			dryer	characteristics of Bollman		
			Drying characteristics of Rotary	Extractor		
			dryer			
			Water purification using ion			
			exchange columns			
			Mass transfer characteristics of			
	1.2		Rotating disc contactor			
			Evaporation studies (Single effect)		1. A A A A A A A A A A A A A A A A A A A	
		· · · · ·	Evaporation studies (Multiple			- A. A.
			effect)			
					T 1	20
3	22CH5203	Process	UNIT-I- INSTRUMENTATION	Recommended to incorporate the	Incorporated	20
	Batch	Instrumenta	Types and principles of	following,		
21 BC	admitted	tion	measurement of temperature,	UNIT-I- PRINCIPLES OF		
	from 2022	Dynamics	pressure, fluid flow, liquid weight			



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· · · · ·	2022	and Control	and weight flow rate wiseesity	MEACUDEMENT.	Г — — — — — — — — — — — — — — — — — — —	r
	- 2025	and Control	and weight now rate, viscosity,	MEASUREMENT:		
	onwards		thermal conductivity humidity of	Introduction to measurement and	• · · · · ·	-
			inernial conductivity, number of	its hardware element - Transducer		
			gases.	function and types – Static and		
			UNIT-II- Laplace transformation	Dynamic characteristics of		
			and its application in process	measuring device - Principles of		
			control Transform of standard	measurements and classification of		
			functions - derivatives and	process instituments transmitter		
-			integrals - inversion theorems -	LINIT II. Transform of standard		
			Open loop system - First order	functions derivatives and		
			systems and their transient	integrals inversion theorems		
- 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10			response for standard input	Open loop system Transfer		
			functions, first order systems in	functions Exprine functions		
			sorias linearization and its	tanctions - Forcing functions -		
			series, integrization, and its	Step, pulse, impulse and sinusoidal		
			application in process control,	UNIT-III- OFFSET calculation		
			dynamics, transportation las	UNIT-IV- Process reaction curve,		
			UNIT III. Cleard lear control	INC tuning.		
			UNIT-III-Closed loop control			
		ta an an an an an an an an an an an an an	systems, development of block		a ta ang ang	
			diagram for feed-back control			
			systems, servo and regulatory			
			problems, transfer function for			
			controllers and final control			
			element, principles of pneumatic			
			and electronic controllers,		1.1.1	<i></i>
			transient response of closed-loop			
			UNIT IV Lites heating to			
-			UNIT-IV-Introduction to			
			frequency response of closed-loop			· · · · ·
			systems, control system design by			
			irequency response techniques,			
			bode diagram, stability criterion,			
			tuning of controllers Z-N tuning			
	·	Þ	rules, C-C tuning rules			

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Department of Chemical Engineering R-2022 NEW COURSES INTRODUCED

S. No.	Course code	Name of the Course
· 1	22CH5207	Petroleum Geology
2	22CH5306	Pinch Technology
3	22CH5307	Biochemistry
4	22CH5308	Bioprocess Technology
5	22CH5309	Fermentation & Bioprocessing

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NEW COURSES

Programme	Course Code	Name of the Course	L	т	Р	С				
B.TECH.	22CH5306	PINCH TECHNOLOGY	3	0	0	3				
	The studer	t should be able to								
Courses	1. Learr	the Concept and fundamentals of Pinch process.								
Course	2. Exam	ine how each Pinch methodology works.								
Objective	3. Apply	/ each resource analysis of various processes.								
Unit		. Description			Inst	ructional Iours				
I	INTRODUC	TION: Thermodynamic review of the process, Pinch Con in grid representation, Threshold problems, capital cost imp	ncept. signil olication of	ficance of the pinch		9				
п	TARGETIN shell targetin	G: Heat exchanger networks, energy targeting, area targeti g, cost targeting, super targeting, and continuous targeting.	ng, unit tarş	geting.		9				
ш	PINCH ME match matrix	THODOLOGY: Problem representation, temperature enth Heat content diagram, Temperature interval diagram.	alpy diagra	m, simple		9				
IV	PINCH DES	GIGN AND OPTIMIZATION: Networks for maximum end, Flexibility criteria of the pinch. CP table, heuristics, opt	nergy recov imization o	ery, Pinch f heat		9				
v	ENERGY A	ND RESOURCE ANALYSIS OF VARIOUS PROCES	SES: Batch	process,		9				
2	distillation process, evaporation process, reaction process, process using mass separating agen									
		Tota	I Instructio	nal Hour	s	45				
In completion	of the cours	e, the students will be able to								
on compication	COL	Understand the pinch concept and process thermodynam	nics.							
	CO2	Identify minimum energy targets.								
Course	C03	Classify different choices and constraint during heat exe	change netv	vorking.						
Outcome	CO4	Apply strategies for retrofitting existing process plant, i multiple processes	ntegration	of energy	demai	nds of				
	CO5	Analyze the concepts in various chemical processes.								
TEXT BOOL	K :	-								
TI	V. Uday Sh	enoy" Heat Exchanger network synthesis" Gulf Publishin	g Co, USA	, 1995						
T2	Prasad, R.,	Petroleum Refining Technology", Khanna Publishers, New	v Delhi, 20	00.	CD	" Drose St				
T3	J. H. Garv.	H. Hanwerk and M. J. Kaiser, Petroleum Refining Techno	ology and E	conomics	CR	11055, 50				
	Edition, 200)7.								
REFERENC	ES:		iont use of	'Energy"	Institu	ution of				
R1	D.W. Linnh	off et al., "User Guide on Process Integration for the effort	cient use of	Lifergy .	moure	inch of				
	Chemical E	ngineers, U.K., 1994.	au Hill M	W Vork	1988					
R2	James M. D	ouglas "Conceptual Design of Chemical Process", McGr	Tata MaC	row Lill	New I	Delhi 1977				
R3	Anil Kumar	, "Chemical Process Synthesis and Engineering Design"	Tata Meo	Co 2nd	editi	on 1988				
R4	Wayne C. E	dmister, "Applied Hydrocarbon Thermodynamics", Gull	Publishing	g C 0., 2m	cuit					

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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10.744 Chairman - BoS OHE - HICET



Programme		ourse	Name of the Course	L	T	Р	С								
B.TECH.	220	H5307	BIOCHEMISTRY	3	0	0	3								
	The	1e student should be able to Learn the fundamentals of Biochemical Processes and Biomolecules. Examine the Structure and properties of Important Biomolecules. Illustrate the Functions of Proteins, Enzymes, introduction to biocatalysts, metabolic pathways. Description IRODUCTION TO BIOMOLECULES - CARBOHYDRATES: Basic principles granic chemistry, role of carbon, types of functional groups, chemical, nature of water, and biological buffers, bio molecules structure and properties of Carbohydrates (mono, oligo & polysaccharides) Proteoglycans, glucosaminoglycans. mutarotation, glycosidic d, reactions of monosaccharides, reducing sugars. 9 RUCTURE AND PROPERTIES OF OTHER BIOMOLECULES : Structure and serties of Important Biomolecules. 9 ids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, solipids, sphingolipids, cholesterol, steroids, prostaglaridins. 9 tein: Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of unization primary, secondary, tertiary and quaternary structures, glycoproteins. 9 roteins, Determine of primary structure. 9 TABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM : Functions roteins, Enzymes, introduction to biocatalysts, metabolic pathways, primary and 9													
6	1.	Learn t	he fundamentals of Biochemical Processes and Biomolecul	CS.											
Objective	2.	Examin	e the Structure and properties of Important Biomolecules.												
	3.	Course Code Name of the Course L T P C 22CH5307 BIOCHEMISTRY 3 0 0 3 The student should be able to I. Learn the fundamentals of Biochemical Processes and Biomolecules Image: Course Co													
Unit			Description			Instr	ours								
1	INTRODUCTION TO BIOMOLECULES - CARBOHYDRATES: Basic principles af organic chemistry, role of carbon, types of functional groups, chemical, nature of water, 9 pH and biological buffers, bio molecules structure and properties of Carbohydrates (mono, 9 di, oligo & polysaccharides) Proteoglycans, glucosaminoglycans. mutarotation, glycosidic 9 cond, reactions of monosaccharides, reducing sugars. 9 STRUCTURE AND PROPERTIES OF OTHER BIOMOLECULES : Structure and properties of Important Biomolecules. 9 Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, 9 glycolipids. sphingolipids, cholesterol, steroids, prostaglandins. 9 Protein: Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of organization primary, secondary, tertiary and quaternary structure, glycoproteins, ipoproteins. Determine of primary structure. 9 METABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM : 9														
П	STRUCTURE AND PROPERTIES OF OTHER BIOMOLECULES : Structure and properties of Important Biomolecules. Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglandins. Protein: Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of organization primary, secondary, tertiary and quaternary structures, glycoproteins, lipoproteins. Determine of primary structure. METABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM : Function of Proteins, Enzymes, introduction to biocatalysts, metabolic pathways, primary and secondary metabolites. Interconnection of pathways and metabolic regulation. Glycolysis, TCC 4.														
	META of Prot second	pids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, vcolipids. sphingolipids, cholesterol, steroids, prostaglandins. otein: Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of ganization primary, secondary, tertiary and quaternary structures, glycoproteins, oproteins. Determine of primary structure. ETABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM : Functions Proteins, Enzymes, introduction to biocatalysts, metabolic pathways, primary and condary metabolites. Interconnection of pathways and metabolic regulation. Glycolysis, 'A cycle, gluconeogenesis, pentose phosphate shunt & glyoxalate shunt. TERMEDIARY METABOLISM AND REGULATION : Fatty acid synthesis and idation, reactions of amino acids, deamination, transamination and decarboxylation, urea													
	NTEI oxidati cycle, l espira	RMEDI on. reac Bioeners tory cha	ARY METABOLISM AND REGULATION : Fatty a tions of amino acids, deamination, transamination and dec getics - High energy compounds, electronegative potential in, ATP cycle, calculation of ATP yield during oxidation	cid synthe arboxylati of compo of glucose	sis and on, urea unds, and fatt	ı y	9								
V F s r	PROT eccretio	EIN TR on; Fold or-media	ANSPORT AND DEGRADATION : Protein targeting ing, Chaperone and targeting of organelle proteins, Proteinted endocytosis, turnover.	g, signal se n degradat	quence ion,		9								
			Total Ir	struction	al Hour	5	45								
completion of	of the	course,	the students will be able to												
	COI		Acquires knowledge on basic concepts on carbohydrates												
c	CO2		Understand the concepts of proteins .												
Dutoeme	CO3 Illustrate the knowledge on importance of nucleic acids.														
Jacome	CO4		Analyze the knowledge on lipids.												
	CO5		Apply the concepts on intermediary metabolism and the	ir pathway	'S.										
EXT BOOK:															
	Lehnin Comp	nger Prin any 201	nciples of Biochemistry 6th Edition by David L. Nelson,	Michael N	1. Cox	W.H.Fr	eeman ar								
	Satvar	aravana	U. and U. Chakeranani, "Biochemistry" 3rd Rev. Edition	Books &	Allied	(P) I td	2006								
i	Rasto	i. S.C.	"Biochemistry" 2 nd Edition. Tata McGraw-Hill 2003	, books a	. uneu	(i / Liu	. 2000								
EFERENCES	S:	,	, 2003.												
	Outlin Wilev	es of Bi	ochemistry, 5th Edition: By E E Conn, P K Stumpf, G B is, New York, 1987.	ruening ar	d R Y I	Doi. pp	693. Joh								
	Berg.	Jeremv	M. et al. "Biochemsitry", 6th Edition, W.H. Freeman &	Co. 2006											
1	Murra	V. R.K	etal "Harper's Illustrated Biochemistry" 31st Edition A	AcGraw 11	11 201	8									
,	Voet, I	D. and V	oet, J.G., "Biochemistry", 4th Edition, John Wiley & So	ons Inc.,20)10.	0.	1								
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	C	ourse Code	Name of the Course	L	т	Р	С
B.TECH.	220	H5308	BIOPROCESS TECHNOLOGY	3	0	0	3
	The	studen	t should be able to				
6	1.	Under	stand the fundamentals of bioprocesses				
Course	2.	Exam	ine the production process of biomolecules				
Objective	3.	Apply	the strong foundation in bioreactors.				
Unit			Description			Ins	tructiona lours
1	INTR and b stoich	RODUC iochemi	'chemic h. the s	1	9		
n	MED Sterili batch of air	IA FOI ization: and cor steriliza	RMULATION AND DEVELOPMENT : Media form Methods of heat sterilization of media, thermal death kine atinuous sterilization. Air Sterilization: Methods of air ster ation, solid and liquid handling. Industrially fermented bro	ulation. Med tics, design c ilization, med th	ia riteria, chanism		9
ш	UNDI Classi biorea reacto Mecha manag	ERSTA ification actors fo r (PFR) anical a gement	g flow cration: for waste		9		
IV	TRAN the equ diffusi and ap	NSPOR uations ion, mas	T PROCESSES: Diffusivity and mechanism of mass to of mass transport by diffusion-stationary and unsteady mass transfer coefficient, macroscopic balances for mass trans of heat transfer-mode of heat transfer-conduction, converse.	ransfer - deri iss transport l sport. Mecha vection and ra	ivation o by inisms adiation	ſ	9
v	BIOE proces making ethical	THICS s of bio g, Defin issues.	AND BIOSAFETY: Introduction to Bioethics. Social technology involved in generating new forms of life for in ition of Biosafety. Biosafety for human health and enviro Use of genetically modified organisms and their release i	and ethical is formed decis nment. Socia nto the enviro	ssues, th sion Il and onment.	e	9
completion	of the	COULSE	the students will be able to Total	Instruction	al Hour	,	45
	COL	-our se	Inderstand the fundamental knowledge on him	1			
-	CO2		earn the the production process of the second states of the	nnology			
Course	COL		Cather knowledge on the process of biomolecules.				
Outcome	COA		Sauler knowledge on the operations of bioreactors and the	eir purposes			
H	C04		illustrate the transportation processes in reactors and their	behaviors			
EVTPOOL	·····	-	apply knowledge on the biosafety and information on bio	pethics.			
	: Bailey 1986.	y, J. E.,	and D. F. Ollis. Biochemical Engineering Fundamentals.	2nd ed. New	York, I	McGrav	w-Hill,
2	H. W.	Blanch	and D. S. Clark, Biochemical Engineering, Margal, Date	kan las 100	(
3	Paulir	ne M. D	oran Bioprocess Engineering Principles 2nd ad El	ker me., 199	0. F 1 -		1
EFERENCE	S:		entry broghoeess Engineering Frincipies. 2nd ed. Elsevier	Science &	echnol	ogy Bo	oks. 1995
1	Transp 2002	port Pho	enomena, by Bird R.B., Steward W.E., and Lightfoot E.N	., John Wile	y & sons	, Inc.,	New Yor
2	C J Go Publis	eankopl	is, Transport Processes and Separation Processes Princip	les, 4th Editi	on, New	Jersey	, PHI
3	Мигта	y, R.K.	etal "Harper's Illustrated Biochemistry" 31st Edition	AcCourse 1171	2010		
4	Voet,	D. and	Voet, J.G., "Biochemistry", 4th Edition, John Wiley & So	ons Inc.,2010	, 2018.).		





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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course	Name of the Course	L	Т	Р	С
B TECH.	22CH5309	FERMENTATION AND BIOPROCESSING	3	0	0	3
Diffeen	The studen	t should be able to				
	1. Under	stand the fermentation and its kinetics				
Course	2. Exam	ine the structural, functional properties of microbes.				
Objective	3. Desig	n fermenter with auxiliaries.			1	
Unit		Description			In	structional Hours
I	FERMENT/ potential, sol Biosensors fr	ATION PROCESSES: Importance of fermentation, Ferme id-liquid fermentation, solid state fermentation, Kinetics of fer- per fermentations, Production processes in fermentation.	ntation an irmentatio	d redox ms,		9
11	MICROBIA and ex situ, M growth, Grow	L GROWTH KINETICS: Diversity of patterns of micr Aicrobial growth under homogeneous conditions. Heterogeneous with kinetics, Derivation of mathematical models, and identifi	obial grov ous micro cation	vth in si obial	tu	9
ш	DESIGN OI stoichiometry Comparison	FERMENTERS: Fermentation processes and microorg y, Mass balances and design for batch, continuous and fed-ba of batch, continuous and fed-batch reactors. Heat generation industrial fermentation processes	anisms, K itch reacte and heat l	inctics ors, palance:	and s,	9
IV	INSTRUME Automation Oxygen, Pres	ENTATION AND CONTROL: Common Instruments for - Temperature, Gas Flowrate, Liquid Flowrate, Off Gas Ana ssure, Foam Level, Stirring, Redox Potential, Advanced Inst	r Process lysis, pH, rumentati	Dissolv on for	ed	9
V	FERMENT.	ATION AND COMMODITY PRODUCTS: Engineerin	g of Secre	etory trial		9
	Pathways, pr	oduction of heterologous proteins, rungal, yeast refinements,	i or maas			
	products.	Total	nstructio	nal Ho	urs	45
)	n of the cours	a the students will be able to				
on completion	CO1	Understand the structural functional properties of microbe	5.			
	C01	Learn the the growth kinetics of microorganisms.				
Course	<u>CO2</u>	Gather knowledge on the operations of bioreactors and the	r purpose	s		
Outcome	C01	A poly knowledge on the operation of control systems in fe	rmentatio	n and bi	oproce	ss industry.
	C04 C05	Acquire knowledge on the commodity, fermentation produ	ction and	their pr	oductio	no
TEXT BOO	K٠	patientajo				
TI	Essentials i	n Fermentation Technology, Aydin Berenjian, Springer ,201	9.			
T2	Principles of Hall, Perga	of Fermentation Technology (Second Edition), Peter F. Stan mon, 1995.	bury, Alla	n Whita	aker an	id Stephen J.
T3	Pauline M.	Doran. Bioprocess Engineering Principles. 2nd ed. Elsevier	Science &	& Techi	nology	Books. 1995
REFERENC	TES:					
RI	Fermentati	on and Biochemical Engineering Handbook; Editors-in-Chie	f: Henry	C. Vog	el and	Celeste M.
R2	Fermentati	on Biotechnology: Principles, Processes, and Products (Pren Vard Prentice Hall, 1989	tice Hall	advance	ed refe	rences series
R3	Anil Kuma	r. "Chemical Process Synthesis and Engineering Design", T	ata McGr	aw Hill	New I	Delhi, 1977.
R4	Wayne C.	Edmister, "Applied Hydrocarbon Thermodynamics", Gulf P	ublishing	Co., 2n	d edit	ion, 1988

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course		Nam	ie of the Course		١.	Т	Р	C							
B.TECH.	22CH5310		AIR POLLU	TION ENGINE	ERING	3	0	0	3							
Difference	The studen	at should be	able to													
	1. Learn	about Air P	ollution, effec	ts of air pollution	, Global effects	1. 										
Course	2. Exam	he student should be able to Learn about Air Pollution, effects of air pollution, Global effects. Examine the Sampling of pollutants, Meteorology and air pollution, Atmospheric st Analyze the dispersion and Prediction of air quality. Description TRODUCTION: Introduction to Air Quality, An Overview of the Clean Air Act nendments; Air Pollution Regulatory Framework - Regulatory System Laws and gulations - Clean air Act - Ambient Air Quality Standards in India; Properties of Air Ilutants; Sources and effects of air pollution. ARTICULATE AIR POLLUTION: Particle Collection mechanisms FECTS OF AIR POLLUTION: Effects of Air Pollution on human beings, plants imals and Properties. Global Effects-Green house effect, Ozone depletion, heat island, orms, Automobile pollution sources and control, Photochemical smog, Future engines a els IR POLLUTION CONTROL: Air Pollution control- at source-equipments for contro- pollution-For particulate matter-Settling chambers-Fabric filters-Scrubbers-Cyclones-extention precipitators.														
Objective	3. Analy	Learn about Air Pollution, effects of air pollution, Global effects. Examine the Sampling of pollutants. Meteorology and air pollution. Atmospheric stability Analyze the dispersion and Prediction of air quality. Description Instructional Hours RODUCTION: Introduction to Air Quality. An Overview of the Clean Air Act endments; Air Pollution Regulatory Framework - Regulatory System Laws and ulations - Clean air Act Ambient Air Quality Standards in India: Properties of Air 9 RTICULATE AIR POLLUTION: Particle Collection mechanisms - Fluid particle 9 namics - Particle size Distribution - Efficiency -Gravity Settling chambers Cyclones- 9 FECTS OF AIR POLLUTION: Effects of Air Pollution on human beings, plants and 9 nals and Properties. Global Effects-Green house effect, Ozone depletion, heat island, dust 9 s s 9 POLLUTION CONTROL: Air Pollution control- at source-equipments for control of 9 pollution-For particulate matter-Settling chambers-Fabric filters-Scrubbers-Cyclones 9 torostatic precipitators, For Gaseous pollutants-control by absorption-adsorption 9														
Unit				Description				Ins	Hours							
I	INTRODUC Amendments Regulations	CTION: In s; Air Polluti – Clean air /	ntroduction to on Regulatory Act –. Ambien ffects of air p	Air Quality: An Framework - R t Air Quality Sta ollution.	Overview of the egulatory Syste ndards in India	e Clean Air / m Laws ar ; Properties o	Act id of Air		9							
11	PARTICUL Dynamics – Electrostatic	ATE AIR I Particle size precipitator	OLLUTION Distribution - s and Bag hou	l: Particle Co - Efficiency –Gr ises.	ollection mecha avity Settling cl	nisms– Eluic nambers Cyc	l particle lones-		9							
ш	EFFECTS (animals and storms, Auto	OF AIR PO Properties. Comobile poll	LLUTION: Global Effects ation sources a	Effects of Air -Green house ef and control, Pho	Pollution on hu fect, Ozone dep tochemical smo	iman beings, letion, heat i og, Future en	plants a sland, di gines an	ind ust d	9							
IV	AIR POLLI air pollution- Electrostatic scrubbers-se	orms, Automobile pollution sources and control, Photochemical smog, Future engines and els IR POLLUTION CONTROL: Air Pollution control- at source-equipments for control of pollution-For particulate matter-Settling chambers-Fabric filters-Scrubbers-Cyclones ectrostatic precipitators, For Gaseous pollutants-control by absorption-adsorption rubbers-secondary combustion after burners, Working principles advantages and sadvantages. POULUTY SAMPLING AND MONITORING:														
V	disadvantage AIR QUAL	crubbers-secondary combustion after burners, Working principles advantages and lisadvantages. AIR QUALITY SAMPLING AND MONITORING: Stack sampling, instrumentation and methods of analysis of SO2, CO etc, legislation for control of air pollution and automobile														
	pollution.	, or unarjoin			То	tal Instruct	ional Ho	urs	45							
			to will be ab	la ta												
n completion	n of the cours	se, the stude	nts will be ab	d abaractoristic	e of air polluta	nts and basi	c concer	ots of a	ir quality							
	COI	Understand standards.	d the nature a	nd characteristic	s of all politica	· · · ·		rol da	vices to meet							
Course Outcome	CO2	Identify, fo	standards.	solve air pollutio	on problems us	ing air poliu		uor de	imale and							
	CO3	Gather kno Properties	owledge on th	e Effects of Air	Pollution on h	uman beings	s, plants	and an	Inidio and							
	CO4	Control th	e air pollutior	n in industries us	ing various eq	uipments.		Court	un La							
	C05	Acquire k	nowledge on 1	the Stack sampl	ing, instrument	ation and m	ethods o	r analy	515							
EVT POOL	2.	, require in	0													
	H.S. Peavy	, D.R. Row	& G. Tchoba	noglous, Enviro	nmental Engin	eering, Mc	Graw Hi	II Inter	mational Editio							
~>	Anjanevulu	u, Y., Air Po	llution and C	ontrol Technolo	gies, Allied Pu	iblishers (P)	Ltd., in	ula, 20								
3	Wang, L.K	Parelra, N	I.C., Hung, Y	.T., Air Pollutio	n Control Engi	neering, To	ky0, 200	H.								
FFFPFNC	ES:															
EFERENC	David HE	Lin Bela	G., Liptak Ai	ir Pollution, Lw	eis Publishers,	2000.										
0	Stern A C	Air Pollut	ion (Vol.1 - V	ol.VIII), Acade	mic Press, 200)6.			1 Edition John							
2	Hack D M	and Farra	uto, R.J., Cata	alytic Air Pollut	ion Control: C	ommercial	Fechnol	ogy, 21	nd Edition John							
8	Wiley Sons	s, 2012	ntol nollution	and control B	utterworth-Hei	nemann, 4t	n edn, 19	997.								
(4	Pierce, J.J.	, Environme		and control, D												





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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	1	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

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Programme	Course Co	ode		Name	eofth	e Cou	rse				L	T	P		С
B.TECH.	22CH620	1	TRA	ANSPO	ORT P	HEN	OMEN	A			3	0	0		3
	The studen	t should b	e able t	D						11		aran yang yang yang yang yang yang yang ya			
Course	1. Under	stand the	mass,	mome	ntum	and	energy	/ trai	spor	t at	mol	ecular,	mic	rosc	opic an
Objective	macro	scopic leve	1							-					
	2. Expres	ss their kno	wledge t	o deterr	nine v	/elocit	y, temp	oeratu	re and	1 cor	ncentr	ation pr	ofile	5.	
	3. Illustra	ate the idea	about e	equation	ns of c	change	and th	eir ap	plicat	tions	•				
Unit			•		Desc	riptio	n				•			Insti Hou	ructiona rs
I	MOMENT	UM TRA	NSPOR	T:Vis	scosity	y, temp	erature	e and	press	ure e	effect	on visco	osity shell		9
	of gases a	ana nquia	s, New	Shoor	iaw,	meena	veloci	tv die	tribu	tions	in t	falling f	īlm		
	momentum	balance i	nemou,	Shear	sues	s anu	VEIDEN	ty uis	niiou	none	5 111 1	anng i	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	circular tub	e.	DT .	Thomas	1	ductiv	the ton	nnorat	uro o	n.l.r	rocci	ro offer	t on		9
11	ENERGY	TRANSPO		I nerma	u con		11y, 1en	iperat	honin	ma j) esse	ne chec	t On		
	thermal con	ductivity (r gases	and ng	uius, i	rourie	r s law	, meer	distri	huti	on in	solide	heat		
	shell energy	y balance	nethoa.	Energ	y nux		nh anga	ature	uisui	oun	on m	sonus,	ncai		
	conduction	through co	mposite	wans,	cyline	ders, s	prieres.	1		offo	at on	diffuci			0
111	MASS IR	ANSPUR		TUSIVITY	y, ten	iperati	ire and	i pres	sure	ene	a M	uniusi	vny,		y .
	Fick's law,	mechanis	n or m	ass trai	nsport	, snen	mass	Dalan	ce m	etho	u, ivi	ass mux	anu		
	concentratio	on distribu	ion in s	onds an		amina	r now.	DDT	CAT		IC.	Momon			0
IV	EQUATIO	INS OF	CHAN	IGE A	AND		IK A	(PPL)			ND: T	Nomen	um.		. 9
	Equations of	of continui	y, moti	on and	mech	anical	energy	y (150	nerm	iai),	Energ	gy: Equa			
	of energy (1	non-isothei	mal). N	lass: E	quatio	ons of (change	(muit	1-con	npor	ient),	equation	15-01		
	continuity f	for each sp	ecies, ec	uation	of ene	ergy (r	nulti-co	ompoi	nent).		•	<u> </u>	•		•
\mathbf{V}^{*}	TRANSPOL	RT IN TU	RBULE	NT FL	ows	AND	ANAL	OGIE	S: C	omp	arisor	i or lan	innar		9
	and turbul	ent flows,	time-s	mooth	ed ec	quation	is of	chang	ge, e	mpii	ical	express	ions.		
	Comparisoi	n of lamina	r and tu	rbulent	hydro	odynai	nics.			/		·			45
									lota	IIns	struci	lonal H	ours		45
On completio	n of the cou	rse, the stu	idents v	vill be	able t	0			1		C	1		1	lon min
	CO1	Inderstand	the me	:hanisn	ns of i	mome	ntum, h	neat ai	nd ma	ass t	ransie	er each a	it me	necu	har, mici
Course	a	nd macro l	evels.			•	•		<u> </u>						
Outcome	CO2 C	Develop ma	ithemat in distri	ical mo bution	odels for flo	to det	ermine nnels.	trans	fer fl	luxes	s and	velocit	y, te	mpe	rature ar
	CO3	Determine	the int	errelati	onship	p betv	veen t	he m	olecu	ılar,	micr	oscopic	and	l ma	acroscop
	CO1 A	nnly the o	unition	of char	age for	$r diff_{0}$	rent co	ordin	ate sv	sten	ne and	I solve o	f mc	men	tum ma
	C04 /	apply the e	quation	or char	ige io	une		orum	ne sy	sten	is and	1 301 40 0	n me	men	tuni, ma
	CO5 A	Ind fical lia	isport p		monoi	onal	nolucio	and	scale	fac	tore	for equa	tion	of	hange f
		Suppry the solution	oncept	s of un	mensi	Unar c	11/1/1315	s and	scare	, iac	1015	or equa	non	01 0	mange i
	<u> </u>	interent co	Junat	system	15.										
TEXT BOOK		<u>C</u> , , , , ,	UT	11.1	с. , т	- 117	6 T	in out F	thana		<u></u>	dEdn	Johr		
TI	Bird, R. B., Wiley 200	, Stewart, V 6	v. E. an	d Light	toot, E	⊐. W.,	"I rans	port P	meno	men	a , 21	ia can.,	JOIII		•
Т2	Brodkey R	S and H	ershev	HC	"Tran	sport I	henor	nena"	McC	iraw	-Hill	1987.			
DEFEDENCI	FS.		eroney,	· · · · · · · · · · · · · · · · · · ·	1 run										
D1	Wolty I	D Wilson	D V	/ and	Wiel	C C	W	Fund	amen	tale	of M	Iomentu	mF	leat	and Ma
KI	Tronofor"	N., WIISOI 5th Edition	, N. W John V	n, and Viley 7	VV ICH	no, C. Zorlz 7	008	r unde	amen	uis	UT IV	iomentu		cui	
D 2	Clatter T	C "A A	and Tree	viley, I	Dham	OIK, 2		brida	o I Ini	Vorc	ity D.	ess I on	don	100	9
<u>K2</u>	plattery, J.	S., Auvar		ansport	rnent	in Cl	, Cam	One	ation	vers	ny FI Ird. E	$\frac{1}{2}$	ntico	199 Hol	$\frac{y}{1}$ of Ind
R3	C. J. Gean New Delhi	коронs, " , 1993.	ranspo	TE Proc	esses	in Ch	emical	Oper	auon	5,3	nu E	un., rie	inice	114	
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3	2	1	-	-	-	-	1.14	-	-	-	1	3	3
3	3	3	2	2	-	-	-	1	-		1	3	3
3	3	3	1	1	-	-	1.17	1	-	-	1	3	3
3	3	3	2	1	-	-	-	1	-	-	1	3	3
3	3	3	2	1	-			1	-		1	3	. 3
	PO1 3 3 3 3 3 3	PO1 PO2 3 2 3 3 3 3 3 3 3 3 3 3 3 3	PO1 PO2 PO3 3 2 1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	PO1 PO2 PO3 PO4 3 2 1 - 3 3 3 2 3 3 3 1 3 3 3 1 3 3 3 2 3 3 3 2 3 3 3 2 3 3 3 2	PO1 PO2 PO3 PO4 PO5 3 2 1 - - 3 3 3 2 2 3 3 3 1 1 3 3 3 2 1 3 3 3 1 1 3 3 3 2 1 3 3 3 2 1	PO1 PO2 PO3 PO4 PO5 PO6 3 2 1 - - - 3 3 3 2 2 - 3 3 3 1 1 - 3 3 3 2 1 - 3 3 3 2 1 - 3 3 3 2 1 - 3 3 3 2 1 -	PO1 PO2 PO3 PO4 PO5 PO6 PO7 3 2 1 - - - - 3 3 3 2 2 - - 3 3 3 1 1 - - 3 3 3 2 1 - - 3 3 3 2 1 - - 3 3 3 2 1 - - 3 3 3 2 1 - -	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 3 2 1 - - - - - 3 3 3 2 2 - - - 3 3 3 1 1 - - - 3 3 3 1 1 - - - 3 3 3 2 1 - - - 3 3 3 2 1 - - - 3 3 3 2 1 - - -	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 3 2 1 - - - - - - 3 3 3 2 2 - - 1 3 3 3 1 1 - - 1 3 3 3 2 1 - - 1 3 3 3 2 1 - - 1 3 3 3 2 1 - - 1 3 3 3 2 1 - - 1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 3 2 1 -	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 3 2 1 - <td>PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 3 2 1 - - - - - - 1 3 3 3 2 2 - - - 1 - 1 3 3 3 1 1 - - 1 - - 1 3 3 3 2 1 - - 1 - - 1 3 3 3 2 1 - - 1 - 1 3 3 3 2 1 - - 1 - 1 3 3 3 2 1 - - 1 - 1</td> <td>PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PS01 3 2 1 - - - - - - 1 3 3 3 3 2 2 - - - 1 3 3 3 3 1 1 - - 1 - - 1 3 3 3 3 2 1 - - 1 - - 1 3 3 3 3 2 1 - - 1 - 1 3 3 3 3 2 1 - - 1 - 1 3 3 3 3 2 1 - - 1 - 1 3</td>	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 3 2 1 - - - - - - 1 3 3 3 2 2 - - - 1 - 1 3 3 3 1 1 - - 1 - - 1 3 3 3 2 1 - - 1 - - 1 3 3 3 2 1 - - 1 - 1 3 3 3 2 1 - - 1 - 1 3 3 3 2 1 - - 1 - 1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PS01 3 2 1 - - - - - - 1 3 3 3 3 2 2 - - - 1 3 3 3 3 1 1 - - 1 - - 1 3 3 3 3 2 1 - - 1 - - 1 3 3 3 3 2 1 - - 1 - 1 3 3 3 3 2 1 - - 1 - 1 3 3 3 3 2 1 - - 1 - 1 3

Chairman

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Programme	Course Co	de Name of the Course	L	T	Р	C									
R Tooh	2201620	2 INSTRUMENTAL METHOD OF ANALYSIS	3	0	0	3									
D. I ech.	The studer	t should be able to	1		L	L									
Course	1. List th	e basic components of a UV-Vis spectrophotometer and	describe	their fur	octions	•									
Objective	2. Expla	n the working principles and theoretical foundations of the	echnique	es such as	s spect	roscopy,									
	chron	atography, and electrochemical analysis.	1	1		magaalto									
	3. Use a	ppropriate instrumental techniques to analyze unknown stately	imples a	na interp	oret the	results									
Unit	accura	Description		-	In H	structional									
-	Introducti	Introduction to classical qualitative and qu	antitativ	e analy	sis.	9									
	classification statistical n	on of instrumental methods, Errors, precision and accunethods of data handling.	racy of	instrume	nts,										
II	Spectrosco	py: Beer"s Law, deviation of Beer"s Law, instrument	ation of	UV and	IR	9									
	spectroscoj	troscopy: Beer"s Law, deviation of Beer"s Law, instrumentation of UV and IR roscopy: Monochromatic Source, grating systems and types of detectors, different ling techniques and application of UV & IR Spectroscopy. Principles, Application omic Spectroscopy, Mass Spectrometry (MS).													
1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	sampling to	pling techniques and application of UV & IR Spectroscopy. Principles, Application tomic Spectroscopy, Mass Spectrometry (MS).													
	of Atomic	Spectroscopy, Mass Spectrometry (MS).				0									
111	Gravimet	ic analysis: Principle of Thermo gravimetric analyzer	(IGA),	construc	tion	9									
	of TGA,	principle of bomb Calorimeter (BC), principle of L	TGA	ial scani	ung										
¥¥.7	calorimeter	(DSC), Instrumentation of IGA and BC, Application of	station	harv nh	250	9									
IV	Gas cnro	matography: Infoduction, Finciple, Carrier gas,	ve and	auantita	tive	,									
	analysis.			-1											
v	High per	ormance liquid chromatography: Principle, instru	mentatio	n, types	of	9									
	columns,	ample injection, detectors used like (absorbance, re	fractive	index,	and										
	electrocher	nical measurements), criteria for mobile phase selectio	n and a	pplicatio	n of										
	phile.	Total	Instruct	tional H	ours	45									
On completio	n of the cou	rse, the students will be able to													
	CO1	Understand the components of a sample using classical q	ualitativ	e analysi	s.										
Course	CO2	Comprehend the Instrumentation of UV and IR Spectrom	eters												
Outcome	CO3	Apply DSC to study phase transitions, material stabi	lity, and	l heat-in	duced	changes i									
		arious materials.		c											
	<u>CO4</u>	Interpret chromatograms to assess the purity and concent	ration of	compou	nds m	a sample.									
	C05	conduct qualitative and quantitative analysis using ΠP		ietermine	ine t	nesence an									
TEXT BOOK		oncentration of substances in complex samples.		·											
TI	Instrument	al Methods of Chemical Analysis: Gurudeen R. Chatwal	and Sha	m K. An	and. H	limalava									
	Publishing	House.													
T2	Douglas A	Skoog, F. James Holler, Stanley R. Crouch., "Principles	of Instr	umental	Analy	sis", 6 th									
	Edition, pu	blished by Thomson Brooks/Cole,2007.													
REFERENCI	ES:														
RI	Lloyd R. S	nyder, Joseph J. Kirkland, John W. Dolan., "Introduction	to Mod	ern Liqu	id										
	Chromatog	raphy"., 3rd Edition, Wiley-Blackwell, scholarly publish	ng.		•										
R2	H.H. Willa	rd, L.L. Merritt, J.N. Dean and F.A. Settle, "Instrumenta	l method	is of ana	lysis".	, I.B.H.									
	Publishing	House, New Delhi.													

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Dean (Academics) HiCET

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	1	2	1	-	1	1	1	1	1	1	2	3	2	I
CO2	2	1	1	1	2	1	1	1	1	1	2	2 ·	3	1	İ
CO3	1	1	2	1	2	T	-	1	1	1	1 -	1	3	2	İ
CO4	1	2	2	2	1	1	2	2	2	1	2	1	3	2	I
CO5	1	2	2	1	1	1	1	2	2	-	1	1	3	2	Ī

Chairman

10.744 Chairman - BoS OHE - HICET



, rogramme	Course Co	Jue		name of t	ne Course			L L	r	
B.TECH.	22HE610)1	Р	ROFESSIO	NAL ETHICS	3	3	0	0	3
	The studen	nt sho	uld be able	to	·.					
Course	1. Foster	ethic:	al behavior	and life skills	for holistic de	evelopment.				r
Objective	2. Illustr	ate the	e value of E	ngineering Et	hics					
	3. Inculc	ate the	e social resp	onsibility of	an engineer.					
	4. Impar	t knov	wledge on is	sues related t	o safety, respo	nsibility and	rights			
	5. Educa	te on	professional	practice on g	global issues	•				
Unit				Des	cription		4		In He	structiona ours
Ι	VALUE E	DUCA	ATION							9
	Moral valu	ies and	d Right und	derstanding-	Holistic devel	opment and	the Ro	le of V	alue	
	Education-	Unde	erstanding V	alue Educati	on- Self-explo	oration as th	e proce	ss for v	alue	
	Education-	Integr	rity -Work E	Ethics- Empat	hy- Spiritualit	У				
II	ENGINEE	RINC	G ETHICS							9
	Senses of '	Engin	neering Ethi	cs' – Variety	of moral issued	ues – Types	of inqu	iry – M	oral	
	dilemmas -	- Mora	al Autonom	v — Kohlberg	's theory – Gi	lligan's the	rv – Co	nsensus	and	
	Controvers	v M	lodels of pr	ofessional rol	es - Theories	about right	iction -	Self_int	prest	
	Contores	y IVI and D	loticion Il	as of Ethical	Theories	about right t	CHOI		LI CSU	
	- Customs		religion = 0	es or Etilical	Theories.	N 7				•
111	ENGINEE	RING	G AS SOCI	AL EXPERI	MENTATIO.	N:				9
	Engineering	g as E	Experimenta	tion – Engin	eers as respon	sible Experi	menters	- Code	s of	
	Ethics $-A$	Balan	ced Outlook	on Law.						·
IV	SAFETY,	RESP	PONSIBILI	TIES AND I	RIGHTS					9
	Safety and	Risk -	– Assessmer	nt of Safety a	nd Risk – Risl	k Benefit Ar	alysis ai	nd Redu	cing	
	Risk - Rest	pect f	for Authority	v – Collectiv	e Bargaining	 Confident 	iality –	Conflic	s of	-
	Interest (Decum	ational Crir	ne – Professi	onal Rights -	Employee	Rights -	Intelle	tual	
	Property Ri	iahte ((IPR) = Disc	rimination	ondi rugilo	2				
¥ 7	CLODAL	TCCTT	TR Disc	i miniacion.						0
v	GLUBAL	19901	LS				in a ·	XX I		9
	Multination	nal Co	orporations	- Environm	ental Ethics -	- Computer	Ethics	– wear	pons	
	Developme	nt – E	Engineers as	s Managers –	- Consulting E	Engineers –	Enginee	rs as Ex	pert	
	Witnesses	and A	Advisors –	Morál Leade	rship –Code	of Conduct	– Corp	orate S	ocial	
	Responsibil	lity								
						Total	Instruct	ional H	ours	45
On completion	a of the cou	rse. th	he students	will be able	to					
	CO1	Inders	stand the im	portance of v	arious compor	nents of hum	an value	s		
Course	CO: A	oply	ethics in soc	ietv						
Outcome	CO3 D	Discus	s the ethical	issues related	to engineerir	ng and				
	CO4 R	Realize	e the respon	sibilities and	rights in the sc	ociety				
	CO5 A	pply	professiona	ethics in sol	ving global iss	ues				
FEXT BOOK	:		1		00					
T1	Mike W. N 2003.	Aartin	r and Rolan	d Schinzinge	r, "Ethics in	Engineering	', Tata	McGrav	v Hill,	New Delh
T2	Govindaraj	an M.	Nataraian S	S. Senthil Ku	mar V. S. "Er	ngineering E	thics", F	rentice	Hall of	f India, Ne
A	Delhi. 2004	ł. '				3 3				
Т3	Edmund G Oxford Uni	Seeb	bauer and R ty Press, Ox	obert L Bar ford, 2001.	ry, "Fundame	ntals of Eth	ics for	Scientis	ts and	Engineers
REFERENCE	S:				1			~		
R1	Charles B.	Fledde	ermann, "Ei	ngineering Et	hics", Pearson	Prentice Ha	II, New	Jersey, 2	2004.	
R2	Charles E. Cases" Cer	Harris	s, Michael S	5. Pritchard a	and Michael J	. Rabins, "E	Engineer	ing Eth	cs – C	oncepts a
R3	John R Roa	tright	"Fthice an	d the Conduc	t of Business"	Pearson Fo	ucation	New D	elhi 21	003
110	POINT N DUA	angin.	, Luits all		LOI DUSHICSS	, i carson Le	acación,	INCW D	Ciril, 20	<u> </u>

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
COL	3	3	2	2	-	2	2	2	-		-	-2	3	3
CÔ2	-	3	2	3	3	2	2	2	2				3	- 3
CO3	2	3	3	2	3	2	2	2	2	2	×	-	3	3
CO4	2	2	2	2	2	3	3	2	2		2	-	3	3
C05	2	2	2	2	2	-	-	-	3	3	2	-	3	3

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Dean (Academics)

Programme	Course Co	ode			Nam	e of t	he Co	urse			L	Т	Р		C
B.TECH.	22CH600	01		PRO	OCES	S CC	ONTR	OL LA	В		0	0	4	- <u> </u>	2
	The studer	nt shou	ld be ab	ole to											
Course Objective	1. Hands proces	s-on exj sses.	perience	e in de	esigni	ng, ir	nplem	enting,	and a	nalyzin	g contro	l systen	ns for i	ndus	trial
	2. Expre monit	ss their oring a	knowled nd contr	ige in t rol of	the fie dynar	eld of mic s	proces ystems	s contr 5.	ol inst	rument	ation an	d softw	are for	real	-time
	LIST OF I	EXPER	RIMENT	TS											
1.	Response o	of first c	order sys	stem			· · · · · · · · · · · · · · · · · · ·				· · · · · · · · · · · · · · · · · · ·				
2.	Response o	fsecon	id order	syster	m							·····			
3.	Response o	f Non-l	Interacti	ing lev	vel sy	stem									
4.	Response o	fIntera	acting le	evel sy	stem										
5.	Open loop	study o	n a theri	mal sy	ystem	1				· .					
6.	Closed loop	o study	on a lev	vel sys	stem					i					
7.	Closed loop	p study	on a flo	ow sys	stem										
8.	Closed loop	p study	on a the	ermal	syste	m									
9.	Tuning of a	i level s	system												
10.	Tuning of a	i pressu	ire syste	em											
11.	Tuning of a	therm:	al system	m											
12.	Flow co-ef	ficient o	of contro	ol valv	ves										· .'
13.	Characteris	tics of	different	t type	es of c	contro	ol valv	es		-	(a				
14.	Closed loop	o study	on a pre	essure	e syste	em	• • •								
15.	Closed loop	o respoi	nse of ca	ascade	e cont	trol s	ystem				· · ·				
In completion	t of the cou	rea the	studan	te mi	ll be	obto	to.			Total	Instruc	ional H	lours		45
on completion	CO1	esion s	and impl	lemen	at PID) cont	troller	s for va	rious	industri	al proce	sses an	d evalu	ate t	heir
Course	p	erform	ance.									un			
Dutcome	CO2 E	Demons imulati	trate pro	oficiei ess co	ncy ir ontrol	n usin svste	ig soft ms.	ware to	ols lik	e MAT	LAB, S	imulink	, or La	bVI	EW for
	CO3 A	nalyze	and intersystem d	erpret	t data	from tunin	proce g.	ss cont	rol exp	perime	nts, imp	roving c	lecisior	n-ma	king in
REFERENCE	S:		-				<u> </u>								
R1	Coughnow	r, D., "	Process	Syste	ems A	naly	sis and	l Contr	ol ", 3	rd Edn.	, McGr	aw Hill,	New Y	ork	, 2008. A
	N	-							-					P	
DA		e e										Dan-	D	N.	
U Chairn	іап, Board o і * тал т	- Rn	S								-	Dean –	Acaden 7 Aver	nics nata	emi
	LAALICIII TT ⁰	- 00									IJ	ean	Inci	au ma	
CH		A REAL				100					Kata	AL COL	HiC	E.	

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	ſ
COL	2	3	1	2	1	2	2	2	2	2	2	2	2	2	
CO2	2	3	3	2	3	2	2	2	2	2	2	1	2	2	ĺ
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	ĺ
105	6	1		7		~	-	-	-					1	

11/14 Chairman - BoS OHE - HICET



Dean (Academics)

22CH6002 The student should es 1. Develop the for various of 2. Equip stude as boilers, v 3. Provide har experiments processes.	COMPUTATIONAL CHEMICAL ENGINEERING LAB be able to ability to interpret and create isometric and orthogra engineering components. ents with practical skills in 3D modeling of mechanics alves, and pipe fittings. eds-on experience in conducting and analyzing heat tr , including steady-state, unsteady-state, convection, a LIST OF EXPERIMENTS	0 phic al sys ransfe and ra	0 proje tem tem	4 ectio s, suo	2 ns ch							
The student should a 1. Develop the for various of 2. Equip stude as boilers, v 3. Provide har experiments processes. Draw the isometric view Draw the orthographic pr	be able to ability to interpret and create isometric and orthogra engineering components. ents with practical skills in 3D modeling of mechanics alves, and pipe fittings. eds-on experience in conducting and analyzing heat to , including steady-state, unsteady-state, convection, a LIST OF EXPERIMENTS	phic al sys ransfe and ra	proj tem tr diat	ectio s. su ion	ns ch							
es 1. Develop the for various e 2. Equip stude as boilers, v 3. Provide har experiments processes. Draw the isometric view Draw the orthographic pr	ability to interpret and create isometric and orthogra engineering components. ents with practical skills in 3D modeling of mechanics alves, and pipe fittings. eds-on experience in conducting and analyzing heat tr , including steady-state, unsteady-state, convection, a LIST OF EXPERIMENTS	phic al sys ransfe ind ra	proje tem ar idiat	ectio s, su ion	ns ch							
Draw the isometric view Draw the orthographic pr	LIST OF EXPERIMENTS											
Draw the isometric view Draw the orthographic pr	former and have made a second second second											
Draw the orthographic pr	from orthographic projection.											
	ojection from isometric view.											
Construct a 3D diagram of	f boiler with valves and pipe fittings,			_								
Construct a 3D diagram of	f helical oil.	1										
Steady state heat transfer	through a composite rectangular slab				-							
Unsteady state heat conduction in a rectangular slab												
Radiation heat transfer between two vertical parallel plates												
Natural convection heat to	ransfer from a vertical plate											
Forced convection heat tr	ansfer across a horizontal cylinder											
Flow through pipe at diffe	erent Reynolds numbers				_							
	Total Practical Hours		4	5								
Upon completion of t	he course students can be able to											
 Draw isometri based on giver Construct 3D helical coils us Perform experimentary Such as slabs, 	ic and orthographic projections accurately for engine i specifications. models of systems such as boilers with valves, pipe sing CAD tools. riments to observe heat transfer processes, including invection, and radiation, and analyze the results for d plates, and pipes.	ering fittin stead	con gs, a ly-st ent s	npon ind ate etups	ents							
NCE BOOKS:		-			_							
Hoffmann, K. A. and Chia	ng, S. T.,Computational Fluid Dynamics for Engi	neers	I, 4t	h								
Edition, Engineering Educ	ation Systems (2000)											
Shah, M.B. & Rana B.C. (2	2008), Engineering Drawing and Computer Graphics	, Pea	rson									
	Draw the isometric view Draw the orthographic pr Construct a 3D diagram of Construct a 3D diagram of Steady state heat transfer Unsteady state heat conduct Radiation heat transfer be Natural convection heat to Forced convection heat to Forced convection heat to Flow through pipe at differ Upon completion of t 1. Draw isometric based on giver 2. Construct 3D helical coils us 3. Perform expection conduction, co such as slabs, Infimann, K. A, and Chiat dition, Engineering Educ- hah, M.B. & Rana B.C. (2)	Draw the isometric view from orthographic projection. Draw the orthographic projection from isometric view. Construct a 3D diagram of boiler with valves and pipe fittings. Construct a 3D diagram of helical oil. Steady state heat transfer through a composite rectangular slab Unsteady state heat conduction in a rectangular slab Radiation heat transfer between two vertical parallel plates Natural convection heat transfer from a vertical plate Forced convection heat transfer across a horizontal cylinder Flow through pipe at different Reynolds numbers Upon completion of the course, students can be able to 1. Draw isometric and orthographic projections accurately for engine based on given specifications. 2. Construct 3D models of systems such as boilers with valves, pipe helical coils using CAD tools. 3. Perform experiments to observe heat transfer processes, including conduction, convection, and radiation, and analyze the results for d such as slabs, plates, and pipes. ICE BOOKS: IOFENDERS	Upon Construct and form of the course, students can be able to 1 Draw isometric and orthographic projections. View Construct a 3D diagram of boiler with valves and pipe fittings. Construct a 3D diagram of helical oil. Steady state heat transfer through a composite rectangular slab Unsteady state heat conduction in a rectangular slab Unsteady state heat conduction in a rectangular slab Radiation heat transfer between two vertical parallel plates Natural convection heat transfer from a vertical plate Forced convection heat transfer across a horizontal cylinder Flow through pipe at different Reynolds numbers Upon completion of the course, students can be able to 1 1 Draw isometric and orthographic projections accurately for engineering based on given specifications. 2 Construct 3D models of systems such as boilers with valves, pipe fittin helical coils using CAD tools. 3 Perform experiments to observe heat transfer processes, including stead conduction, convection, and radiation, and analyze the results for differe such as slabs, plates, and pipes. ICE BOOKS: Ioffmann, K. A. and Chiang, S. T., —Computational Fluid Dynamics for Engineers dition, Engineering Education Systems (2000) hah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Peaducation	Draw the isometric view from orthographic projection. Draw the orthographic projection from isometric view. Construct a 3D diagram of boiler with valves and pipe fittings. Construct a 3D diagram of helical oil. Steady state heat transfer through a composite rectangular slab Unsteady state heat conduction in a rectangular slab Radiation heat transfer between two vertical parallel plates Natural convection heat transfer from a vertical plate Forced convection heat transfer across a horizontal cylinder Flow through pipe at different Reynolds numbers Total Practical Hours 4 Upon completion of the course, students can be able to 1. Draw isometric and orthographic projections accurately for engineering con based on given specifications. 2. Construct 3D models of systems such as boilers with valves, pipe fittings, a helical coils using CAD tools. 3. Perform experiments to observe heat transfer processes, including steady-st conduction, convection, and radiation, and analyze the results for different s such as slabs, plates, and pipes. CE BOOKS: Ioffmann, K. A. and Chiang, S. T., —Computational Fluid Dynamics for Engineers!, 4t dition, Engineering Education Systems (2000) hah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson ducation	Draw the isometric view from orthographic projection. Draw the orthographic projection from isometric view. Construct a 3D diagram of boiler with valves and pipe fittings. Construct a 3D diagram of helical oil. Steady state heat transfer through a composite rectangular slab Unsteady state heat conduction in a rectangular slab Radiation heat transfer between two vertical parallel plates Natural convection heat transfer from a vertical plate Forced convection heat transfer across a horizontal cylinder Flow through pipe at different Reynolds numbers Upon completion of the course, students can be able to 1. Draw isometric and orthographic projections accurately for engineering compon- based on given specifications. 2. Construct 3D models of systems such as boilers with valves, pipe fittings, and helical coils using CAD tools. 3. Perform experiments to observe heat transfer processes, including steady-state conduction, convection, and radiation, and analyze the results for different setups such as slabs, plates, and pipes. CE BOOKS: Ioffmann, K. A. and Chiang, S. T., —Computational Fluid Dynamics for Engineersl, 4th dition, Engineering Education Systems (2000) hah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson ducation							

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	P01	PO2	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	PS01	PSO2	
CO1	3	3	3	3	-	-	-	-	3	-	3	3	-	-	İ
CO2	3	3	3	3	3	۰.	-		3	-	3	3	3	2	İ
CO3	3	3	3	3	3	-	-		3	-	3	3	3	2	Ì

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Dean (Academics)

Programme	Course Code	Name of the Course	L	Т	P	C
B.TECH.	22CH6301	MEMBRANE SEPARATION PROCESS	3	0	0	3
	The student sh	ould be able to				
Course	1. Understan	d the principle and technical concept of advanced so	eparation	processe	es.	
Objective	2. Describe	ne process of Reverse Osmosis, Nanofiltration.				· · ·
	3. Summariz	e the Types and choice of Adsorbents.				
Jnit	Description					nstructional Hours
	BASICS OF	SEPARATION PROCESS : Overview and	membra	ne mater	rials,	9
-	Material prop	rties and preparation of phase-inversion mer	nbranes,	Review	i of	
	Conventional 1	rocesses, Process concept, Theory and Equipment	nt used i	n cross	flow	
	Filtration, cros	s flow Electro Filtration, Surface based solid	– liqui	d separat	tions	
	involving a sec	ond liquid, Dual functional Filter.				0
II	MEMBRANE	SEPARATIONS: Types and choice of Membra	nes, Plat	e and Fra	ame,	9
	tubular, spiral	wound and hollow fiber Membrane, Porous and I	ion-poro	us memb	brane	
	transport and (smosis concepts . Reverse Osmosis, Nanofiltratio	n, Ultra	filtration	and	
	Micro filtratio	n, Preparation of composite, inorganic membr	anes,	MF and	, Ur	
	characterizatio	and membrane transport, Problems and solutions	based on	KU, MIF	·	a
ш	SEPARATIO	N BY ADSORPTION: Types and choice of	Adsorb	ents, All	unity	У
	Chromatograp	y, Ion Exchange Chromatography and Immuno Ch	romatog	rapny, Ke	ecem	
	Trends in Adso	rption.		aatra dia	bucic	0
IV	INORGANIC	SEPARATIONS: Electrophoresis, Dielectrophor	ESIS, , El	d Trans	iysis,	
	Evaporation,	roblems and solutions based on ED, PV,	racimati		spon,	
	Membrane con	tactors and other memorane processes.	Liquic	Membr	anes	9
$\sim 10^{-10}$ V $\sim 10^{-10}$	OTHER TEC	Mombrana Distillation zone melting Add	ictive (rvstalliza	ation.	
	Gas separatio	hid Extraction			,	
	Supercritical I	Tot:	l Instru	ctional H	lours	45
On completio	n of the course	the students will be able to				
on compieno	CO1	Understand the Concent of Senaration Process				
Course		Understand the Concept of Separation Process.	nahudina	oquilibr	ium	stages reflu
Duteome	02	Analyze key concepts of separation processes i	nenuung	equinor	ort of	facts
Jucome		countercurrent contacting, limiting cases, efficiency	y and ma	ss transp		rects.
	CO3	Illustrate the concept of adsorption and its applicat	ion.			
	CO4	Acquire Knowledge in inorganic separations for th	e reactio	n.		
	C05	Differentiate and determine various processes by p	erformi	ng the spe	ecific	tests.
IFXT BOOK	<u>.</u>					
<u>T1</u>	Schoen H.M.	"New Chemical Engineering Separation Technique	es", Inter	science F	Publis	hers,1972.
T2	Trevhal R E	"Mass Transfer Operations", 3rd Edition, McGraw	Hill Boo	ok Co., 19	980.	
	B K Dutta N	ass Transfer and Separation Processes, PHI.2007.				-
REFERENC	ES:					
R1	King C L "S	eparation Processes". Tata McGraw Hill, 1982.				
R7	M H. Mulder	Basic Principles of Membrane Technology, Spring	er, 2004			
	Roussel R W	"Handbook of Separation Process Technology", J	ohn Wil	ey, New	York	. 1987
P.4	Nakaoawal C	V., "Membrane Science and Technology" Marce	Dekkar	, 1992.		
13.7	, tanagama, O					
L	10					Λ
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course Code	Name of the Course	L	Т	P	C
B.TECH.	22CH6301	MEMBRANE SEPARATION PROCESS	3	0	0	3
	The student sh	ould be able to				
Course	1. Understan	d the principle and technical concept of advanced so	eparation	processe	es.	
Objective	2. Describe	ne process of Reverse Osmosis, Nanofiltration.				· · ·
	3. Summariz	e the Types and choice of Adsorbents.				
Jnit	Description					nstructional Hours
	BASICS OF	SEPARATION PROCESS : Overview and	membra	ne mater	rials,	9
-	Material prop	rties and preparation of phase-inversion mer	nbranes,	Review	i of	
	Conventional 1	rocesses, Process concept, Theory and Equipment	nt used i	n cross	flow	
	Filtration, cros	s flow Electro Filtration, Surface based solid	– liqui	d separat	tions	
	involving a sec	ond liquid, Dual functional Filter.				0
II	MEMBRANE	SEPARATIONS: Types and choice of Membra	nes, Plat	e and Fra	ame,	9
	tubular, spiral	wound and hollow fiber Membrane, Porous and I	ion-poro	us memb	brane	
	transport and (smosis concepts . Reverse Osmosis, Nanofiltratio	n, Ultra	filtration	and	
	Micro filtratio	n, Preparation of composite, inorganic membr	anes,	MF and	, Ur	
	characterizatio	and membrane transport, Problems and solutions	based on	KU, MIF	·	a
ш	SEPARATIO	N BY ADSORPTION: Types and choice of	Adsorb	ents, All	unity	У
	Chromatograp	y, Ion Exchange Chromatography and Immuno Ch	romatog	rapny, Re	ecem	
	Trends in Adso	rption.		aatra dia	bucic	0
IV	INORGANIC	SEPARATIONS: Electrophoresis, Dielectrophor	ESIS, , El	d Trans	iysis,	
	Evaporation,	roblems and solutions based on ED, PV,	racimati		spon,	
	Membrane con	tactors and other memorane processes.	Liquic	Membr	anes	9
$\sim 10^{-10}$ V $\sim 10^{-10}$	OTHER TEC	Mombrana Distillation zone melting Add	ictive (rvstalliza	ation.	
	Gas separatio	hid Extraction			,	
	Supercritical I	Tot:	l Instru	ctional H	lours	45
On completio	n of the course	the students will be able to				
on compieno	CO1	Understand the Concent of Senaration Process				
Course		Understand the Concept of Separation Process.	nahudina	oquilibr	ium	stages reflu
Duteome	02	Analyze key concepts of separation processes i	nenuung	equinor	ort of	facts
Jucome		countercurrent contacting, limiting cases, efficiency	y and ma	ss transp		rects.
	CO3	Illustrate the concept of adsorption and its applicat	ion.			
	CO4	Acquire Knowledge in inorganic separations for th	e reactio	n.		
	C05	Differentiate and determine various processes by p	erformi	ng the spe	ecific	tests.
IFXT BOOK	<u>.</u>					
<u>T1</u>	Schoen H.M.	"New Chemical Engineering Separation Technique	es", Inter	science F	Publis	hers,1972.
	Trevhal R E	"Mass Transfer Operations", 3rd Edition, McGraw	Hill Boo	ok Co., 19	980.	
	B K Dutta N	ass Transfer and Separation Processes, PHI.2007.				-
REFERENC	ES:					
R1	King C L "S	eparation Processes". Tata McGraw Hill, 1982.				
R7	M H. Mulder	Basic Principles of Membrane Technology, Spring	er, 2004			
	Roussel R W	"Handbook of Separation Process Technology", J	ohn Wil	ey, New	York	. 1987
P.4	Nakaoawal C	V., "Membrane Science and Technology" Marce	Dekkar	, 1992.		
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course	Name of the Course	L	T	Р	C
D TE OIL	Code	WASTE WATED TDEATMENT	3	0	0	3
B.IECH.	22CH0302	should be able to				
Course	The student	on the wastewater transport system				
Course	1. Focus of	a the theory and design technique for the wastewater tre	atment n	rocess		
Objective	2. Expres	to the applications of advanced waste water treatment	unent p			
F T : A	5. Inusua Decemintion	te the applications of advanced waste water redunient.			Inst	ructional
Unit	Description				Hou	irs
Y	WASTE W	ATER TREATMENT AN OVERVIEW: Terminolo	gy – Re	gulations	_	9
	Health and I	Environment Concerns in waste water management – Co	onstituen	ts in was	te	
	water inorg	anic Organic and heavy metal constituents.				
н	CHEMICA	L UNIT PROCESSES: Role of unit processes in was	te water	treatmen	it-	9
	Principles of	f Chemical treatment – Coagulation - flocculation– Pre	cipitatio	n-flotati	on	1
	- solidificat	ion and stabilization – disinfection.				• •
Ш	BIOLOGIC	CAL TREATMENT: Objectives of biological treatme	ent – sig	nificance		9
	Principles o	f aerobic and anaerobic treatment - kinetics of biologic	al growtl	h – Facto	ors	
	affecting gi	rowth - attached and suspended growth - Determ	ination	of Kine	tic	
	coefficients	for organics removal.				
IV	TREATME	INT METHODS : Activated Sludge process and vari	ations, S	Sequenci	ng	9
	Batch react	ors, Membrane Biological Reactors-Trickling Filters-	RBC-M	loving B	ed	
	Reactors- fl	uidized bed reactors, aerated lagoons, waste stabilizatio	n ponds-	- Design	of	
	units – UAS	B, up flow filters, Fluidized beds MBR, septic tank and	disposa			
V	ADVANCE	D WASTE WATER TREATMENT: Technologies	used in	1 advanc	ed	9
	treatment -	Classification of technologies- Removal of Collo	ds and	suspend	ed	
	particles- N	1embrane Filtration – Ion Exchange – Advanced oxida	tion proc	cess – Ze	ero	
	liquid Disch	arge Software Applications				
		Total I	nstructu	onal Hou	ITS	45
On completi	on of the co	arse, the students will be able to	<u> </u>			
	CO1	Understand the Physical and chemical Characteristics of	of wastev	water and	ineir	
Course		measurement.				
Outcome	<u>CO2</u>	Illustrate the various pollutant treatment techniques.				
	<u>CO3</u>	Apply the concepts using biological treatment method	5			
	<u>CO4</u>	Analyze the reactors used for various treatment technic	ues.	Il. tout t		t
	CO5	Understand the membrane based electrochemical proce	ss for pe	onutant t	eanne	
TEXT BOO	<u>K:</u>		-1 -1	alaus El	Disto	n 2002
<u> </u>	Waste wate	r Engineering Treatment and Reuse: McGraw Hill, G. I	chobanc	igious, r	DISIO	11, 2002. 11 III Editio
T2	Industrial W 2008.	Vaste Water Management Treatment and Disposal by W	aste wa	ier McGi		
T3	S.P. Mahaja Ltd., 2012.	an, Pollution control in process industries, 27th Ed. Tata	McGrav	v Hill Pu	blishii	1g Compan
REFERENC	CES:			-		and best of constant large states and an and an and
R1	Casey, T.J., 2006	Unit Treatment Processes in Water and Wastewater En	gineerin	g, John V	Viley a	& Sons,
R2	Metcalf & I McGraw-H	Eddy, Inc. Wastewater Engineering - Treatment, Dispos ill 1995	al, and F	leuse, Fo	urth E	dition, Tata
P 3	Snellman I	R F Handbook of water and wastewater treatment plant	operatio	ons. CRC	Press	/Taylor &
110	Francis Put	lications, 2009	1	· · · ·		
R4	C.S. Rao, E	nvironmental Pollution Control Engineering, New Age	Internat	ional, 20	07.	Λ
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4	12					PI

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course	Name of the Course	L	T	Р	С
DTECH	Code	COLID WASTE MANACEMENT	3	0	0	3
B.IECH.	22CH630	SOLID WASTE MANAGEMENT	5	U	U	5
·	I ne studer	It should be able to				
Course	1. Conve	ersant with the types, sources, generation of WiSW.	alofmi	nicinal	olid n	acte
Objective	2. Expre	ss the storage, conection, transport, processing and dispos		meipars	sonu w	asic.
	3. Illustr	ate the applications of advanced disposal of MISW.			Inct	ructional
Unit	Descriptio	0	· .		Hou	rs
I	SOURCES	AND CHARACTERISTICS : Sources and types o	f munic	cipal sol	id	. 9
	wastes- Pul	olic health and environmental impacts of improper dispos	al of sol	id waste	S-	
	sampling a	nd characterization of wastes - factors affecting waste g	eneratio	n rate ai	ıd	
-	characteris	ics. Elements of Municipal Solid Waste Management Plan	1.			
II	SOURCE	REDUCTION, WASTE STORAGE AND RECYC	LING	: Was	te	9
	Manageme	nt Hierarchy - Reduction, Reuse and Recycling - source	reductio	n of was	te	
	- On-site	storage methods - Effect of storage, materials used	for co	ntainers		
· .	segregation	of solid wastes – Public health and economic aspects of c	open sto	rage		
III	COLLEC	FION AND TRANSFER OF WASTES : Methods of	of Resid	lential a	nd	9
	commercia	I waste collection – Collection vehicles – Manpower – C	Collectio	n routes	-	
	Analysis o	f waste collection systems; Transfer stations -location	on, oper	ration a	nd	
	maintenanc	e; options under Indian conditions				· · · · ·
IV	PROCESS	ING OF WASTES: Objectives of waste processing – P	hysical	Processi	ngki ski	÷ -9 ;
	techniques	and Equipment; Resource recovery from solid waste co	mpostii	ig and b	io	
	meth nation	n; Thermal processing options – case studies under Indian	conditio	ons.		
V	WASTE	DISPOSAL: Land disposal of solid waste- Sanitar	y landf	ills – s	ite	9
	selection, c	lesign and operation of sanitary landfills – Landfill liners	– Mana	igement	of	
	leachate an	d landfill gas- Landfill bioreactor – Dumpsite Rehabilitati	on.			
	-	Total In	structio	nal Hou	rs	45
On completion	on of the co	urse, the students will be able to				
	CO1	State solid waste characteristics and its sources.				
Course	CO2	Identify and analyze different methods of treatment of se	olid was	te		
Outcome	CO3	Illustrate Industrial practices in solid waste management	•			
	CO4	Discuss the significance of recycling reuse and reclamat	ion of s	olid wast	tes.	
	C05	Assess the relationships between environmental guideling	ies, hun	an activ	ities ar	nd quality
		of impacted soil, water and air.		1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		· · ·
TEXT BOOI	K:					
T1	William A	Worrell, P. AarneVesilind (2012) Solid Waste Engineeri	ng, Cen	gage Lea	urning,	2012.
T2	John Pitche	el (2014), Waste Management Practices-Municipal, Hazar	dous an	d industi	ial – C	RC Press,
	Taylor and	Francis, New York.				
T3	Vesilind, P	A. and Rimer, A.E., "Unit Operations in Resource Recov	ery Eng	ineering	", Prer	itice Hall,
	Inc., 1981					
REFERENC	ES:					
R1	Governme	nt of India, "Manual on Municipal Solid Waste Managem	ent", CP	HEEO.	Minist	ry of Urban
	Developm	ent. New Delhi. 2000.				
R2	Manser A	G.R. and Keeling A.A.," Practical Handbook of Processin	g and R	ecveling	of Mu	nicipal
	solid Wast	es". Lewis Publishers, CRC Press, 1996				
R3	Spellman	R.F., Handbook of water and wastewater treatment plant of	operatio	ns. CRC	Press/	Tavlor &
	Francis Pu	blications, 2009	,		-	-
R 4	Tchohanog	dous G. Theisen M. M. and Fliassen R. "Solid Wastes	Engine	ering Pr	inciple	s and
	Managen	nt Issues" McGraw Hill: New York 1993				
	prining Con					Z
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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B.TECH. 2 Course 1. Dbjective 2. Junit D I II S H L	22CH6304 he studen To im impac contes Exam catego NTRODU Sustainable Historical	ENVIRONMENTAL IMPACT ASSESSMENT 3 0 it should be able to 0 part the knowledge and skills to identify, assess and mitigate the environ ts of developmental projects. 0 ment appropriate methodologies for assessing environmental impacts in a st. 0 ine the potential environmental, social, and economic impacts of the proprizing them into direct and indirect effects. 0 n 0 0 DCTION: Impacts of Development on Environment – Rio Principles 0 Development Environmental Impact Assessment (EIA) – Objective 0	0 menta a spec posed In H	3 I and social ific project project, structional
Litechi, 2 T Course 1. Dijective 2. Jnit D I II S H L	he studen he studen To im impac Imple contes Exam catego Description NTRODU	t should be able to part the knowledge and skills to identify, assess and mitigate the environ ts of developmental projects. ment appropriate methodologies for assessing environmental impacts in a ct. ine the potential environmental, social, and economic impacts of the prop prizing them into direct and indirect effects. n UCTION: Impacts of Development on Environment – Rio Principles Development Environmental Impact Assessment (EIA) – Objective	menta i spec bosed In Hi	l and social ific project project, structional
Course 1. Descrive 2. Jnit D I II I II S H L	To im impac Imple contes Exam catego Description NTRODU Sustainable Historical	part the knowledge and skills to identify, assess and mitigate the environ ts of developmental projects. ment appropriate methodologies for assessing environmental impacts in a ct. ine the potential environmental, social, and economic impacts of the prop prizing them into direct and indirect effects. n UCTION: Impacts of Development on Environment – Rio Principles Development Environmental Impact Assessment (EIA) – Objective	nenta spec bosed In Hu	l and social ific project project, structional
Jnit D I II Juit L	impac Imple conte> Exam catego Description NTRODU	ts of developmental projects. ment appropriate methodologies for assessing environmental impacts in a st. ine the potential environmental, social, and economic impacts of the proportion prizing them into direct and indirect effects. n ICTION: Impacts of Development on Environment – Rio Principles Development Environmental Impact Assessment (EIA) – Objective	n spectorsed	ific project project, structiona
Jnit D I I E H	. Imple contex . Exam catego Description NTRODU Sustainable Historical	ment appropriate methodologies for assessing environmental impacts in a ct. ine the potential environmental, social, and economic impacts of the prop prizing them into direct and indirect effects. n ICTION: Impacts of Development on Environment – Rio Principles Development Assessment (EIA) – Objective	n spec bosed In H	project, structiona
Jnit D I I S H L	contex Exam catego Description NTRODU Sustainable Listorical	tt. ine the potential environmental, social, and economic impacts of the proporizing them into direct and indirect effects. n ICTION: Impacts of Development on Environment – Rio Principles Development Assessment (EIA) – Objective	in H	project, structiona
Jnit D I II S H L	Exam catego Description NTRODU Sustainable Listorical	ine the potential environmental, social, and economic impacts of the prop orizing them into direct and indirect effects. n ICTION: Impacts of Development on Environment – Rio Principles	ln H	project, structiona
Init D	catego Description NTRODU Sustainable Listorical	orizing them into direct and indirect effects. n JCTION: Impacts of Development on Environment – Rio Principles Development Assessment (EIA) – Objective	ln H	structiona
Jnit D I II S H L	Description NTRODU Sustainable Historical	n JCTION: Impacts of Development on Environment – Rio Principles	In H	structiona nurs
	NTRODU Sustainable	ICTION: Impacts of Development on Environment – Rio Principles	H	aurs
I II S H L	NTRODU Sustainable Historical	ICTION: Impacts of Development on Environment – Rio Principles		
S H L	ustainable Iistorical	Dt. Environmental Impact Assessment (EIA) - Objective	01	9
	listorical	Development Environmental impact Assessment (ELT)	s –	
		development – EIA Types – EIA in project cycle –EIA Notification	and	
17 F	egal Fran	nework.		0.1
II E	ENVIRON	MENTAL ASSESSMENT: Screening and Scoping in EIA – Drafting	g of	. 9
Т	Ferms of I	Reference, Baseline monitoring, Prediction and Assessment of Impact	on	
la	and, water	; air, noise, flora and fauna - Matrices - Networks - Checklist Metho	as -	
N	Mathemati	cal models for Impact prediction.		0
HI F	ENVIRO	MENTAL MANAGEMENT PLAN: Plan for mitigation of adv	erse	9
ii	mpact on	water, air and land, water, energy, flora and fauna – Environme	ncel	
N	Monitoring	g Plan – EIA Report Preparation – Public Hearing-Environmental Cleara	mic	9
IV S	SOCIO E	CONOMIC ASSESSMENT: Baseline monitoring of Socio econo	and	,
e	environme	nt – Identification of Project Affected Personal – Reliabilitation	anu	
न	Resettleme	ent Plan- Economic valuation of Environmental impacts – Cost oc		
/	Analysis	THE OTHER AND ADDI ICATIONS. Environmental monitori	nσ -	9
V N	MONITO	RING STUDIES AND APPLICATIONS. Environmental moment	ntal	
<u>ou</u>	guidelines	- policies - planning of momoring programmes, Environme		
ľ	Manageme	ent Plan- Post project audit. Total Instructional H	ours	45
	6.0	the students will be able to		· · · · ·
<u>On completion</u>	n of the c	burse, the students will be able to	ومطاقفة مستعدية	
		Understand the concept of environmental impact assessment.		
Course	<u>CO2</u>	Identify the various components and assessment teeningues of End		
Outcome	<u>CO3</u>	Illustrate Environmental management plan.		
-	<u>CO4</u>	G is hearded as short ELA monitoring studies through various indust	rial ex	nosure.
	<u>CO5</u>	Gain knowledge about ETA monitoring studies infough various mause		<u> </u>
TEXT BOOK	<u>.</u>	W. F		
<u> </u>	Canter, L.	W., Environmental impact Assessment, McGraw Imi, Act Ford, 1990	Scien	ce. London
12	Petts, J., F	landbook of Environmental impact Assessment vol. Fund it, Brackhen	~	,
	2009.	D.D. Environmental Impact Assessment - Practical solutions to recurre	ent	
13	Lawrence	Wilow Intercolonce New Jercey 2003		
DEPENDENC	Problems.	whey-interscience, ivew jersey, 2005.		
REFERENC	ES:	Le V and Manigham V Environmental Impact Assessment Methodal	ogies	2 nd Edition
RI	Anjaneyu	III, T., and Wianickani, V., Environmental impact Assessment, wethous	0.10	
	BS PUBLIC	A Fronk Venclay, "The International handbook of social impact assess	ment	' conceptua
R2	Becker H	A., Frank vanciay. The international nanouous of social impact asses.		
	and metho	Dadiogical advances, Edward Elgar Fuorshing, 2005.	source	Manual".
R3	Barry Sac	Her and wary wiceare, Environmental impact Assessment framing we		· · · · · · · · · · · · · · · · · · ·
	United Na	ations Environment Programme, 2002.	kwell	
R4	Judith Per			~ /
	Science N	New York, 1998.		P

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course Code	Name of the Course	L	T	Р	С
B.TECH.	22CH6306	RISK AND HAZOP ANALYSIS	3	0	0	3
	The student	should be able to				
Course	I. Condu	ct, evaluate, and apply Hazard and Operability (HAZOP)	analysi	s technic	ues	
Objective	2. Identif	y, assess, and mitigate risks in industrial processes				
Ū	3. Analyz	ing potential hazards, and creating effective solutions to	ensure s	afety an	d com	oliance.
Unit	Description				Inst Hou	ructional rs
1	RISK ANA	LYSIS: Risk analysis introduction, quantitative risk	assessm	nent, rap	id	9
•	risk analysi	s – comprehensive risk analysis – identification, evaluat	ion and	control	of	
	risk					
II	RISK ASS	ESSMENT: Risk assessment - introduction and availal	ole meth	odologi	es,	9
	Rick assess	ment steps- Quantitative risk analysis-event tree, fault	tree, co	nsequen	ce	
	analysis and	layer of protection analysis- Bow tie analysis				
	analysis and	Tayler of protection analysis Don the analysis				
TIT	EMEDCEN	ICV PLANNING: Overall risk analysisemergency r	lanning	-on site	&	9
A A Province of the second sec	off cite eme	rgency nlanning risk management ISO 14000 EMS m	odels ca	se studio	es-	
	marketing to	erminal gas processing complex · Risk due to Radiation	1, explos	sion due	to	
	marketing u	e iet fire-fire hall	., p .o.			
11.7	UVEL PIESSU	Hazard - Hazard identification - methods. Process	Hazard	Analysis	5 -	9
IV	HAZARD:	to DUA Overview of DHA Techniques Selection of	f PHA	technia	ies	-
	introduction	tion of recommendation Key Aspects Cyclic Pl	HA /Re	validatio	nn.	
	Implementa	Ut mothodology (Prerequisites Team Composition and	their at	tributes)		
	Review of F	HA methodology (Frerequisites, Fean Composition and	ZOP m	cocedure		9 /
Programme Course Name of the Course L T P BTECH. 22CH6306 RISK AND HAZOP ANALYSIS 3 0 0 Course 1. Conduct, evaluate, and apply Hazard and Operability (HAZOP) analysis techniques 0 Objective 2. Identify, assess, and mitigate risks in industrial processes 3 0 0 Int Description Instructure Instructure Instructure Instructure 1 RISK ANALVSIS: Risk analysis - comprehensive risk analysis - identification, evaluation and control of risk. Instructure Instructu						
	HAZOP Ar	arysis -Computer usage in HAZOP- softwares employed	u - Lm	manons	01	
	HAZOP - c	ase studies	stmati	nal Ha	irs	45
	<u> </u>	I CALL	istiutta	<u> </u>	113	
On completi	on of the co	urse, the students will be able to	orking	nvironn		
	COI	Understand the knowledge of types of risks arising in w	orking	Invitonn	iem.	
Course	CO2	Identity the Risk Assurance and Assessment				
Outcome	<u>CO3</u>	Design Risk management systems and planning.				
	<u>CO4</u>	Analyze the effect of process hazard.		1	1.0	1
	CO5	Gain knowledge about hazop and its consequences and	to crea	te hazaro	i free v	vorking
		premises				
TEXT BOO	K:					D
T1	Chemical P Hall, NJ, 19	rocess Safety: Fundamentals with Applications, Daniel /	A. Crow	I, J.F. Lo	ouvar,	Prantice
T2	Fawatt, H.F	I. and Wood, W.S., "Safety and Accident Prevention in	Chemica	l Operat	tion", V	Wiley
	Interscience	e, 1965		-		
T3	Marcel. V.0	C., Major Chemical Hazard- Ellis Harwood Ltd., Chi Ch	ester, Ul	K, 1987.		
REFERENC	ES:					
R1	Handley, W	"Industrial Safety Hand Book ", 2nd Edn., McGraw-I	fill Boo	k Compa	iny, 19	69
R7	Heinrich F	W. Dan Peterson, P.E. and Rood, N., "Industrial Accide	ent Prev	ention",		
112	McGrawHi	11 Book Co., 1980.				
D 2	Taylor I D	Risk analysis for process plant nipelines and transport	, Chapm	an and I	Hall.	
КJ	London 10	04			12	
Di	London, 15	27 Ruidalines for process hazards analysis hazards identific	ation &	risk ana	lvsis	-
K4	riyatt, IN., C	Junctimes for process nazarus analysis, nazarus fuctione	anon a	. ion unti		
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CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course	Name of the Course	L	T	Р	C
D TE OH	Code	COMPUTATIONAL TECHNIQUES	3	0	0	3
B.IECH.	22CH0307	should be able to			·	
Course	1 Apply	analyze and create computational techniques to solve en	gineeri	ng and so	cientifi	c problems
Dhiaatiya	1. Apply,	tand the algorithms and evaluating numerical methods.	9			
Jujective	2. Druelo	ping solutions using computational tools.				
•.	Description	ping solutions using computational croth			Inst	ructional
Unit	Description				Hou	rs
T	NUMEDIC	AL METHODS FOR SYSTEM OF LINEAR ALGEP	BRAIC			9
1	FOUATIO	NS: Gauss elimination. LU decomposition, matrix invers	ion, Tri	-diagona	1	
	matrix algor	ithm, Gauss-Seidel method, Chemical Engineering probl	ems inv	olving		
	solution of l	inear algebraic equations.			-	
TT	NUMERIC	AL METHODS FOR NON LINEAR ALGEBRAIC F	EQUAT	IONS:		9
11	Introduction	Root finding methods for solution on non-linear al	gebraic	equation	ns:	
	Bisection 1	Jewton-Raphson and Secant methods, System of Non	-linear	Equatio	ns,	
	Chemical E	igineering problems involving solution of non-linear equ	ations.			
III	INTERPO	ATION AND NUMERICAL INTEGRATION: Inter	polatior	n and		9
	Approximat	ion, Newton's polynomials and Lagrange polynomials, sp	pline			
	interpolation	1, linear regression, polynomial regression, least square r	egressio	on,		
	Numerical i	ntegration: Trapezoidal rule, Simpson's rule, integration	with un	nequal		
	segments.				<u> </u>	
IV	NUMERIC	AL METHODS FOR ODES: Euler method – explicit a	and imp	licit,		9
	Runge-Kutt	a method – 2nd and 4th order. Boundary value problems	- shool	ting		
-	method, Ch	emical engineering problems involving single and system	n of UL	NES.		<u> </u>
V	NUMERIC	AL METHODS FOR PDES: Introduction to Partial D	ifferenti	al		9
	Equations:	Characterization of PDEs, parabolic, elliptic and first ord	er nype	rbonc	the	
• •	equations, e	xplicit and implicit methods, Chemical engineering prob	nems m	vorving	inc	
	three types	of PDEs.	structi	onal Ho	1116	45
			istructi	0111110		
On completi	ion of the co	arse, the students will be able to	equation	 ns		
	COl	Understand the numerical methods for mean algebraic equ	ations			
Course	<u>CO2</u>	Identify numerical methods for interpolation and numeri	cal inte	oration		
Outcome	<u>CO3</u>	Identity different methods for interportation and numeric	ntial eq	nations		
-	<u>CO4</u>	Illustrate on the numerical methods for ordinary differential equation	nc nc	durions.		
	<u>C05</u>	Apply the basic methods for partial differential equation	113.			
TEXT BOO	K:	C. & Caula D. D. "Numerical Methods for Engineers"	Fighth	Edition.	McGr	aw Hill,
11	Chapra. S.	c. & Callale, K. F., Tvullereal Methods for Engineers,	2.8	· ,		
	2021.	"Numerical Methods for Engineers New Academic S	cience.	2012.		
	Abuia D	Introduction to Numerical methods in Chemical Engine	ering" 2	2nd Editi	on, PH	I learning
13	Driveto Ltd	2010	6			
DEFEDEN	CES.	, 2019.				
REFEREN	DI Durda	n & I D Faires "Numerical Analysis" 7th Ed. Brooks	Coles,	2000.		
	R.L. Duruc	V Ravindran A Ragsdell K M Engineering Optimiz	zation, V	Wiley, N	ew Yo	rk, 1980.
R2	Luyben W	L. Process Modeling Simulatio5n and Control for Che	mical E	Ingineers	, McG	raw Hill,
КЭ	Internation	al Student Edition Second Edition. 1996.		÷		
D.	Ramirez V	V D. Computational Methods for Process Simulation. S	econd F	Edition, I	Elsevie	r Science,
K4	1907	T. D., Computational methods for traces can all any				
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CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course	Name of the Course	L	T	Р	C 4
BTECH	22CH6308	OPTIMIZATION OF CHEMICAL PROCESSES	3	0	0	3
D.I.D.C.H.	The student	should be able to				
Course	1. Apply.	analyze, and optimize chemical processes by understand	ing opti	mization	techn	ques
Objective	2. Evaluat sustain	ing process performance, and designing improvements to ability.	o enhan	ce efficie	ncy, s	afety, and
	3. List con optimiz	nmon optimization techniques and recall key parameters ation.	involv	ed in cher	nical	process
Unit	Description				Inst Hou	ructional rs
I	PROBLEM	FORMULATION & CLASSIFCATION: Introduction	n; form	ulation of		9
	objective fur sufficient co methods.	nctions; fitting models to data; classification of functions; nditions for optimum; unimodal, multimodal functions; a	necess	ary and al		
II	LINEAR PI methods; Bi	ROGRAMMING: Review on basic concepts of LP form g-M method, two phase method and Duality in linear pro	nulation gramm	s; Simple ing.	x	9
ш	NON-LINE quadratic, ge	AR PROGRAMMING: The Lagrange multiplier metho cometric and dynamic programming.	od, Inte	ger,		9
IV	NUMERIC methods; reg interpolation technique; it	AL METHODS: Unimodal functions; Newton, quasi Ne gion elimination methods, polynomial approximation; qu techniques for optimum. Multimodal functions; direct n indirect methods; gradient and conjugate gradient method	ewton, s adratic nethods s; secan	secant and cubic ; Powell's it method		9.4
V	APPLICAT flow system	IONS: Heat transfer and energy conservation; separations; reactor design and operation; large scale systems.	n proce	sses; fluic		9
		Total In	structio	onal Hou	~s	45
On completion	on of the cou	urse, the students will be able to				
· · · · · · · · · · · · · · · · · · ·	COI	Understand the basic problem formulation and optimizat	tion.			
Course	CO2	Identify mathematical characteristics of Linear program	ming			
Outcome	CO3	Identify computational solution techniques for nonlinear	uncon	strained o	ptimi	zation.
	CO4	Illustrate various techniques used in constrained optimiz	ation.			
	CO5	Apply the optimal and dynamic optimization				
TEXT BOOI	K:					
T1	Edgar T.F., McGraw-Hi	Himmelblau D.M., Lasdon,L.S., Optimization of Chemic II, New York, 2001	al Proc	æsses, Se	cond	Edition,
T2	Rao, S. S., H	Engineering Optimization: Theory and Practice, Fifth Edi	tion, W	iley, Nev	Yorl	<u>k,2019.</u>
T3.	Ahuja, P., " Private Ltd,	Introduction to Numerical methods in Chemical Enginee 2019.	ring" 21	nd Edition	I, PHI	learning
REFERENC	ES:					
R1	R.L. Burder	a & J. D. Faires, "Numerical Analysis", 7th Ed., Brooks (Coles, 2	000.		
R2	Reklaitis G.	V., Ravindran A., Ragsdell, K.M., Engineering Optimiza	tion, W	/iley, Nev	v Yor	k, 1980.
R3	Luyben, W. Internationa	L.: Process Modeling, Simulatio5n and Control for Chen I Student Edition, Second Edition, 1996.	nical Er	ngineers,	McGr	aw Hill,
R4	Ramirez, W 1997.	. D., Computational Methods for Process Simulation, Se	cond E	dition, Els	evier	Science,

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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rogramme	Course	Name of the Course	L	T	P	C							
	Code	PROCESS MODELING AND SIMULATION	3	0	0	3							
B.TECH.	22CH6309	PROCESS MODELING AND SIMULATION											
	The student	t should be able to	unders	tanding	cev mo	deling							
ourse	I. Develo	p, analyze, and apply process models and simulations of	unders	iunag		. 0							
bjective	technic	2 Evaluating and simulating the dynamic systems.											
	2. Evalua	ting and simulating the dynamic systems.	uracy										
	3. Optimi	izing process operations for improved efficiency and dee	aracyr		Inst	ruction							
nit	Description				Hou	irs							
7	INTRODU	CTION AND FIRST PRINCIPLES: Definition, Uses	of math	nematica	1	9							
L	Models - Pr	inciples of formulation. Classification of Process Models	s, Funda	mental									
	laws: Total	Continuity equation-Macroscopic and Microscopic Exa	mples, C	Compone	nt								
	Continuity I	Equation – Macroscopic and Microscopic Examples, End	ergy equ	ation,									
	Equations o	f motion, Transport equations, Equations of State, Equil	brium a	nd									
	Chemical K	inetics. Simple Examples.											
11	LUMPED	SYSTEMS: Simple Hydraulic Tank, Variable flo	w hydr	aulic ta	nk,	9							
	Enclosed ta	ank, Adiabatic compression in gas space, Mixing ve	essel, M	lixing w	rith								
	reaction, Re	eversible reaction, Steam jacketed vessel, Continuous flo	w boilir	ig systen	n.								
III	STAGED (OPERATIONS AND DISTRIBUTED SYSTEMS: Sta	iged Op	erations:		9							
	Counter cur	rent extraction, Distillation columns - Binary distillation	. Distril	outed									
	systems: Co	ounter current Heat exchanger, Membrane separation pro	cess, tu	bular									
	reactor and	evaporators.											
IV	FITTING	MODEL TO DATA: Fitting Linear Model, Multi-Linea	ar Mode	ls, Matri	X	9							
	representati	ion of Multi Linear Model. Fitting Quadratic Model, Cul	nc Mod	el and		7							
	Polynomial	model using Regression, Power Law models. Performa	nce Crit	eria to									
	check quali	ty of model, Co-efficient of Determination (R2)				0							
V	SIMULAT	TION OF BASIC MODELS: MATLAB/Simulink - Intr	oductio	n, Basic		.9							
	component	s, Operational Blocks, Examples - Gravity flow tank, In	ree CSI	KS III									
	series, Nun	nerical solution of model using RK4, Euler's explicit and	1 implie	н									
· .	techniques,	Introduction to ODE 45 solver.		ional U	mre	45							
			nstruct		Jurs								
On complet	ion of the co	urse, the students will be able to	nlicatio	ns to trai	isport/e	energy							
	CO1	Understand the fundamentals of moderning and then ap	prication	15 10 114	isport (
Course		equations, chemical and phase equilibria kinetics	nhenor	nenolog	cal law	vs. rate							
Outcome	CO2	Associate the model with constitutive relations such as	ods.	nenolog	etti itti								
		equations, equations of state, property estimation met	ations e	nuinmer	its								
	CO3	Create the mathematical models for unreferit unreper	amond s	vetems a	nd stea	dv state							
	CO4	Analyze the principles of steady state/unsteady state it	imped a	y stemis a	na stou								
		unsteady state distributed systems.	models	with rel	evant i	nitial and							
	CO5	Apply relevant solution methods for the mathematical	models										
		boundary conditions.											
TEXTBOC	JK:	D. W. Process Dynamics: Modeling Analysis and Sim	lation.	Prentice	-Hall, 2	2002.							
<u>T1</u>	Bequette, I	B. W., Process Dynamics. Woulding, Analysis, and Smith	04										
<u>T2</u>	Babu, B V	., Process Plant Simulation, Oxford Oniversity (1935, 20	Secon	d Editio	n. Pren	tice							
T3	Jana, A. K	, Chemical Process Wodering and Comparer Simulation	, 0000	a banno									
	Hall India	Pvi. Liu, 2011.											
REFEREN	ICES:	W. D. Commentational Methods for Process Simulation	Second	Edition.	Elsevie	r Scienc							
RI	Ramirez,	w. D., Computational Methous for Process Simulation,	Jeeona										
	1997.	C.V. Dovindren A. Dagsdoll K.M. Engineering Optim	ization	Wiley. N	Vew Yo	ork. 1980							
R2	Reklaitis (J.V., Kavindran A., Kagsden, K.M., Engineering Optim	emical	Engineer	s. McC	Fraw Hil							
1 23	Luyben, V	V.L.: Process Modering, Simulation and Control for Cit	ennear 1	55	_,								
K5	Internation	nal Student Edition, Second Edition, 1990.	Casand	Edition	Elennie	er Scian							
K 5		17 D. C	Second	F. F. F. F. F. F. F. F. F. F. F. F. F. F	r Sevi	OLIMER'S							
R3 R4	Ramirez,	W. D., Computational Methods for Process Simulation,	Second	Eution,	EISEVI								
R4	Ramirez, 1997.	W. D., Computational Methods for Process Simulation,	Second	Lumon,	EISEVI								

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CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course Code	Name of the Course	L	T	Р	С
в.тесн.	22CH6310	PINCH ANALYSIS AND HEAT EXCHANGER NETWORK DESIGN	3	0	0	3
	The student	should be able to				
Course Objective	1. Identif differen	y key concepts of pinch analysis, including hot and cold nee, and pinch point.	streams,	minimu	m tem	perature
, , , , , , , , , , , , , , , , , , ,	2. Descril	be the process of identifying energy inefficiencies in a pr	ocess us	ing pinc	n anal	ysis.
	3. Summa	arize how pinch analysis impacts the design and operatio	n of hea	t exchan	ger ne	tworks.
Unit	Description				Inst Hot	ructional Irs
I.	INTRODU energy targe cost targetin	CTION: Pinch analysis, process synthesis, pinch point, or ting: problem table algorithm, shifted composite curve, or g, process modification.	composi capital c	te curves ost, total		5
II	TARGETIN targeting, sh	NG: Heat exchanger networks, energy targeting, ar ell targeting, cost targeting, super targeting, and continue	ea targ ous targ	eting, un eting.	nit	9
III .	PINCH AN minimum te optimum tar	ALYSIS: Identification of streams, temperature, enthalp mperature difference, construction of composite curves, get, design of heat exchanger network.	y diagra energy (am, cost targe	:t,	9
IV	PINCH DE Pinch design network, op	SIGN AND OPTIMIZATION: Networks for maximur n method, flexibility criteria of the pinch, optimization of timality for a minimum area network, Sensitivity analysi	n energy f heat ex s.	recover changer	у ,	9
V	ENERGY A	AND RESOURCE ANALYSIS OF VARIOUS PROC scible process, distillation process, evaporation process, re- mass separating agent, heat pipes and heat pumps	ESSES: eaction p	Batch	1.1	9
	process usin	Total In	structio	onal Hou	rs	45
On completi	on of the cou	urse, the students will be able to				
-	CO1	Understand the pinch concept and process thermodynan	nics.			
Course	CO2	Identify minimum energy targets.			1	•
Outcome	CO3	Illustrate the knowledge of diagrams and energy cost ta	rget			
	CO4	Identify different choices and constraint during heat exc	hange n	etworki	ıg.	
	CO5	Apply strategies for retrofitting existing process plant, i multiple processes.	ntegrati	on of ene	rgy de	emands of
TEXT BOO	K:					
TI	Kemp, 1. C.	, Pinch Analysis and Process Integration, Second edition	, Elsevi	er, 2006		
Τ2	Shenoy, V.	U., Heat Exchanger network synthesis, Gulf Publishing,	1995			ч.
Т3	Jana, A. K., Hall India P	Chemical Process Modeling and Computer Simulation, vt. Ltd, 2011.	Second	Edition.	Prenti	ce
REFERENC	CES:					
R1	Douglas, J.	M. Conceptual Design of Chemical Process, McGraw F	lill, 198	8.		1. 1080
R2	Reklaitis G.	V., Ravindran A., Ragsdell, K.M., Engineering Optimiz	ation, W	ney, ne	w yor	<u>K, 1980.</u>
R3	Luyben, W. Internationa	L.: Process Modeling, Simulatio5n and Control for Cher Il Student Edition, Second Edition, 1996.	mical Er	igineers,	McGr	aw mill,
R4	Ramirez, W 1997.	7. D., Computational Methods for Process Simulation, Se	cond E	dition, E	sevier	Science,

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Dean-Academics Dean (Academics) HICET

Programme	Course Code	Name of the Course	L	Т	Р	С
BTECH	22CH6311	CHEMICAL PROCESS FLOW SHEETING	3	0	0	3
b.itEch.	The student	t should be able to				
Course Objective	I. Identif (PFDs)	y the basic symbols, conventions, and components used	in chemi	cal proce	ss flo	w diagrams
	2. Descri	be how material and energy balances are integrated into	process 1	low shee	ts.	
	3. Summ	arize the information conveyed by a typical chemical pro	cess flor	w sheet.	- <u>-</u>	
Unit	Description				Inst Hou	ructional
I	FLOWSHI manual flov	ETING: Introduction, symbols, flowsheet presentation sheet calculation, flow sheeting approaches.	on with	example	s,	9
II .	DECOMPO algorithms l various tear	DSITION OF NETWORKS: Partitioning and tearing a based on signal flow graph, algorithms based on reduced ing algorithms.	l flowsho l graph,	eet, tearin comparin	ıg ıg	9
Ш	SEQUENT method, con substitution criteria for a	IAL MODULAR APPROACH TO FLOWSHEET avergence of flowsheet using different methods - Newto , Wegstein's method, dominant Eigenvalue method, qua acceleration	ING: P on's met si Newto	rinciple hod, dire on metho	of ct d,	9
IV	FLOWSHI disjoining, solution of	EETING BY EQUATION SOLVING METHODS: Pro- tearing a system of equations, SWS algorithm, massystem of equations using Newton's method	recedenc	e orderin g sparsi	g, y,	· 9
V	CASE STU recycle, tea heeting soft	JDIES: Simulation of process flowsheets involving mar stream and design specification, demonstration of ware	ass recy open so	cle, ener urce flo	gy vs	9
		Total h	istructio	onal Hou	rs	45
On completion	on of the co	urse, the students will be able to				
	COI	Understand the basic concept in preparation of flow she	eet.			
Course	CO2	Identify the preparing networks				
Outcome	CO3	Illustrate the different approach in flow sheeting.				
	CO4	Identify flow sheet preparation by equation solving me	thods			
	CO5	Evaluate the case studies using flow sheeting software.				
TEXT BOO	K:					
TI	Babu, B V.	Process Plant Simulation, Oxford University Press, 200)4			
T2	Shenov, V.	U., Heat Exchanger network synthesis, Gulf Publishing.	, 1995			
T3	Jana, A. K. Hall India I	, Chemical Process Modeling and Computer Simulation, Pvt. Ltd, 2011.	Second	Edition,	Prent	се
REFERENC	CES:					
R1	Douglas, J.	M., Conceptual Design of Chemical Process, McGraw	Hill, 198	8.	V	1. 1090
R2	Reklaitis G	.V., Ravindran A., Ragsdell, K.M., Engineering Optimiz	zation, V	ley, Ne	W YOI	<u>K, 1980.</u>
R3	Luyben, W Internation	L.: Process Modeling, Simulatio5n and Control for Che al Student Edition, Second Edition, 1996.	mical E	igineers.	McGi	aw Hill,
R4	Ramirez, V 1997.	V. D., Computational Methods for Process Simulation, S	econd E	dition, E	sevier	Science,

Va Chairman, Board of Studies

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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q Chairman, Board of Studies

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	Ī
CO1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	Ī
CO2	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO3	2	3	2	2	3	2	2	2	2	2	2	1	2	2	T
CO4	2	3	2	2	3	2	2	2	2	2	2	1	2	2	Ī
CO5	2	3	3	2	3	2	2	2	2	2	2	1	2	21	Ī

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Programme	Course Code	Name of the Course	L	Т	P	С					
BTECH	22CH6401	WASTE TO ENERGY CONVERSION	3	0	0	3					
B. I D.C.I.	The student s	hould be able to									
Course	1. Learn ab	out production of energy from different types of waste	s throug	h therma	ıl, biol	ogical and					
Objective	chemical	routes									
	2. Express	heir knowledge in the field of the utilization of different typ	es of was	tes for en	ergy p	roduction.					
	3. Illustrate	the idea about incineration and Pyrolysis.									
Unit	Description				In: He	structional ours					
I	INTRODUC wastes, Energ gasification of	FION: Introduction to waste to energy conversion, y production form wastes through incineration, energy wastes.	charact product	erizatior ion thro	ı of ugh	9					
II	PYROLYSIS utilization. Inc (grate, fluidize	: Energy production through pyrolysis and gasification ineration: Basics of waste incineration, process flow, ed bed, rotary kiln), energy recovery from incineration.	on of wa types of	stes, syr incinera	igas tors	9					
III	DENSIFICA Densification from waste pl	TION OF BIOMASS AND WASTE PLA of solids, efficiency improvement of power plant an astics, Energy production form wastes Plastic, gas clea	STIC d energy nup.	BLEN produc	DS: tion	9					
IV	ENERGY PI through anaer	RODUCTION FROM WASTE: Energy production obic digestion and fermentation, introduction to microl	from org pial fuel	ganic wa cells	stes	9					
V	CULTIVATION OF MICROALGAE FOR BIOFUEL PRODUCTION: Energy 9 production from wastes through fermentation and transesterification. Cultivation of algal 9 biomass from wastewater and energy production from algae. 9										
	promuss nom	Total	Instruct	ional H	ours	45					
On completio	n of the course	e. the students will be able to									
	CO1 Und	lerstand the basic principles of waste management, inc	luding v	vaste cla	ssifica	tion					
Course Outcome	CO2 Eva	luate various thermal conversion technologies, such as ification.	s incinera	ation, py	rolysis	3,					
	CO3 Ass	ess the principles and applications of densification of l	piomass.								
	CO4 And	alyze the Energy production from organic wastes throu nentation	gh anaei	obic dig	estion	and					
	CO5 Ap	olv chemical conversion techniques, such as transesteri	fication	for biod	iesel p	roduction					
TEXT BOOK	<:					-					
. T1	Ashok K. Rat 2019. 1st Edi	houre, Zero Waste: Management Practices for Enviror ion.	mental	Sustaina	bility,	CRC Press.					
T2	M. Habibur F 2010	ahman, Abdullah Al-Muyeed, Solid and Hazardous W	'aste Ma	nagemer	nt, ITN	I-BUET,					
T3	S. Vander Gh	eynst, S.C. Capareda., Introduction to Biomass Energ	y Conve	rsion, C	RC Pr	ess,2013					
REFERENC	ES:										
R1	A.V. Bridgwa Power, Wile	nte, Thermochemical Processing of Biomass: Convers y-Blackwell, 2010	ion into	Fuels, C	hemic	als, and					
R2	Samir K. Kha Wiley-Blacky	nal, A Anaerobic Biotechnology for Bioenergy Produvell, 2008.	ction: Pr	inciples	and A	pplications.					
R3	Nickolas J. T	hemelis. Energy from Waste: A Practical Guide. Spri	nger, 20	11							
R4	James G. Spe	ight, Gasification of Unconventional Feedstocks, Elsi	ever, 20	14.		1					

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HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore - 641032

DEPARTMENT OF CHEMICAL ENGINEERING Revised Curriculum and Syllabus for the Batch 2021-2025 (Academic Council Meeting Held on 03.03.2023)

2019 REGULATIONS WITH AMENDMENT



HindusthanCollegeofEngineering andTechnology

(AnAutonomousInstitution, Affiliatedto AnnaUniversity,Chennai ApprovedbyAICTE,NewDelhi&AccreditedbyNAACwith'A'Grade) ValleyCampus,PollachiHighways,Coimbatore,Tamilnadu.



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. CHEMICAL ENGINEERING (UG)

REGULATION-2019 WITH AMENDMENT

(For the students admitted during the academic year 2021-2025 and onwards)

SEMESTER I

S.No.	Course Code	Course Title	Category	L	Т	Р	С	CIA	ESE	TOTAL
		THEOR	RY							
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	40	60	100
	- -	THEORY WITH LAP	B COMPONE	NT						
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	21CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	21ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
		PRACTIO	CAL	•		•				
7	21HE1001	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
		MANDATORY	COURSES							
8	21HE1072	Career Guidance Level – I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
			Total :	14	2	12	20	480	320	800

SEMESTER II

S.No.	Course Code	Course Title	Category	L	Т	Р	C	C	IA	ESE	TOTAL
		THE	ORY			-	1				
1	21HE2101	Business English for Engineers	HS	2	1	0	3	4	40	60	100
2	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	4	40	60	100
3	21EE2103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	4	40	60	100
4	21CH2101	Principles of Chemical Engineering	ES	3	0	0	3	4	40	60	100
		THEORY WITH L	AB COMPO	NEN	T				ľ		
5	21PH2151	Material Science	BS	2	0	2	3	5	50	50	100
6	21CY2151	Environmental Studies	BS	2	0	2	3	5	50	50	100
		PRAC	ГІСАL								
7	21ME2001	Engineering Practices	ES	0	0	4	2	6	50	40	100
8	21HE2001	Language Competency Enhancement Course-II	HS	0	0	2	1	1	00	0	100
		MANDATOR	Y COURSES	5							
9	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	1	00	0	100
10	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	1	00	0	100
			Total :	18	2	10	22	6	20	380	1000
		SEMES	TER III								
S.No	Course Code	Course Title	Category	Ι		ТІ		С	CIA	ES	E TOTA L
		THE	ORY								
1	21MA3103	Fourier Analysis and Numerical Methods	BS	3	3	1 ()	4	40	60	100
2	21CH3201	Chemical Process Calculations	PC		3	1 ()	4	40	60	100
3	21CH3202	Fluid Mechanics for Chemical Engineers	PC		3	0 0)	3	40	60	100
4	21CH3203	Chemical Engineering Thermodynamics – I	PC		3	0 0)	3	40	60	100
		THEORY WITH L	AB COMPO	NEN	T						
5	21CH3251	Analytical Instruments for Analysis	PC	2	2	0 2	2	3	50	50	100
		PRAC	ГІСАL								
6	21CH3001	Fluid Mechanics Lab	PC	()	0 3	3	1.5	60	40	100
7	21CH3002	Chemical Analysis Lab	PC	()	0 3	3	1.5	60	40	100
		MANDATOR	Y COURSES	5							
8	21AC3191	Indian Constitution	AC	2	2	0 ()	0	100	0	100
9	21HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	2	0 0)	0	100	0	100
10	21HE3073	Leadership Management Skills	EEC	1		0 ()	0	100	0	100
			T 4 1	1	•	2 4	,	20	(20)	250	1000

SEMESTER IV

S.No	Course Code	Course Title	Category	L	Т	Р	С	CIA	ESE	TOTAL
		THE	ORY	•						
1	21CH4201	Process Heat Transfer	PC	3	1	0	4	40	60	100
2	21CH4202	Mass Transfer – I	PC	3	0	0	3	40	60	100
3	21CH4203	Chemical Engineering Thermodynamics - II	PC	3	0	0	3	40	60	100
		THEORY WITH I	LAB COMPO	NENT						
4	21CH4251	Mechanical Operations	PC	3	0	2	4	50	50	100
5	21MA4153	Applied Probability Statistics	BS	3	0	2	4	50	50	100
		PRAC	TICAL							
6	21CH4001	Heat Transfer Lab	PC	0	0	3	1.5	60	40	100
7	21CH4002	Petrochemical Analysis Lab	PC	0	0	3	1.5	60	40	100
		MANDATO	RY COURSES	5						
8	21AC4191	Essence of Indian tradition knowledge/Value Education	AC	2	0	0	0	100	0	100
9	21HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	21HE4073	Ideation Skills	EEC	2	0	0	0	100	-	100
			Total	21	1	10	21	640	360	1000
	-	SEME	STER V					,	<u>.</u>	
S.No.	Course Code	Course Title	Category	L	Т	Р	С	CIA	ESE	TOTAL
	·	THE	ORY							
1	21CH5201	Chemical Reaction Engineering – I	PC	3	1	0	4	40	60	100
2	21CH5202	Mass Transfer – II	PC	3	1	0	4	40	60	100
3	21CH5203	Process Instrumentation Dynamics and Control	PC	3	1	0	4	40	60	100
4	21CH5204	Safety in Chemical Industries	PC	3	0	0	3	40	60	100
5	21CH53XX	Professional Elective -I	PE	3	0	0	3	40	60	100
		THEORY WITH I	LAB COMPO	NENT						
6	21CH5251	Water Treatment and Solid Waste Management	PC	2	0	2	3	50	50	100
		PRAC	FICALS							
7	21CH5001	Mass Transfer Lab	PC	0	0	3	1.5	60	40	100
8	21CH5002	Process Control Lab	PC	0	0	3	1.5	60	40	100
		MANDATO	RY COURSES	5						
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100

Total

S No.	Course Code	Course Title	Category	L	Т	Р	С	СІА	ESE	TOTAL
0.110	course code	T		-	-	-	U	U.I.I	LOL	IOIIIL
			HEUK I	1	1					[
1	21CH6201	Engineering–II	PC	3	1	0	4	40	60	100
2	21CH6202	Chemical Process Industries	PC	3	0	0	3	40	60	100
3	21CH6181	Professional Ethics in Engineering	HS	3	0	0	3	40	60	100
4	21CH63XX	Professional Elective - II	PE	3	0	0	3	40	60	100
5	21XX64XX	Open Elective– I	OE	3	0	0	3	40	60	100
		THEORY WITH	H LAB COMPO)NEN	TS					
6	21CH6251	Fluidization Engineering	PC	2	0	2	3	50	50	100
	•	PRA	ACTICALS							
7	21CH6001	Chemical Reaction Engineering Lab	PC	0	0	4	2	60	40	100
		MANDAT	FORY COURSI	ES						
8	21CH6701	Internship/Industrial Training/Skill Development Course (Minimum 3 weeks)	EEC	-	-	-	1	100	0	100
9	21HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
10	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
			Total	19	1	6	24	610	390	1000

SEMESTER VI

SEMESTER VII

S.No.	Course Code	Course Title	Category	L	Т	Р	С	CIA	ESE	TOTAL
		ſ	THEORY							
1	21CH7201	Process Economics and Engineering Management	PC	3	0	0	3	40	60	100
2	21CH7202	Process Equipment Design	PC	3	1	0	4	40	60	100
3	21CH73XX	Professional Elective-III	PE	3	0	0	3	40	60	100
4	21XX74XX	Open Elective – II	OE	3	0	0	3	40	60	100
		PR	ACTICALS							
5	21CH7001	Design and Simulation Lab	PC	0	0	3	1.5	60	40	100
6	21CH7002	Computational Fluid Dynamics Lab	РС	0	0	3	1.5	60	40	100
PROJECT WORK										
7	21CH7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total 12 1 10 18 330 370								700		

SEMESTER VIII										
S.No.	Course Code	Course Title	Category	L	Т	Р	С	CIA	ESE	TOTAL
THEORY										
1	21CH83XX	Professional Elective –IV	PE	3	0	0	3	40	60	100
2	21CH83XX	Professional Elective- V	PE	3	0	0	3	40	60	100
PROJECT WORK										
3	21CH8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
Total 6 0 16 14 180 220 400										

TOTAL NO OF CREDITS: 165

S.No.	Course Code	Course Title	Categor y	L	Т	Р	С	CIA	ESE	TOTA L	
		PROFESSION	NAL ELEC'	ΓIVE	Ι						
1	21CH5301	Energy Technology	PE	3	0	0	3	40	60	100	
2	21CH5302	Petroleum Formation Evaluation	PE	3	0	0	3	40	60	100	
3	21CH5303	Electrochemical Engineering	PE	3	0	0	3	40	60	100	
4	21CH5304	Polymer Technology	PE	3	0	0	3	40	60	100	
5	21CH5305	Food Technology	PE	3	0	0	3	40	60	100	
	PROFESSIONAL ELECTIVE II										
1	21CH6301	Petroleum Exploration and Exploitation Techniques	PE	3	0	0	3	40	60	100	
2	21CH6302	Enzyme Engineering	PE	3	0	0	3	40	60	100	
3	21CH6303	Fundamentals of Nano science	PE	3	0	0	3	40	60	100	
4	21CH6304	Corrosion Science and Engineering	PE	3	0	0	3	40	60	100	
5	21CH6305	Piping and Instrumentation	PE	3	0	0	3	40	60	100	
PROFESSIONAL ELECTIVE III											
1	21CH7301	Natural Gas Engineering	PE	3	0	0	3	40	60	100	
2	21CH7302	Pulp and Paper Technology	PE	3	0	0	3	40	60	100	
3	21CH7303	Transport Phenomena	PE	3	0	0	3	40	60	100	
4	21CH7304	Multicomponent Distillation	PE	3	0	0	3	40	60	100	
5	21CH7305	Chemical Process Optimization	PE	3	0	0	3	40	60	100	
6	21CH7306	Blue Economy Entrepreneurship	PE	3	0	0	3	40	60	100	
		PROFESSION	AL ELECT	IVE I	V						
1	21CH8301	Industrial Management	PE	3	0	0	3	40	60	100	
2	21CH8302	Process Plant Utilities	PE	3	0	0	3	40	60	100	
3	21CH8303	Total Quality Management	PE	3	0	0	3	40	60	100	
4	21CH8304	Foundation Skills in Integrated Product Development	PE	3	0	0	3	40	60	100	
5	21CH8305	Supply Chain Management	PE	3	0	0	3	40	60	100	

LIST OF PROFESSIONAL ELECTIVES

	PROFESSIONAL ELECTIVE V										
1	21CH8306	Fermentation Technology	PE	3	0	0	3	40	60	100	
2	21CH8307	Frontiers of Chemical Technology	PE	3	0	0	3	40	60	100	
3	21CH8308	Industrial Nanotechnology	PE	3	0	0	3	40	60	100	
4	21CH8309	Drugs and Pharmaceutical Technology	PE	3	0	0	3	40	60	100	
5	21CH8310	Membrane Separation Process	PE	3	0	0	3	40	60	100	

LIST OF OPEN ELECTIVES											
CHEMICAL ENGINEERING											
S.No.	Course Code	Course Title	Category	L	Т	Р	С	CIA	ESE	TOTAL	
1	21CH6401	Waste to Energy Conversion	OE	3	0	0	3	40	60	100	
2	21CH7401	Biomass Conversion and Biorefinery	OE	3	0	0	3	40	60	100	
LIFE SKILL COURSES											
3	21LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	40	60	100	
4	21LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	40	60	100	
5	21LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	40	60	100	
6	21LSZ404	Indian Constitution and Political System	OE	3	0	0	3	40	60	100	
7	21LSZ405	Yoga for Human Excellence	OE	3	0	0	3	40	60	100	
		NCC	COURSES								
	(Only forthe students' who have opted NCC subjects in Semester I, II, III & IV are eligible)										
8	21HEZ401	NCC course level 1	OE	3	0	0	3	40	60	100	
9	21HEZ402	NCC course level 2	OE	3	0	0	3	40	60	100	

(Note: Z Stands for semester, students can't choose twice the course)

ADDITIONAL CREDIT COURSE FOR CHEMICAL ENGINEERING									
S.No	Course Code	Course Title	Category	Duration	Assessment	Credit			
1.	21VACH01	Industrial Automation	VA	30 hrs	Internal	1			
2.	21VACH02	Bulk Solid Handling for Chemical Engineers	VA	30 hrs	Internal	1			
3.	21VACH03	Fundamentals of AI and it's Chemometric Applications	VA	30 hrs	Internal	1			
4.	21VACH04	Introduction to Chemical Engineering MATLAB	VA	30 hrs	Internal	1			
5.	21VACH05	IOT- Basics and Application in Unit Operations	VA	30 hrs	Internal	1			

CREDIT DISTRIBUTION

	B.E. / B.TECH.PROGRAMMES									
	Course Area			Cr	edits per	Semester				Total Credits
S.No.		Ι	II	III	IV	V	VI	VII	VIII	
1	HSC	4	4	-	-	-	3	-	-	11
2	BSC	10	10	4	4	-	-	-	-	28
3	ESC	6	8	-	-	-	-	-	-	14
4	PCC	-	-	16	17	21	12	10	-	76
5	PEC	-	-	-	-	3	3	3	6	15
6	OEC	-	-	-	-	-	3	3	-	6
7	EEC	-	-	-	-	2	3	2	8	15
8	MC	-	-	-	-	-	-	-	-	-
	Total	20	22	20	21	26	24	18	14	165

Enrolment for B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation.

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

(i) B.E. / B.Tech. Honours (specialisation in the same discipline):

a. The student should have earned additionally a minimum of 18 credits from a vertical of the same programme.

- b. Should have passed all the courses in the first attempt.
- c. Should have earned a minimum CGPA of 7.50.

(ii) B.E. / B.Tech. Honours:

a. The students should have earned additional courses (minimum of 18 credits) from more than one vertical of the same programme.

b. Should have passed all the courses in the first attempt.

c. Should have earned a minimum CGPA of 7.50.

(iii) B.E. / B.Tech. (Minor in other specialisation):

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E. / B.Tech. programmes or from any one of the following verticals

VERTICAL I: FINTECH AND BLOCK CHAIN VERTICAL II: ENTREPRENEURSHIP VERTICAL III: ENVIRONMENT AND SUSTAINABILITY

- Students can earn maximum of 6 credits in online mode (SWAYAM platform), out of these 18 credits as approved by Centre for Academic Courses.
- B.E. / B. Tech. (Honours) Specialisation in the same discipline, B.E / B.Tech. Honours and B.E. / B.Tech. Minor in other specialisation degree will be optional for students.
- For the categories (i) to (ii), the students will be permitted to register the courses from V Semester onwards provided the marks earned by the students until III semester should be of CGPA 7.50 and above and cleared all the courses in the first attempt.

- For the category (iii), the students will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- If a student decides not to opt for Minor, after completing certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.
- The Head of Department, shall forward the proposal to the Controller of Examinations after getting the approval from Head of the Institution / Dean Academics, before the commencement of the fifth semester of the programme for the students undergo optionally B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation

VERTICALS FOR MINOR DEGREE CHEMICAL ENGINEERING OFFERING MINOR DEGREE

SL. NO.	Course		Category Periods Per week				Total	Credits
	Code	Course Title		L	Т	Р	Contact	
							Periods	
1	21CH5231	Introduction to Chemical Process	MDC	3	0	0	3	3
2	21CH6231	Fluid Flow Operations in Chemical	MDC	3	0	0	3	3
		Engineering	WIDC	5	0	0	5	,
3	21CH6232	Fundamentals of Chemical	MDC	3	0	0	3	3
		Thermodynamics	MDC	5	0	0	5	,
4	21CH7231	Process Heat and Mass Transfer	MDC	3	1	0	4	4
			WIDC	5	1	0	-	
5	21CH7232	Reaction Engineering	MDC	3	0	0	3	3
6	21CH8231	Unit Operations and Process Laboratory	MDC	0	0	1	4	2
			WIDC	0	0	4	4	2

Minor Specialization in Chemical Process Engineering

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

	VERTICAL I: FINTECH AND BLOCK CHAIN										
s	Course		a .	Periods I	Per w	eek	Total	~ 1			
No	Code	Course Title	Category	L	Т	Р	Contact Periods	Credits			
1	21MB5231	Financial Management	MDC	3	0	0	3	3			
2	21MB6231	Fundamentals of Investment	MDC	3	0	0	3	3			
3	21MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3			
4	21MB7231	Introduction to Block chain and its Applications	MDC	3	0	0	3	3			
5	21MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3			
6	21MB8231	Introduction to Fintech	MDC	3	0	0	3	3			

VERTICAL II: ENTREPRENEURSHIP										
	Course			Perie	ods Pe	r week	Total			
S No	Code	Course Title	Category	L	Т	Р	Contact Periods	Credits		
1	21MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3		
2	21MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3		
3	21MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3		
4	21MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3		
5	21MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3		
6	21MB8232	Financing New Business Ventures	MDC	3	0	0	3	3		
		VERTICAL III: ENVIR	ONMENT A	ND SU	STAI	NABILI	ГҮ			
	Course			Perie	ods Pe	r week	Total			
S No	Code	Course Title	Category	L	Т	P	Contact Periods	Credits		
1	21CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3		
2	21AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3		
3	21BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3		
4	21ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3		
5	21CE7233	Green Technology	MDC	3	0	0	3	3		
6	21CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3		

VERTICALS FOR B Tech (Hons) and B Tech (Hons) in Chemical Engineering with Specialization

Vertical I Computer Aided Process Engineering	Vertical I Vertical II Vertical II omputer Aided Process Engineering Polymer Technology Petroleum Engineeri		Vertical IV Instrumental Chemical Analysis
Process Flow Sheeting	Polymer Chemistry	Petroleum Geology	Principles of Mass Spectrometry
Transport Phenomena	Processing Technology	Petroleum Exploration	Advanced Analytical Separation Techniques
Advanced Process Optimization	Rubber Technology	Drilling Technology	Advanced Spectrometry: ICP- MS and LC-MS
Artificial Intelligence in Process Engineering	Polymer Product Design, Blends, and Alloys	Petroleum Production Engineering	Instruments for Morphology and Structural Characterization
Digital Twin and Soft Computing in Process Modelling	Polymer Structure and property relationships	Petroleum Reservoir Engineering	Statistical Analysis and Data Processing (Lab)
Advanced Process Modelling and Simulation	Polymer Compounding Technology	Offshore Engineering	Troubleshooting Analytical Methods and Instruments

B Tech (Hons) Chemical Engineering with Specialization in Computer Aided Process Engineering

S No	Course			Peri	ods P	er	Total	
S No	Codo	Course Title	Category	weel	ĸ		Contact	Credits
	Coue			L	Т	Р	Periods	
1	21CH5203	Process Flow Sheeting	MDC	2	0	2	4	3
2	21CH6202	Transport Phenomena	MDC	3	1	0	3	4
3	21CH6203	Advanced Process	MDC	2	0	2	4	3
5		Optimization	MEC					
4	21CH7203	Artificial Intelligence in	MDC	2	0	2	4	3
-		Process Engineering	WIDC					
	21CH7204	Digital Twin and Soft		2	0	2	4	3
5		Computing in Process	MDC					
		Modelling						
6	21CH8201	Advanced Process Modelling	MDC	0	0	4	4	2
0		and Simulation	MIDC					

B Tech (Hons) Chemical Engineering with Specialization in Polymer Technology

S No	Course	Course Title	Category	Peri weel	ods P s	er	Total Contact	Credits
	Code		ourogor,	L	Т	Р	Periods	ci cui s
1	21CH5204	Polymer Chemistry	MDC	3	0	0	3	3
2	21CH6204	Processing Technology	MDC	3	0	0	3	3
3	21CH6205	Rubber Technology	MDC	3	0	0	3	3
4	21CH7205	Polymer Product Design, Blends, and Alloys	MDC	3	0	0	3	3
5	21CH7206	Polymer Structure and property relationships	MDC	3	0	0	3	3
6	21CH8202	Polymer Compounding Technology	MDC	3	0	0	3	3

B Tech (Hons) Chemical Engineering with Specialization in Petroleum Engineering

S No	Course	Course Title	Category	Peri weel	ods P k	er	Total Contact	Credits
	Code			L	Т	P	Periods	
1	21CH5205	Petroleum Geology	MDC	3	0	0	3	3
2	21CH6206	Petroleum Exploration	MDC	3	0	0	3	3
3	21CH6207	Drilling Technology	MDC	3	0	0	3	3
4	21CH7205	Petroleum Production Engineering	MDC	3	0	0	3	3
5	21CH7206	Petroleum Reservoir Engineering	MDC	3	0	0	3	3
6	21CH8203	Offshore Engineering	MDC	3	0	0	3	3

B Tech (Hons) Chemical Engineering with Specialization in Instrumental Chemical Analysis

S No	Course	Course Title	Category	Peri weel	ods P k	er	Total Contact	Credits
	Code			L	Т	Р	Periods	
1	21CH5206	Principles of Mass Spectrometry	MDC	3	0	0	3	3
2	21CH6208	Advanced Analytical Separation Techniques	MDC	3	0	0	3	3
3	21CH6209	Advanced Spectrometry: ICP-MS and LC-MS	MDC	3	0	0	3	4
4	21CH7207	Instruments for Morphology and Structural Characterization	MDC	3	0	0	3	3
5	21CH7208	Statistical Analysis and Data Processing (Lab)	MDC	3	0	0	4	2
6	21CH8204	Troubleshooting Analytical Methods and Instruments	MDC	3	0	0	3	3

Principal man Board of Studies Dean (Academics) Chairman - BoS Dean (Academica) **CHE** - HICET HICET EINCIPA Kindusthan College Of Engine COMBATORE - 641 037

Programme P Took		Course Code	L	T	Р	C	
B.	Tech	21CH7201	PROCESS ECONOMICS AND ENGINEERING MANAGEMENT	3	0	0	3
Co Obj UNIT	ourse ectives	• To enable the st design considerate	udents to understand the various concepts of economics, pation and cost estimation in chemical industry. DESCRIPTION	process o INSTE	level RUCI	opme TION RS	nt, AL
Ι	INTERI Deprecia plant, cos	EST AND PLAN ation, Depletion, estin st indices, capital rec	T COST: Time value of money - equivalence, mation of capital cost, Capital requirement for complete overy.	-	9		
Π	PROJEC profitabil sheet pre	CT PROFITABILT lity, Investment alter paration- problems.	Y AND FINANCIAL RATIOS: Estimation of project rnatives, income statement and financial ratios, balance		9		
III	ECONO economic insulation	DMIC BALANCE c balance in batch n, evaporation, heat t	IN EQUIPMENTS: Essentials of economic balance, operations, cyclic operations, economic balance for ransfer equipments.		9		
IV	PRINCI organizir organiza	PLES OF MANA ng, staffing, coordina tions, Management in	AGEMENT: Principles of management, planning, ting, directing, controlling and communicating. Types of nformation systems (MIS).		9		
V	PRODU study, pr routing, productio	CTION PLANNIN inciples of time stud scheduling, dispatch on and quality contro	G CONTROL: Work measurement techniques, motion y, elements of production control, forecasting, planning, ning, inventory and control, role of control charts in l.		9		
			Total Instructional Hours		45		
	U	pon completion of t	he course, students can be able to				

CO1- Calculate the capital cost and the value of money for the complete plant

Course CO2- Illustrate the profitability of the project and balance sheet preparation

Outcomes CO3- Estimate the economic operation of the equipment

CO4- Identify the planning and management

CO5- Examine the production planning, control chart preparation and quality control

TEXT BOOKS:

- 1. Peters and Timmerhaus, Plant design and Economics for Chemical Engineers, McGraw Hill 5th Edition, 2004.
- 2. Schweyer. H.E, "Process Engineering Economics", Mc Graw Hill, 1969.

REFERENCE BOOKS:

- 1. F.C. Jelen and J.H. Black, "Cost and Optimization Engineering", McGraw Hill, 3rd Edn., 1992
- 2. Ahuja K.K, Industrial management, Khanna publishers, New Delhi, 1985.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	-	2.0	-	-	-	-	-	2.0	-	3.0	3.0	-
CO2	3.0	3.0	-	2.0	-	-	-	-	-	-	-	3.0	3.0	2.0
CO3	3.0	3.0	-	2.0	2.0	-	-	-	-	-	-	3.0	3.0	-
CO4	3.0	3.0	-	2.0	2.0	-	-	-	-	-	-	3.0	3.0	-
CO5	3.0	3.0	-	2.0	2.0	-	-	-	-	2.0	-	3.0	3.0	2.0
Avg	3.0	3.0	-	2.0	2.0	-	-	-	-	2.0	-	3.0	3.0	2.0

Dean (Academics) HICET

Prog	ramme	Course Code	Name of the Course	L	Т	Р	С			
B. '	Tech	21CH7202	PROCESS EQUIPMENT DESIGN	3	1	0	4			
Course Objectives UNIT		• Students learn to different chemical	• Students learn to do in detail process and mechanical design and eng different chemical engineering equipments.							
UNIT		DESCRIPTION	INSTR H	UCT IOUI	TON RS	AL				
Ι	DESI Shell	12								
Π	DESI single		12							
III	DESI colum	¹ 12								
IV	DESIG	12								
V	DESIC Presen	GN OF PLANT LAYO tation Materials of Constr	UT: Pipe Lines and Pipe Layouts, Schematics and ruction and Selection of process equipments.		12					
		Upon completion of the	Total Instructional Hours course, students can be able to		60					
Cou	rse	CO1- Understand the print exchangers, condensers, a CO2- Analyze and design	nciples and apply design procedures for thermal equipn and evaporators.	nent such	i as h	ieat rvers				
Outco	mes	 CO3- Evaluate and design mass transfer equipment including absorption, distillation, extraction, and adsorption columns. CO4- Design pressure vessels, packed bed reactors, and storage vessels considering safety, mechanical integrity, and process requirements. CO5- Develop comprehensive plant layouts including pipelines and piping systems, and prepare schematic presentations with appropriate selection of materials of construction. 								
TEXT	BOOK	S:								
1	. Gree	en D. W., "Perry's Chemic	cal Engineer's Handbook", 8th Edition McGraw Hill, 20	007						

2. Coulsion and Richardson's., "Chemical Engineering Design - Volume 6", Pergamon; 2nd edition, 1993.

REFERENCE BOOKS:

- 1. R. K. Sinnott, "Coulson & Richardson's Chemical Engineering", Vol. 6, Butterworth Heinermann, Oxford, 1996.
- Green D. W., "Perry's Chemical Engineer's Handbook", 8th Edition McGraw Hill, 2007.
 Dawande, S. D., "Process Design of Equiment", 4th Edition, Central Techno Publications, Nagpure, 2005.
- 4. Baranan, C.R., "Rules of Thumb for Chemical Engineers", Gulf Publishing Co, Texas, 1996.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	1.0	-	-	-	-	-	-	-	-	-	3.0	2.0
CO2	3.0	3.0	3.0	2.0	2.0	-	-	-	-	-	-	-	3.0	2.0
CO3	3.0	2.0	3.0	2.0	1.0	-	-	-	-	-	-	-	3.0	2.0
CO4	3.0	3.0	3.0	2.0	2.0	-	-	-	-	-	-	-	3.0	2.0
CO5	3.0	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	1.0	-	3.0	3.0	-
Avg	3.0	2.6	2.6	2.25	1.75	2.0	1.0	1.0	-	1.0	-	3.0	3.0	2.0

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Academics ean
Program	me Course Code	Name of the Course	L	Т	Р	С
B.Tech	1 21CH7001	DESIGN AND SIMULATION LAB	0	0	3	1.5
Course Objectiv	• To give the stude solving and comp	ents an understanding the fundamentals concepts in mathemuter programming.	matic	es, p	roble	ems
S.No.		DESCRIPTION				
1.	Equations of state using N	ewton's method.				
2.	Regression for parameter	estimation using a set of data points.				
3.	Equilibrium flash distillati	on (Multicomponent Ideal).				
4.	Batch Reactor.					
5.	CSTR in Series Stage wise	e contacting equipment.				
6.	Solving a simple flow shee	et by simultaneous approach.				
7.	Simulation of batch Distil	ation (binary ideal).				
8.	Gravity Flow Tank.					
9.	Heat Exchanger.					
10.	Plug Flow Reactor.					
11.	Absorber.					
12.	Drag coefficient of solid p	article				
		Total Practical Hours		45	5	
	Upon completion of t	he course, students can be able to				

Course Upon completion of the course, students can be able to

Outcomes

- Solve equations of state using Newton's method for accurate thermodynamic calculations.
- Perform regression analysis to estimate model parameters from experimental data.
- Model batch reactors, CSTRs in series, and plug flow reactors for optimal performance
- Calculate equilibrium and simulate flash distillation and gas absorption for multicomponent systems.
- Simulate heat exchangers and gravity flow tanks for efficient energy and fluid dynamics control

REFERENCE BOOKS:

- 1. Bequette. B.W, "Process Dynamics": Modelling, Analysis and Simulation," Prentice Hall (1998).
- 2. Himmelblau. D.M. and Bischoff. K.B, "Process Analysis and Simulation", Wiley, 1988.
- 3. Strang.G., "Introduction to Linear Algebra", Cambridge Press, 4th edition, 2009.
- 4. William. Luyben, "Process Modelling, simulation and control for Chemical Engineers, 2nd Edn., McGraw Hill International Editions, New York, 1990.
- 5. Chapra.S.C. and Canale.R.P. "Numerical Methods for Engineers", McGraw Hill, 2001.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO2	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO4	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO5	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	_	-	3.0	2.0
Avg	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0



Program B.Tec	me Course Code h 21CH7002	Name of the Course	L 0	Т 0	Р 3	C 1.5	
Cours Objectiv	• The lab involved aim to visualize t	the numerical solution of some common problems of chemic he effect of various factors on the flow of heat and mass tran	al eng sfer.	ginee	ring	and	
S.No.		DESCRIPTION					
1.	Study of fluid flow and he	eat transfer in mixing tee.					
2.	Study of flow mal distribution	ution in different shapes of headers.					
3.	Velocity boundary layer a	analysis of flow of fluid over a flat plate in laminar flow.					
4.	Study of laminar and turb	ulent flow in pipe line.					
5.	Modeling of forced conve	ection in pipe line flows.					
6.	Study of flow of fluid over	er air foil and effect of angle of attack.					
7.	Modeling steady flow pas	st cylinder and other geometries.					
0	G(1) C C (1 C)	· · · · · · · · · · · · · · · · · · ·					

- 8. Study of fluid flow and heat transfer in mixing elbow.
- 9. Study the effect of roughness in turbulent flow through pipe line.
- 10. Study of flow of fluid through a nozzle.
- 11. Study of fluid flow in a rotating disk.
- 12. Modeling motion of sphere in cylinder falling under gravity.

Total Practical Hours45

Course Upon completion of the course, students can be able to

- Analyze fluid flow and heat transfer in mixing tees and elbows for process efficiency
 - Evaluate flow distribution in various header shapes and assess velocity boundary layers in laminar flow.
 - Distinguish between laminar and turbulent flow in pipelines and assess the impact of surface roughness.
 - Model forced convection, fluid flow over airfoils, and steady flow past cylinders and complex geometries.
 - Examine flow behavior in nozzles, rotating disks, and the motion of spheres in cylindrical systems

REFERENCE BOOKS:

Outcomes

- 1. P.S. Ghosdastidar, Computer Simulation of Flow and Heat Transfer, Tata McGraw-Hill (1998).
- 2. Muralidhar, K.,andSundararajan,T. Computational Fluid Flow and Heat Transfer, Narosa Publishing. House (1995).
- 3. Ranade, V.V., Computational flow modeling for chemical reactor engineering, Academic Press (2002).
- 4. Finlayson, B. A., Introduction to Chemical Engineering Computing, John Wiley & Sons, New Jersey, 2006.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO2	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO4	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO5	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
Avg	3.0	3.0	3.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0

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Progra	amme	Course Code	Name of the Course	L	Т	Р	С
B.1	lech	21CH5301	ENERGY TECHNOLOGY	3	0	0	3
Cou Objec	urse ctives	• Students will gain know	vledge about different energy sources				
UNIT			DESCRIPTION	INST	RUCT HOUI	'IONA RS	L
Ι	ENEI conve	RGY: Introduction to energy – rsion factors, general classification	Global energy scene – Indian energy scene - Units of energy, on of energy, energy crisis, energy alternatives.		9		
Π	CON therm combi	VENTIONAL ENERGY: Con al, hydel and nuclear power pl astion processes, fluidized bed c	ventional energy resources, Thermal, hydel and nuclear reactors, ants, efficiency, merits and demerits of the above power plants, ombustion.		9		
Ш	NON- focusi solar j energy genera therm	CONVENTIONAL ENERG ng collectors, solar water heatin pond, solar thermal power gener y, types of windmills, types of v ation, wind power in India, ec al energy conversion, tidal energy	Y: Solar energy, solar thermal systems, flat plate collectors, g, solar cooling, solar distillation, solar refrigeration, solar dryers, ration, solar energy application in India, energy plantations. Wind vind rotors, Darrieus rotor and Gravian rotor, wind electric power conomics of wind farm, ocean wave energy conversion, ocean sy conversion, geothermal energy.		9		
IV	BION – Bio biodie	IASS ENERGY: Biomass orig logical conversion, Chemical of sel power generation gasifier, bi	in - Resources – Biomass estimation. Thermochemical conversion conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, logas, integrated gasification.		9		
V	ENEI respor perfor	RGY CONSERVATION: Ener isibilities; Energy audit - Type mance, material and energy bala	gy conservation - Act; Energy management importance, duties and es methodology, reports, instruments. Benchmalcing and energy ance, thermal energy management.		9		
			Total Instructional Hours		45		
		Upon completion of the cours	e, students can be able to				
		CO1- Understand about the energy	ergy and its classification				
Cour	se	CO2- Illustrate about the conve	ntional energy resources and its production				
Outco	mes	CO3- Examine about non-conv	entional energy resources and its production				
		CO4- Explain about production	of biomass energy				
		CO5- Understand about the ene	rgy conservation and management				
TEXT B	OOKS:						
1.	. Rao, S	S. and Parulekar, B.B., Energy To	echnology, Khanna Publishers, 2005.				
2.	. Rai, C	B.D., Non-conventional Energy S	ources, Khanna Publishers, New Delhi, 1984.				
3.	. Energ	y Management, Paul W.O'Calla	ghan McGraw – Hill, 1993				
REFER	ENCEB	OOKS:					
1.	. Nejat	Vezirog, Alternate Energy Sour	ces, II, McGraw Hill, New York.				
2.	. El. W	akii, Power Plant Technology, T	ata wicoraw Hill, New York, 2002.				
3.	. Sukna	une. S.P., Solar Enery - Therma	Conection and Storage, Tata McGraw nill, New Deini, 1981.				

4. Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0



Dean (Academics)

Progr	amme	Course Code	Name of the Course	L	Т	Р	С				
B. 1	l'ech	21CH5302	PETROLEUM TECHNOLOGY	3	0	0	3				
Cor Obje	urse ctives	• To make the stude petroleum and natu	ents understand petroleum engineering principles, t ral gas manufacturing problems.	heir app	licati	on to)				
UNIT			DESCRIPTION	INSTR I	RUCT HOUI	'ION RS	AL				
Ι	INTR Cokin	ODUCTION: Refinery g and thermal process.	products - Refinery Feeds - Crude distillation -		9						
II	CATA Hydro	ALYTIC CRACKING: processing and Reused p	Catalytic Cracking - Catalytical hydro cracking – rocessing hydro treating.		9						
III	CATA Produ	ALYTICAL: Reforming ct blending – Supporting	and isomerization alkylation and polymerization – processes.		9						
IV	LUBE	RICIATING: Lubriciatin	g oil blending stocks petrochemical feedstocks.		9						
V	COST reused	EVALUATION: Cost and refineries.	Evaluation - Economic evaluation of petroleum		9						
			Total Instructional Hours		45						
Cour Outcoi	se (mes (()	Upon completion of the of CO1- Understand the basic CO2- Examine about the petroleum products CO3- Illustrate about the of CO4- Determine the lubric CO5- Understand the cost	course, students can be able to c refinery products by unit operation and process process of catalytic cracking and hydro treating for catalytical process of petroleum products production cation of petroleum feed stock evaluation process in petroleum refineries	[.] the pro	ducti	on of					
TEXT	BOOK)OKS.									
1	Potrol	leum Refining: Technolog	w and economics CRC Press V Edition 2007 LCH G	rry Har	dwar	AGE	2				

- 1. Petroleum Refining: Technology and economics CRC Press V Edition 2007 J.CH Garry, Hardward G.E and M.J.Kaiser.
- 2. Nelson, W. L., "Petroleum Refinery Engineering", 4th Edition., McGraw Hill, New York, 1985.

- 1. Modern Petroleum Technology Upstream Vol I A.G. Lucas Hurley Edition 2002.
- 2. Wiseman. P., "Petrochemicals", UMIST Series in Science and Technology, John Wiley & Sons, 1986.
- 3. Bhaskara Rao, B. K. "A Text on Petrochemicals", 1st Edition, Khanna Publishers, New Delhi, 1987.
- 4. Bhaskara Rao, B. K., "Modern Petroleum Refining Processes", 2nd Edition, Oxford and IBH Publishing Company, New Delhi, 1990.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Dean (Academics) HICET -

Progra	amme	Course Code	Name of the Course	L	Т	Р	C
B.1	ech	21CH5303	ELECTROCHEMICAL ENGINEERING	3	0	0	3
Cou Objec	urse ctives	• Students will gain ki	nowledge about electrochemical process and its application.				
UNIT			DESCRIPTION	INST	RUCT HOUI	IONA RS	L
Ι	REV – Pol curve	IEW BASICS OF ELECTR larography, The electrical doi – Helmoltz layer – Guoy – St	OCHEMISTRY: Faraday's law - Nernst potential –Galvanic cells uble layer: 94lt's role in electrochemical processes –Electrocapillary even's layer – fields at the interface.		9		
П	MAS contr over	S TRANSFER IN ELI olled electrochemical reaction potential, primary-secondary c	CTROCHEMICAL SYSTEMS: Diffusion – the importance of convention and the concept of limiting current. Furrent distribution – rotating disc electrode.		9		
ш	INTI relati Form contr – catl	RODUCTION TO CORRC ons of activities controlled is of corrosion- definition, fa ol measures- industrial boiler hodic protection, sacrificial an	DSION: Series, corrosion theories derivation of potential-current and diffusion controlled corrosion process. Potential-pH diagram, ctors and control methods of various forms of corrosion-corrosion water corrosion control – protective coatings –Vapor phase inhibitors odes – Paint removers.		9		
IV	ELE Selec	CTRO DEPOSITION : ele tive solar coatings, Primary ar	ctro refining – electroforming – electro polishing – anodizing – and secondary batteries – types of batteries, Fuel cells.		9		
v	ELE IND – sen fluidi figur	CTRODES USED IN U STRIES: Metals-Graphite – ni conducting type etc. Metal i zed bed electrochemical readers es of merits of different type o	DIFFERENT ELECTROCHEMICAL Lead dioxide – Titanium substrate insoluble electrodes – Iron oxide finishing-cell design. types of electrochemical reactors, batch cell, ctor, filter press cell, Swiss roll cell, plug flow cell, design equation, f electrochemical reactors.		9		
			Total Instructional Hours		45		
		Upon completion of the cou	irse, students can be able to				
		CO1- Understand the basic e	lectrochemistry				
Cour	se	CO2- Understand the diffusi	on transfer in electrochemical systems				
Outcol	mes	CO3- Understand the corros	ion formation and control measures				
		CO4- Understand the proces	s of electro plating and fuel cells				
		CO5- Understand the variou	s types of electrodes in electrochemical industries				
TEXT B	OOKS:						

1. Picket, "Electrochemical Engineering", Prentice Hall. 1977.

2. Newman, J. S., "Electrochemical systems", Prentice Hall, 1973.

- **REFERENCE BOOKS:**
 - 1. Barak, M. and Stevenge, U. K., " Electrochemical Power Sources Primary and Secondary Batteries" 1980.
 - 2. Mantell, C., "Electrochemical Engineering", McGraw Hill, 1972.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Progra	amme	Course Code	Name of the Course	L	Т	Р	(
B.T	Tech	21CH5304	POLYMER TECHNOLOGY	3	0	0	3
Cou Objec	urse ctives	• To enable the studer	ts to compute molecular weight averages from the molecular w	eight distr	ibution	,	
0		Condensation polymer	ization and transition in polymers.				
UNIT			DESCRIPTION	INSTRU	JCTIO	NAL	
				I	HOUR	5	
Ι	INTE rubbe betwe	RODUCTION: History of M er, proteins – concepts of macro een simple organic molecules an	acromolecules – structure of natural products like cellulose, molecules – Staudinger's theory of macromolecules – difference d macromolecules.		9		
П	ADD free r polyn	ITION POLYMERIZATION adicals – monomers – functiona nerization – cationic polymeriza	: Chemistry of Olefins and Dienes – double bonds – Chemistry of lity – Polymerization: Initiation – types of initiation – free radical tion – anionic polymerization – coordination polymerization		9		
Ш	CON conde of po polym	DENSATION POLYMERI ensation reactions to polymer sy plycondensation- Carother's en nerization – crosslinked polymer	CATION: Simple condensation reactions – Extension of nthesis – functional group reactivity – polycondensation – kinetics juation – Linear polymers by polycondensation – Interfacial s by condensation – gel point.		9		
IV	MOI molea polyn weigł	ECULAR WEIGHTS OF P cules and polymers – number nerization and molecular weight the determination.	OLYMERS: Difference in molecular weights between simple • average and weight average molecular weights – Degree of nt – molecular weight distribution – Polydispersity – molecular		9		
v	TRA transi polyn	NSITIONS IN POLYMERS: tions in polymers – experiment ners – effect of crystallization –	First and second order transitions – Glass transition, Tg – multiple al study – significance of transition temperatures – crystallinity in in polymers – factors affecting.		9		
			Total Instructional Hours		45		
		Upon completion of the cours	se, students can be able to				
		CO1- Understand about the var	ious macromolecules and its difference with organic molecules				
Cour	se	CO2- Understand about the ini	tiation of addition polymerization and its types				
Outco	mes	CO3- Understand about conder	asation polymerization reaction for polymer synthesis				
		CO4- Understand the molecula	r distribution and the methods of determination				
		CO5- Understand the transition	n in polymers and crystallization process				
TEXT B	OOKS:						
1.	. Billm	eyer.F.W.,Jr, Text Book of Poly	mer Science, Ed. Wiley-Interscience, 1984.				
2.	. Gowa	riker.V.T., Viswanathan.N.V., a	nd Sreedar.J., Polymer Science, Wiley Eastern Ltd., 1988.				
REFERI	ENCE E	BOOKS:					

- 1. Joel, R.F; Polymer Science and Technology, Eastern Economy Edition, 1999.
- 2. Rodriguez, F., Cohen.C., Oberic.K and Arches, L.A., Principles of Polymer Systems, 5th edition, Taylor and Francis.
- Vishu Shah, Hand book of Plastics Testing and Failure Analysis, 3rd Edition, John-Willey &Sons, New York, 2007.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0



Progra	amme	Course Code	Name of the Course	L	Т	Р	C				
B.1	ſech	21CH5305	FOOD TECHNOLOGY	3	3 0 0						
Co Obje	urse ctives	• To enable the students	to learn to design processing equipments for Food Industrie	s.							
UNIT			DESCRIPTION	INSTI	RUCI	ION	AL				
Ι	AN C	VERVIEW: General aspects	of food industry; world food needs and Indian situation.]	HOUI 9	RS					
Ш	FOO food; contro	D CONSTITUENTS, QUA quality and nutritive aspects; f	LITY AND DERIVATIVE: Constituents of food additives; standards; deteriorative factors and their		9						
Ш	GEN proce	ERAL ENGINEERING AS ssing methods; conversion and	SPECTS AND PROCESSING: Preliminary preservation operations.		9						
IV	FOO conce ferme	D PRESERVATION MET entration; drying irradiation; entation and pickling; packing	HODS: Preservation by heat and cold; dehydration; microwave heating; sterilization and pasteurization; methods.		9						
v	PRO pulses soft a	DUCTION AND UTILISAT s; vegetables; fruits; spices; fat nd alcoholic beverages; dairy p	TON OF FOOD PRODUCTS: Cereal grains; as and oils; bakery; confectionery and chocolate products; products; meat; poultry and fish products.		9						
			Total Instructional Hours		45						
		Upon completion of the cour	rse, students can be able to								
a		CO1- Understand the basic an	d general aspects of food industry								
Cour	se	CO2-Examine the quality stan	idards and control of food constituents								
Juico	mes	CO_{4-} Categorize about the dif	y and general methods of food processing								
		CO5- Understand about the pr	roduction of different food products and utilization								
TEXT H	BOOKS	:	-								

1. Heid J.L. Joslyn M.A., Fundamentals of Food Processing Operation, The AVI publishing Co., West port 1967.

2. Potter N.N., Food Science, The AVI publishing Co., Westport, 1963.

- 1. Heldman D.R., Food Process Engineering, The AVI publishing co., 1975.
- 2. Charm S.E., The Fundamentals of Foods Engineering, The AVI Publishing Co., Westport, 1963.
- 3. Chakraverty, Amalendu, and Dhiren Sankar De. "Post harvest technology of cereals and pulses.1981.
- 4. Fellows, Peter John. Food processing technology: principles and practice. Elsevier, 2009.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0





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Prograi B.Te	mme ech	Course Code 21CH6301	Name of the Course PETROLEUM EXPLORATION AND EXPLOITATION TECHNIQUES	L 3	Т 0	Р 0	C 3
Cou Objec	rse tives	• To make the stud	ents understand the stages of oil and gas formation, exploration and pr	roductio	n		
UNIT			DESCRIPTION	INSTI	RUCT HOU	IION/ RS	AL
Ι	ORI ENV occu accu	GIN AND OCCURR (IRONMENT: Origin rrence – Source, cap mulation - Continental	ENCE OF PETROLEUM AND SEDIMENTRARY of oil – Rock cycle - Important factors that control petroleum o and reservoir rocks - Oil bearing rocks - Migration and environment – Transitional environment – Marine environment.		9		
Π	EXP Geol - Pr prog	LORATION METH ogical exploration met ognostication – Class ramme – Geotechnical	IODS, WELL PROGNOSIS AND ECONOMIC: hods – Geophysical exploration methods – Geochemical methods sification of drilling locations – Economic analysis – Well order.		9		
Ш	GEC Colle Form pont Logg etc.	DLOGICAL STRUCT ection Techniques – S nation Evaluation Tec ential logging, Natura ging, Neutron Porosity	TURE AND GEOLOGGING: Various traps and faults – Core Sample logging, Drilling time logging, Mud/Gas/Oil logging – chniques using wire line well logging include – Spontaneous al Gamma Ray Logging, Caliber Logging, Formation Density logging, Sonic velocity Logging, Electrical Resistance Logging,		9		
IV	DRI Fluic – Va	LLING FLUIDS AN ls: Function, compositi rious well completion	D WORK COMPLETION: Drilling Technology - Drilling on, and classification – Packer fluid – Casing packs – Cementing methods – Various stimulation methods.		9		
V	OFF techi meth	- SHORE TECH nology – Off-shore rigs nods – Major well comp	NOLOGY: Seismic technology – Sniffer survey – Drilling s – Primary, secondary and enhanced oil recovery techniques and plication and Remedies.		9		
			Total Instructional Hours		45		
Cour Outco	rse mes	Upon completion of CO1- Understand the CO2- Understand the CO3- Understand the CO4- Understand the CO5- Understant	the course, students can be able to origin and occurrence of petroleum various exploration methods and economic analysis of exploration process of various logging based on various geological structure process of drilling for well completion and different stimulation meth d the process various off-shore technology oil recovery techniques	iods			
TEXT I	воок	S:					

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

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

REFERENCE BOOKS:

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

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0



Dean (Academics) HICET

Progr	amme	Course Code	Name of the Course	L	Т	Р	С
B. 7	Гесh	21CH6302	ENZYME ENGINEERING	3	0	0	3
Co Obje	urse ctives	 To develop skills of the and design. 	students in the area of Enzyme Engineering with emphas	is on reac	tor ope	eratio	'n
UNIT		and acception	DESCRIPTION	INSTR H	UCTI IOUR	ONA S	L
Ι	TYPI of mi from	ES OF MICROORGANISM: crobial growth, batch and cor cells. Cell and Enzyme Immobi	Structure and function of microbial cells. Fundamentals tinuous culture. Isolation and purification of enzymes lization.		9		
Π	FERI kineti	MENTATION: Types of mecha cs of fermentation – Processes	anisms, Continuous fermentation – aeration and agitation,		9		
Ш	INTE biorea oxyge heat t	CODUCTION OF BIOREA actors. Mixing power correlation of from air bubbles and effect of ransfer and power.	CTOR DESIGN: Continuously stirred aerated tank on. Determination of volumetric mass transfer rate of mechanical mixing and aeration on oxygen transfer rate,		9		
IV	Introc Coenz applic	luction to Biochemistry, Func zyme / Cofactor. Classification cations of enzymes in industry, a	tion and applications. Nature and function of enzyme. n of enzymes. Assay methods and units. Examples of analytical technique medicine and Pharmaceuticals.		9		
V	Indus applic reacto	trial Bioreactors Utilizing I cations. Designs of reactor, Bat ors. Sterile and non sterile opera	solated enzymes and biosensors development and ch and continue type; analysis for immobilized enzyme tions; reactors in series with and without recycle.		9		
			Total Instructional Hours		45		
		Upon completion of the cours	se, students can be able to				
		CO1- Understand the types a and immobilizing both	nd structure of different microbial cells, its isolation, p	ourificatio	n of ei	nzym	es
		CO2- Understand the fermenta	tion operation and its kinetics				
Cour Outco	rse mes	CO3- Understand the mixing, the design of bioreactor	oxygen transfer methodology into the cells and power rec	luirement	for		
		CO4- Understand the basic I	and enzyi	me app	olicati	ons	
		CO5- Understand the design	of bioreactors under batch, continuous mode by the un	se of isol	lated e	nzym	es
TEXT I	BOOKS	:					
1.	. Tech	nological Applications of Bio-c	atalysts, BIOTOL series, Butter worth, 1995.				
2.	. Corn	ish. A -Bowden, Analysis of En	zyme Kinetic Data, Oxford University Press, 1996.				
REFER	RENCE	BOOKS:					
1.	. Wise Harv	man. A and Blakeborough N a vood, U.K. (1981).	nd Dunnill P, Enzymic and nonenzymic catalysis, Ex. Vo	ol.5 Ellis a	and		
2.	. Wise	man A (Ed.), Topics in enzyme	and fermentation Bio-technology, Ellis and Harwood, U.I	K. Vol-5.			

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Dean (Academics)

Progra	amme	Course Code	Name of the Course	L	Т	Р	C
В.Т	Гесh	21CH6303	FUNDAMENTALS OF NANO SCIENCE	3	0	0	3
Cor Objec	urse ctives	• To learn about basis	s of nanomaterial science, preparation method, types and application				
UNIT			DESCRIPTION	INST	RUCT	FIONA RS	٩L
Ι	INT and I ultra- Elect study	RODUCTION: Nanoscale Se Engineering- Classifications of thinfilms- multilayered mate ronic, Optical, Magnetic and (qualitative only).	cience and Technology- Implications for Physics, Chemistry, Biology of nanostructured materials- nano particles- quantum dots, nanowires- orials. Length Scales involved and effect on properties: Mechanical, Thermal properties. Introduction to properties and motivation for		9		
Π	GEN Preci depo MON	ERAL METHODS OF PRI pitation, Ultrasonication, Mec sition, MOCVD, Sputtering /IBE.	EPARATION: Bottom-up Synthesis-Top-down Approach: Co- chanical Milling, Colloidal routes,Self-assembly, Vapour phase g, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy,		9		
Ш	NAN Singl synth appli	OMATERIALS: Nanoform le wall carbon Nanotubes (S lesis(arc-growth, laser ablati cations- Nanometal oxides-Zr	s of Carbon - Buckminster fullerene- graphene and carbon nanotube, WCNT) and Multi wall carbon nanotubes (MWCNT)- methods of ion, CVD routes, Plasma CVD), structure-property Relationships nO, TiO2,MgO, ZrO2,		9		
IV	CHA Micro resol Nanc	RACTERIZATION TECH oscopy- environmental tec ution imaging, Surface Analys bindentation.	NIQUES: X-ray diffraction technique, Scanning Electron hniques, Transmission Electron Microscopy including high- sis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-		9		
V	APP nano Targe Mech Nano	LICATIONS: NanoInfoTech crystal, Nanobiotechlogy: nan etted drug delivery, Bioimag nanical Systems (NEMS)- oparticles for sunbarrier produ	n: Information storage- nanocomputer, molecular switch, super chip, noprobes in medical diagnostics and biotechnology, Nano medicines, ging - Micro Electro Mechanical Systems (MEMS), Nano Electro Nanosensors, nano crystalline silver for bacterial inhibition, cts - In Photostat, printing, solar cell, battery.		9		
			Total Instructional Hours		45		
		Upon completion of the co	urse, students can be able to				
		CO1- Understand the con fundamental properties	cept of nanoscience, implications of science and mathematics and the	ie			
Cour	rse	CO2- Understand the proces					
Outco	omes	CO3- Understand about the	various nanomaterials preparation, its properties and applications				
		CO4- Understand about the structure	various characterization techniques for the identification of nano size and				
		CO5- Understand the applic	ation of nanotechnology in various fields				
ГЕХТ В	BOOKS	CO5- Understand the application of nanotechnology in various fields					
1		District and DC C	and a white a second and a Countly of Description of A 1' 4' 2'				

- A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
- 2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

- 1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
- 2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Dean (Academics)

Program	mme	Course Code	Name of the Course	L	Т	P	C 2
D.Te	ech	21CH0304	Conosion Science and Engineering	3	U	U	3
Cour Object	rse tives	 Course Code 21CH6304 To provide an understanding of the corrosion principles and engineering n and prevent the corrosion. Basic concepts: Definition and importa Electrochemical nature and forms of corrosion, Corrosion rate and its determine DESCRIPTION ORROSION: Corrosion - Definition, classification, forms of corrosion, expressions for genesium and aluminium - Forms of corrosion, Uniform, pitting, intergranular, stree rosion - Corrosion fatigue - Dezincification - Erosion corrosion - Crevice corrosion use and remedial measures, Pilling Bedworth ratio, High temperature oxidation. DILERS: Boiler water corrosion by carbon dioxide and unstable salts - Corrosio ding, high temperature, corrosion, turbine corrosion - Corrosion failure - Inspectid analysis of corrosion damage. DRROSION TESTING: Purpose of corrosion testing, classification, susceptibility test elerated weathering tests - ASTM standards for corrosion testing. DARIZATION: Polarization - Exchange current density, Activation larization, Tafel Equation , Passivating metals and nonpassivating metals, Effect of dizing agents. ECTROLESS PLATING AND ANODISING: Electroless plating and Anodizing thodic protection, metallic, organic and inorganic coatings, corrosion inhibitors elevel and surfacing processes - CVD and PVD processes, sputter coating - Laser and is plantation, arc spray, plasma spray, flame spray. HVOF. 	ls used	to m	inimiz	ze	
UNIT			DESCRIPTION	INSTI]	RUCT HOUI	TON# RS	4L
Ι	CORROS corrosion magnesium corrosion Cause and	GION: Corrosion - E rate, emf and galvau n and aluminium - - Corrosion fatigue - d remedial measures,	Definition, classification, forms of corrosion, expressions for nic series, merits and demerits, Pourbaix diagram for iron, Forms of corrosion, Uniform, pitting, intergranular, stress Dezincification - Erosion corrosion - Crevice corrosion - , Pilling Bedworth ratio, High temperature oxidation.		9		
Π	BOILERS prevention of antiscal loading, h and pract and analys	S: Boiler water cor a methods by treatmen ant - Water treatmen igh temperature, corn ice, inhibitors for a sis of corrosion dama	rosion by carbon dioxide and unstable salts - Corrosion nt cooling water, specification, types of scales and causes, use tts - Maintenance of boilers - Protection of boilers during off rosion, turbine corrosion - Corrosion inhibitors, principles acidic neutral and other media - Corrosion failure - Inspection ge.		9		
III	CORROS for intergr	SION TESTING: Put anular corrosion, streed d weathering tests -	arpose of corrosion testing, classification, susceptibility tests ess corrosion test, salt spray test, humidity and porosity tests, ASTM standards for corrosion testing.		9		
IV	POLARIZ polarizatio	ZATION: Polari on, Tafel Equation ,P agents.	ization - Exchange current density, Activation assivating metals and nonpassivating metals, Effect of		9		
V	ELECTR Cathodic Special su implantati	OLESS PLATING protection, metallic, urfacing processes on, arc spray, plasma	AND ANODISING: Electroless plating and Anodizing - , organic and inorganic coatings, corrosion inhibitors - - CVD and PVD processes,sputter coating - Laser and ion spray, flame spray, HVOF.		9		
	•		Total Instructional Hours		45		
	Upo	on completion of the	course, students can be able to				

CO1- Understand about corrosion and its forms

- Course CO2- Understand about Protect boiler against corrosion
- Outcomes CO3- Understand various corrosion test and its ASTM standards
 - CO4- Understand the Polarization and Effect of oxidizing agents on corrosion
 - CO5- Understand the Corrosion prevention methods and its applications.

TEXT BOOKS:

- 1. Fontana and Greene., Corrosion Engineering, McGraw Hill Book Co, New York, 1983
- 2. Raj Narayan ., An Introduction to Metallic Corrosion and its prevention, Oxford and IBH, New Delhi, 1983.

- 1. Budinski, K.G., Surface Engineering for Wear Resistance, Prentice Hall Inc., Engelwood Cliff, New Jersey, USA, 1988
- 2. Uhlig, H.H., Corrosion and Corrosion Control, John Wiley and Sons, New York, USA, 1985.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Dean (Academics) HICET

Progra	amme	Course Code	Name of the Course	L	Т	Р	С
В.Т	Tech	21CH6305	PIPING AND INSTRUMENTATION	3	0	0	3
Cou Objec	urse ctives	• To impart knowledge	ge on piping technology and instrumentation on pipelines.				
UNIT			DESCRIPTION	ľ	NSTR H	UCTIO IOURS	ONAL 5
Ι	FUNDA introduc Installati			9			
Π	PIPE E consider general a	IYDRAULICS AND a ation cost, least annual arrangement drawing, dir	SIZING: Pipe sizing based on velocity and pressure drop l cost approach, pipe drawing basics, development of piping nensions and drawing of piping.			9	
III	PLOT I process impact o	PLAN: Development of piping layout, utility pip n piping, methods of cal	plot plan for different types of fluid storage, equipment layout, ping layout. Stress analysis - Different types of stresses and its culation, dynamic analysis, flexibility analysis.			9	
IV	PIPING	SUPPORT: Different	types of support based on requirement and its calculation.			9	
V	INSTRU introduc	J MENTATION: Final tion to process flow diag			9		
			Total Instructional Hours			45	
	U	pon completion of the c	ourse, students can be able to				

- CO1- Understand about the basic piping engineering, its standards and installations
- CO2- Understand the drawing, sizing and hydraulics study of pipe

Course Outcomes CO2- Understand the drawing, sizing and hydrautics study of pipe CO3- Understand about the development of pipe layout, plot plan and equipment layout and its dynamic analysis

CO4- Understand about the different types of piping support for various requirements

CO5- Understand about the process and instrumentation diagram and cost elements

TEXT BOOKS:

- 1. Piping Handbook, 6 th edition, M.L. Nayyar, P.E., Mc Graw-Hill, Inc.
- 2. Piping Design Handbook edited by Johan J McKetta, CRC Press, 1992.

REFERENCE BOOKS:

1. Luyben, W. L.," Process Modeling Simulation and Control for Chemical Engineers, McGraw Hill, 1990.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Dean (Academics)

Progra B.T	amme `ech	Course Code 21CH7301	Name of the Course NATURAL GAS ENGINEERING	L 3	Т 0	Р 0	С 3					
Cou Objec	irse tives:	• Enable the students t	to learn the basic concept and applications of Natural Gas Engine	neering.	DUCT		A T					
UNII			DESCRIPTION	116/11 [HOU]	RS	AL					
Ι	NAT petro Geole Petro temp	URAL GAS TECHNOLO leum Industry. Sources of Ir ogy and earth sciences: Ea leum reservoirs, Origin o eratures, Earth pressure. Petro	DGY AND EARTH SCIENCE: Branches of nformation for natural gas engineering and its applications. arth sciences-Historical geology, Sedimentation process, of petroleum. Earth temperatures & pressure, Earth oleum: Natural gas, LP gas, Condensate, & Crude oil.		9							
Π	PRO cubic energ gas trans	PERTIES OF NATURAL e equations, specific high acc y properties, gas measureme dehydrations, compressors mission, and natural gas lique	GASES: Typical compositions. Equations of state: general curacy equations. Use of equation of state to find residual ent gas hydrates, condensate stabilization, acid gas treating, , process control deliverability test, gathering and efaction.		9							
Ш	GAS Calcu flow:	COMPRESSION: Positilation of poser requirements continuity, momentum, eles	ive displacement and centrifugal compressors; fans. s. Compressible Flow in Pipes: Fundamental equations of gy equations.		9							
IV	ISO hole equat gener	THERMAL FLOW IN PIP pressures in wells. Fundam tions. Definition of pseudo ral equation for radial flow of	AL FLOW IN PIPES: The Weymouth equation. Static and flowing bottom s in wells. Fundamentals of Gas flow in porous media: Steady state flow effinition of pseudo-pressure function. Gas flow in cylindrical reservoir on for radial flow of gases in symmetrical homogeneous reservoirs.									
V	NON coeff stead curve	-DIMENSIONAL FORM icients relation dimensionle y-state solution. Gas Well De and AOF for the well. Isoc		9								
	rates.		Total Instructional Hours		45							
		Upon completion of the co	urse, students can be able to									
		CO1: Understand about th applications	ne various sources of information for natural gas enginee	ring and	1 its							
Cour	se	CO2: Understand about the	composition and various properties of natural gases									
Outcor	nes	CO3: Understand about the	compression equipment and its analysis									
		thermodynamic property	the fundamentals of gas flow in various conduits und	er cons	tant							
		CO5: Understand abou	at the non-dimentional forms of the equation for gas deliverabil	ity								
TEXT B	SOOKS	5:										
1. REFER	Katz ENCE	D.L.et al., Natural Gas Engin BOOKS:	neering (Production & storage), McGraw-Hill, Singapore.									
1.	Stan Plis	dard Handbook of Petroleum ga. Gulf Professional Publishi	n and Natural Gas Engineering. 2nd Edition. William C Lyoning.	ns, Gary	C C							
2.	Mod	ern Petroleum Technology U	pstream Vol I A.G. Lucas Hurley Edition 2002.									

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0





Dean (Academics)

Progra	mme	Course Code	ourse Code Name of the Course						
B.T	ech	21CH7302	PULP AND PAPER TECHNOLOGY	3	0	0	3		
Cou Objec	rse tives	 Focused on paperm majoring in program would interface wit 	aking science and technology and is intended to be especially ns leading to careers in corporate or government positions wh h the paper related industries.	valuable ich	to stu	dents			
UNIT			DESCRIPTION	INSTR 1	UCTI HOUF	ONA RS	L		
Ι	INTR Wood	ODUCTION: Introductio as a raw material.	n Basic pulp and paper technology – Wood haves dry –		9				
Π	WOO pulpin	DYARD OPERATION: g – Secondary fibre pulp p	Woodyard operation - Mechanical pulping – Chemical rocessing.		9				
Ш	PAPE – Pape	R MACHINE: Paper M er machine - Wet and opera	achine wet and addition paper machine dry and operation tion.		9				
IV	PAPE treatm	R AND PAPERBOARD ents – Finishing operation-	: Paper and paperboard frames and products – Surface – End uses.		9				
V	PROP Testing contro	ERTIES AND TESTI g of pulp and paper Proc l.	NG OF PULP AND PAPER: Properties and ess control – Quality assurance – Water and air pollution		9				
			Total Instructional Hours		45				
Cours Outcom	e les	Upon completion of the c CO1- Understand the basic CO2- Understand about the CO3- Understand about the CO4- Understand about the CO5- Understand about the	ourse, students can be able to pulp and paper technology e mechanical and chemical pulping processes e wet and dry machines and operations for paper production e production of paper and paperboard ne various properties and quality testing of pulp and paper	and pollu	ition c	ontrol	1		

TEXT BOOKS:

- 1. Pulp and paper chemistry and Technology Monica ER Monica, Goran Gellerstcdt Gunnar Hennksson De Gneyter 2009.
- 2. Paper and Pulp Technology, K.P Rao, Oxford and Ibh Publishers 2003

- 1. Modern Technology of Pulp, Paper and Paper Conversion Industries [NI104] by NIIR Board of Consultants and Engineers
- 2. Pulp & Paper Chemistry & Chemical Technology, Second Edition Revised & Enlarged Volumes I-iii, Casey, James P., Interscience Publishers, New York (1960)
- 3. Handbook of Pulp and Paper Technology, Second Edition Revised and Enlarged, Kenneth W. Britt, Van Nostrand Reinhold Co.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

Chairman - BoS OHE - HICET



Programme	Course Code	Name of the Course	L	Т	Р	С
B.Tech	21CH7303	TRANSPORT PHENOMENA	3	0	0	3
Course	 To develop a fundamer 	tal knowledge of the physical principles that govern the tra	nsport of momen	tum	enerav	and mas

• To develop a fundamental knowledge of the physical principles that govern the transport of momentum, energy and mass, with emphasis on the mathematical formulation of the conservation principles.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
Ι	TRANSPORT PHENOMENA BY MOLECULAR MOTION: Vectors/Tensors, Newton's law of viscosity, Newtonian & Non-Newtonian fluids, rheological models, Temperature, pressure and composition dependence of viscosity, Kinetic theory of viscosity, Fourier's law of heat conduction, Temperature, pressure and composition dependence of thermal conductivity, Kinetic theory of thermal conductivity, Fick's law of diffusion, Temperature, pressure and composition dependence of diffusivity. Kinetic theory of diffusivity.	9
П	ONE DIMENSIONAL MOMENTUM TRANSPORT: Shell Momentum balances, boundary conditions, velocity profiles, average velocity, momentum flux at the surfaces, of Newtonian and non-Newtonian for flow of a falling film, flow through circular tube, slits, flow through an Annulus, Adjacent flow of two Immiscible fluids. Equations of Change (Isothermal), equation of continuity, equation of motion, equation of energy (isothermal) their applications in fluid flow problems.	9
Ш	ONE DIMENSIONAL HEAT TRANSPORT: Shell energy balances, boundary conditions, temperature profiles, average temperature, energy fluxes at surfaces for different types of heat sources such as electrical, nuclear viscous and chemical, Equations of change (non- isothermal), equation of motion for forced and free convection, equation of energy (non-isothermal).	9
IV	ONE DIMENSIONAL MASS TRANSPORT: Shell mass balances, boundary conditions, concentration profiles, average concentration, mass flux at surfaces for Diffusion through stagnant gas film, Diffusion with homogeneous and heterogeneous chemical reaction, Diffusion in to a falling liquid film, Diffusion and chemical reaction in porous catalyst and the effectiveness factor, equation of continuity for binary mixtures, equation of change to set up diffusion problems for simultaneous heat and mass transfer.	9
V	TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW: Turbulence phenomena; phenomenological relations for transfer fluxes; time smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics thermal and concentration boundary layer and their thicknesses; analysis of flow over flat surface. Introduction to macroscopic balances for isothermal flow systems, non-isothermal systems and multicomponent systems.	9
	Total Instructional Hours	45
	Upon completion of the course, students can be able to	
Course	CO2- Understand about the one dimensional momentum transport, its boundary condition and velocity prof	ile
Outcome	s CO3- Understand about the one dimensional heat transport, its boundary conditions and temperature profile	s
	CO4- Understand about the one dimensional mass transport, its boundary conditions, concentration profiles	
	CO5- Understand about the transport in turbulent and boundary layer flow	
TEXT BO	OKS:	
1.	R. B. Bird, W.E. Stewart, E.W. Lightfoot, Transport Phenomena, 2nd Revised Edition, John Wiley, 2007.	
2.	Brodkey, R. S., and Hershey, H. C., "Transport Phenomena", McGraw-Hill, 1988.	

REFERENCE BOOKS:

Objectives

- C. J. Geankoplis, Transport Processes and Separation Process Principles, Prentice- Hall Inc., 4th Edition 2003.
- 2. Slattery, J. S., "Advanced Transport Phenomena", Cambridge University Press, London, 1999.
- 3. C. O. Bennett, J. O. Myers, Momentum, Heat and Mass Transfer, 2nd International Student Edition Mc- Graw Hill, 1983.
- 4. R. Welty, R.W. Wilson, and C.W.Wicks, Rorer G.E, Wilson R.W. "Fundamentals of Momentum Heat and Mass Transfer", 5th Edition, John Wiley, New York, 2007.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Dean (Academics) HICET

Progran	ıme Course Code	Name of the Course	Т	Р	C			
B.Te	ch 21CH7304	MULTICOMPONENT DISTILLATION	0	0	3			
Cour	se To understand the concepts of Mu	lti component distillation systems.						
Objecti	ves							
UNIT		DESCRIPTION	INSTR	UCTIO	NAI			
			Н	OURS				
Ι	THERMODYNAMIC PRINCIPLES: of vapor – liquid equilibria and enthalpie the calculation of K values – Estimation – calculation of liquid – phase activity co	Fundamental Thermodynamic principles involved in the calculation s of multi component mixtures – Use of multiple equation of state for of the fugacity coefficients for the vapor phase of polar gas mixtures sefficients.	9					
П	THERMODYNAMIC PROPERTY E multi component mixtures – Determi component mixtures – equilibrium flash of multi component mixtures at total refl	VALUATION: Fundamental principles involved in the separation of ination of bubble-point and Dew Point Temperatures for multi distillation calculations for multi component mixtures – separation ux.	9					
Ш	MINIMUM REFLUX RATIO FOR M Column sequencing – Heuristics for colu Distributed components – Adjacent keys component distillation Underwood metho	ACD SYSTEM: General considerations in the design of columns – umn sequencing – Key components – Distributed components – Non- s. Definition of minimum reflux ratio – calculation of Rm for multi od – Colburn method.	9					
IV	VARIOUS METHODS OF MCD convergence – Kb method and the con complex columns and to system of colu Short cut methods and Simplified graphic	9						
v	VARIOUS TYPES OF MCD COLU	MNS: Design of sieve, hubble cap, valve	9					
·	trays and structured packing column efficiencies.	is for multi component distillation – computation of plate						
		Total Instructional Hours	45					
	Upon completion of the course, s	students can be able to						
	CO1- Remember and apply the im	portant thermodynamic principles in multi component mixtures						
	CO2- Understand about the fund	amental principles involved in the separation of multi component						
Course	mixtures							
Outcomes	GCO3- Understand about Underw reflux ratio	CO3- Understand about Underwood method – Colburn method for the calculation of minimum reflux ratio						
	CO4- Understand about Theta me Matheson method for MCD colum							
	CO5- Understand about the design	n procedure of sieve, bubble cap, valve tray and packed columns						
ГЕХТ ВО	OKS:							
1.	Holland, C.D., "Fundamentals of Multi C	Component Distillation", McGraw Hill Book Company, 1981.						
2.	Van Winkle, "Distillation Operations", M	IcGraw Hill Publications, 1987.						

- 1. King, C.J., "Separation Process Principles", Mc Graw Publications, 1986.
- 2. Treybal, R.E., "Mass Ttransfer Operations", 5th Edition, Mc Graw Hill publications. 1996.
- 3. Mc Cabe and Smith, J.C., Harriot, "Unit Operation of Chemical Engineering", 6th Edition, McGraw Hill, 2001.
- 4. Seader, J.D. and E.J. Henley, "Separation Process Principles", 2nd Ed., John Wiley, 2006.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0		1	~	5			0	3.0	2.0

Chairman - BoS OHE - HICET

Dean (Academics)

Progr	amme	Course Code	Name of the Course	L	Т	Р	С
B.T	Tech	21CH7305	CHEMICAL PROCESS OPTIMIZATION	3	0	0	3
Cou Obje	urse ctives	• Students will gain	knowledge about process modeling and optimization				
UNIT			DESCRIPTION	INSTR I	RUCT HOU	TION RS	AL
Ι	INT chen	RODUCTION: Introduc	tion to optimization; applications of optimization in cation of optimization problems.		9		
II	SIN for meth	GLE VARIABLE OPT optimum; region elimir ods.	TMIZATION: Necessary and sufficient conditions nation methods; interpolation methods; direct root		9		
III	MU CON meth	CTIVARIABLE OP STRAINTS: Necessary ods; indirect search meth	TIMIZATION WITHOUT AND WITH and sufficient conditions for optimum; direct search tods.		9		
IV	OTH and i	IER OPTIMIZATION nteger programming and	METHODS: Introduction to geometric, dynamic genetic algorithms.		9		
V	APP fittin react	LICATIONS OF OPT g models to data; applica ion engineering, equipme	IMIZATION: Formulation of objective functions; ations in fluid mechanics, heat transfer, mass transfer, ent design, resource allocation and inventory control.		9		
			Total Instructional Hours		45		
Cours Outcor	se mes	Upon completion of the CO1- Understand the va CO2- Understand the pr optimum CO3- Understand the pr CO4- Understand the ba algorithms. CO5- Understand the or reaction engineer	e course, students can be able to arious classification of optimization process in chemical procedure for the determination of necessary and suff ocess multivariable optimization without and with const usic concepts about geometric, dynamic and integer prog optimization application in fluid mechanics, heat tran ing, equipment design, resource allocation and inventory	engineer icient co raints rammin sfer, ma v control	ing ondit g and	ions gene ansfe	for etic r,

TEXT BOOKS:

- 1. Rao, S. S., Engineering Optimization Theory and Practice, Third Edition, John Wiley & Sons, New York, 1996.
- 2. Edgar, T.F., Himmelblau, D.M., "Optimisation of Chemical Processes ", McGraw-Hill Book Co., New York, 2003.

REFERENCE BOOKS:

1. Reklaitis, G.V., Ravindran, A., Ragsdell, K.M. "Engineering Optimisation ", John Wiley, New York, 1980.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

Chairman - BoS OHE - HICET

Dean (Academics)

Progra	amme	Course Code	Name of the Course	L	Т	Р	С
B.T	ech	21CH8301	INDUSTRIAL MANAGEMENT	3	0	0	3
Cou Objec	ırse tives	• To provide an opport	unity to learn basic management concepts essential for busines	38.			
UNIT			DESCRIPTION	INSTI	RUCI HOUI	TION RS	AL
Ι	INTR Manag	ODUCTION: Managemer gement – Scientific Manage study of Management, Form	nt - Definition – Functions – Evolution of Modern ment Development of Management Thought. Approaches is of Organization – Individual Ownership – Partnership		9		
Π	FUNC Strateg Proces Organi – Care	CTIONS OF MANAGEM gies – Policies and Planning ss – Premises – Departm izational culture, Staffing - s er Strategy – Organizational	ENT: Planning – Nature and Purpose – Objectives – g Premises – Decision Making – Organizing – Nature and nentalization – Line and staff – Decentralization – selection and training – Placement – Performance appraisal l Development. Leading – Managing human factor.		9		
III	ORGA function Effect Contri Learni	ANIZATIONAL BEHAVI ons – Organizational appro – Behavior and Performanc buting factors - Dimension ng and Behavior – Learnir	OUR: Definition – Organization – Managerial Role and baches, Individual behaviour – causes – Environmental ce, Perception – Organizational Implications. Personality – – Need Theories – Process Theories – Job Satisfaction, ng Curves, Work Design and approaches.		9		
IV	GROU Comm leaders Group Causes	UP DYNAMICS: Group B- nunication – Process – B ship – formal and informal Decision Making – Leader s.	ehavior – Groups – Contributing factors – Group Norms, arriers to communication – Effective communication, characteristics – Managerial Grid – Leadership styles – ship Role in Group Decision, Group Conflicts – Types –		9		
V	MOD (MBE) Inform engine Supply	ERN CONCEPTS: Manag), Strategic Management hation technology in manage ering (BPR) – Enterprises F y Chain Management (SCM)	ement by Objectives (MBO), Management by Exception - Planning for Future direction – SWOT Analysis – ement – Decisions support system – Business Process Re- Resource Planning (ERP) – 0 – Activity Based Management (ABM).		9		
			Total Instructional Hours		45		
Cours Outcom	e 1es	Upon completion of the con CO1- Understand the definit CO2- Remember the functio CO3- Understand the behavi CO4- Understand the dynam CO5- Understand the variou	urse, students can be able to ion for management, partnership, ownership, etc ons of management ioral characteristics in the industry tic conflicts and its solution in a group s modern industrial management concepts				
TEXT B	OOKS:						
1.	Herald	Knottz and Heinz Weihrich	n, "Essentials of Management", Tata McGraw Hill Education	Pvt. Ltd.	, 2010).	
2.	Stepho	en P. Robbins, "Organization	n Behaviour", Pearson Education Inc., 13 edition, 2010.				

- 1. Ties, AF, Stoner and R.Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd. New Delhi 110 011, 1992.
- 2. Joseph J, Massie, "Essentials of Management" Prentice Hall of India Pvt. Ltd. 1985.
- 3. Tripathi. P.C. & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 2006.
- 4. Ahuja K.K, Industrial management, Khanna publishers, New Delhi, 1985.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

Chairman - BoS OHE - HICET



Program B.Tec	me Course Code h 21CH8302	Name of the Course SUGAR TECHNOLOGY	L 3	T 0	P 0	C 3
Course Objectiv	e To educate individuals in the set and sugar beet into refined sug	scientific principles and practical techniques involved in the gar and related products.	processi	ng of s	ugarc	cane
UNIT		DESCRIPTION	INSTR H	RUCTI IOUR	IONA S	L
Ι	INTRODUCTION: Sugar industr and reducing sugars. Source for Su compounds of sugar cane. Inorgan methods used in Sugar Industry.	y in India. Chemical and Physical properties of Sucrose acrose. Formation of sucrose plants. Non sugar ic constituents of sugar cane juices and sugars. Analytical		9		
Π	PURIFICATION: Chemical techn reactions and physical chemistry a carbonation processes. Filtration o		9			
III	EVAPORATION: Evaporation of equipment and auxiliaries. Method economy. Chemistry of the evapor evaporators.	sugar juice. Heat transfer in evaporators. Evaporation ls of obtaining steam and quality of steam. Steam ration process. Scale formation and cleaning of		9		
IV	CRYSTALLIZATION: Solubility saturated solutions - kinetics and g Control methods and equipment in Evaporation and circulation in vac	y of sucrose. Solubility of sucrose - nucleation in super rowth of crystallization. Chemistry of crystallization. a sugar crystallization; Technology of sugar crystallization. uum pans.		9		
V	CENTRIFUGATION: Theory of Engineering principles of sugar of equipment and	the centrifugal processes. Centrifugal operation. centrifugals and the centrifugal process. Centrifugal		9		
a	uxiliaries. Production of final mola	sses and its utilizations. Grading of sugar. Total Instructional Hours		45		
	Upon completion of the cour	rse, students can be able to				
~	CO1- Understand about the su	agar industries and analytical methods				
Course	CO2- Examine the purification	on methods				
Sucomes		tion teeningteen sugar julee processing				

CO4- Illustrate the crystallization technique in sugar juice processing CO5- Remember the centrifugation technique in sugar juice processing

TEXT BOOKS:

1. Honig P., Principles of Sugar Technology, Vol.1,2 and 3, Elsevier Publishing Company, 1953.

2. Van der Poel P.W., Schwartz T.K., Schiweck H.M., Sugar Technology [Beet and Cane Sugar Manufacture], Beet Sugar

REFERENCE BOOKS:

1. Payne J.H., Sugarcane factory Analytical control, Fifth Edition, Elsevier Publisher, London, 1968.

Jenkins G.H., Introduction to Sugarcane technology, Elsevier Publisher, London, 1966
 Hoing P., Principle of Sugar Cane Technology, Elsevier Publisher, London.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Dean (Academics)

Progra	amme	Course Code	Name of the Course	L	Т	Р	С
B.T	ech	21CH8303	TOTAL QUALITY MANAGEMENT	3	0	0	3
Cou	ırse	• To facilitate the under	standing of Quality Management principles and process.				
Objec	tives						
UNIT			DESCRIPTION	INST	RUCT HOUI	'IONA RS	4L
Ι	INTR Dimen of De satisfa	ODUCTION: Introduction - asions of product and service q ming, Juran and Crosby - Bar action, Customer complaints, Cu	Need for quality - Evolution of quality - Definitions of quality - uality - Basic concepts of TQM - TQM Framework - Contributions riers to TQM - Customer focus - Customer orientation, Customer ustomer retention.		9		
Π	TQM Emplo Perfor partne	PRINCIPLES: Leadership - oyee involvement - Motivation mance appraisal - Continuou ership - Partnering, Supplier sele	Quality Statements, Strategic quality planning, Quality Councils - , Empowerment, Team and Teamwork, Recognition and Reward, s process improvement - PDCA cycle, 5S, Kaizen - Supplier ection, Supplier Rating.		9		
Ш	TQM - Six s marki	TOOLS AND TECHNIQUE sigma: Concepts, Methodology, ng - Reason to bench mark, Ber	S I: The seven traditional tools of quality - New management tools , applications to manufacturing, service sector including IT - Bench and marking process - FMEA - Stages, Types.		9		
IV	TQM Deplo Perfor	TOOLS AND TECHNIQU yment (QFD) - Taguchi qu mance measures.	JES II: Quality Circles - Cost of Quality - Quality Function ality loss function - TPM - Concepts, improvement needs -		9		
V	QUA Series Requi ENVI Conce	LITY MANAGEMENT SYS of Standards—Sector-Specif rements—Implementation— D RONMENTAL MANAGEME pts of ISO 14001—Requirement	STEM: Introduction—Benefits of ISO Registration—ISO 9000 fic Standards—AS 9100, TS16949 and TL 9000 ISO 9001 ocumentation—Internal Audits—Registration ENT SYSTEM: Introduction—ISO 14000 Series Standards— ints of ISO 14001—Benefits of EMS.		9		
			Total Instructional Hours		45		
		Upon completion of the cour	se, students can be able to				
		CO1- Understand about qua	lity management towards Customer focus - Customer orientation,	Custome	er satis	factio	n,
		Customer complaints, Custom	er retention				
Cour	se	CO2- Illustrate about Quality S	Statements and principles in detail				
Outcor	mes	CO3-Examine about the tradition	onal tools like six sigma in TQM				
		CO4- Determine about the Qua Taguchi quality loss function	ality Circles - Cost of Quality - Quality Function Deployment (QFD) -				
		CO5- Understand about the qu	ality management system				
TEXT B	OOKS:						
1.	Dale	H.Besterfiled, Carol B.Mich	na.Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and				

- Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
- 2. Janakiraman. B and Gopal .R.K., "Total Quality Management Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

REFERENCE BOOKS:

- 1. Joel.E. Ross, "Total Quality Management Text and Cases", Routledge., 2017.
- Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth Heinemann Ltd, 2016.
- 3. Oakland, J.S. "TQM Text with Cases", Butterworth Heinemann Ltd., Oxford, Third Edition, 2003.
- 4. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

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Progra	mme	Course Code	Name of the Course	\mathbf{L}	Т	Р	С
B.Te	ech	21CH8304	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	3	0	0	3
Cou Object	rse tives	• To get an idea about development	at the global trends and the requirement of skills for integ	rated pro	oduct		
UNIT		Ĩ	DESCRIPTION	INSTR	UCTJ	IONA	L
				I	IOUI	RS	
Ι	FUNDA decision Political Overvie	MENTALS OF PRODUC - Social Trends - Techn /Policy Trends - Introductio w of Products and Services	T DEVELOPMENT: Global Trends Analysis and Product ical Trends- Economical Trends - Environmental Trends - n to Product Development Methodologies and Management -		9		
П	REQUI - Requir	REMENTS AND SYSTEM ement Engineering - traceabi	DESIGN: Requirement Engineering - Types of Requirements lity Matrix and Analysis - Requirement		9		
	Manage Optimiz	ment - System Design & Mo ation - System Specification -	odeling - Introduction to System Modeling - System Sub-System Design - Interface Design.				
Ш	- Introdu - Concep	N AND TESTING: Conceptu action to Concept generation 7 pt Screening & Evaluation - D	alization - Industrial Design and User Interface Design Techniques – Challenges in Integration of Engineering Disciplines etailed Design		9		
IV	SUSTE to Product Product Repair Manage	NANCE ENGINEERING A act verification processes and Testing Standards and Certif – Enhancements - Product ment – Configuration Manage	ND END-OF-LIFE (EOL) SUPPORT : Introduction stages - Introduction to Product Validation processes and stages - ication - Product Documentation Sustenance -Maintenance and EoL - Obsolescence ment - EoL Disposal.		9		
V	BUSINI Enginee - Introd Assemb	ESS DYNAMICS – ENGIN ring Services Industry - Produ uction to Vertical Specific 1 ly of Systems	EERING SERVICES INDUSTRY: The Industry - ct Development in Industry versus Academia –The IPD Essentials Product Development processes - Manufacturing/Purchase and		9		
			Total Instructional Hours		45		
	τ	pon completion of the cours	e, students can be able to				
	C	O1: Understand the global tre	nds and development methodologies of various types of products an	d services			
	s	ystem specification and charac	odeling for system, sub-system and their interfaces and arrive at the teristics	ne optimu	m		
Course Outcome	s d	CO3: Illustrate the requirement evelopment and convert them	engineering and know how to collect, analyze and arrive at requirem in to design specification	ents for n	ew pro	duct	
	0	204: Examine the process of 205: Understand the process of	f documentation, test specifications and coordinate with various f conceptualize prototype and develop product management plan for	teams	duct		
TEXT BO	OKS:	os. Onderstand the process o	e conceptualize, prototype and develop product management plan for	a new pro	auer.		
1.	John W	Newstorm and Keith Davis,	"Organizational Behavior", Tata McGraw Hill, Eleventh Edition,	2005.			
2.	Karl T	Ulrich and Stephen D Epping	ger, "Product Design and Development", Tata McGraw Hill, Fifth	Edition, 2	2011.		
REFERE	REFERENCE BOOKS:						
1.	1. Hiriyappa B, "Corporate Stra		anaging the Business", Author House, 2013.				
2.	Peter F I	Drucker, "People and Performa	ance", Butterworth - Heinemann [Elsevier], Oxford, 2004.				
3.	Vinod H	Kumar Garg and Venkita Kr	ishnan N K, "Enterprise Resource Planning - Concepts", Second	d Edition,	Prentic	e Hall	,

- 2003. Mark S Sandars and Ernest I McCormick "Human Factors in Engineering and Design" McCraw Hill Education Savanth
- 4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0



Dean (Academics) HICET

Progr	amme	Course Code	Name of the Course	\mathbf{L}	Т	Р	С		
B.7	Tech	21CH8305	SUPPLY CHAIN MANAGEMENT	3	0	0	3		
Cor Obje	urse ctives	• To provide an insig	nt on the fundamentals of supply chain networks, tools and tech	iniques.					
UNIT			DESCRIPTION	INSTI]	RUCI HOUI	TON. RS	AL		
Ι	INTR Impor and S	RODUCTION: Role of rtance- Evolution of Supply upply chain Strategies – Driv	Logistics and Supply chain Management: Scope and y Chain - Decision Phases in Supply Chain - Competitive vers of Supply Chain Performance and Obstacles.		9				
Π	SUPF influe Distri netwo	PLY CHAIN NETWORK encing Distribution netwo bution Network in Practice ork Decisions.	DESIGN: Role of Distribution in Supply Chain – Factors rk design – Design options for Distribution Network -Role of network Design in Supply Chain – Framework for		9				
III	LOG transp Routin	ISTICS IN SUPPLY CHA ortations decision – Design ng and scheduling in transpo	9						
IV	SOUI supply planni ordina supply	RCING AND COORDIN y chain supplier selection ing and analysis - supply chain ation in supply chain and of y chain.	ATION IN SUPPLY CHAIN: Role of sourcing assessment and contracts- Design collaboration - sourcing nain co-ordination - Bull whip effect – Effect of lack of co- ostacles – Building strategic partnerships and trust within a	9					
V	SUPP chain- manag supply	PLY CHAIN AND INFORM The supply chain IT frame gement – supplier relationship y chain.	AATION TECHNOLOGY: The role IT in supply work Customer Relationship Management – Internal supply chain o management – future of IT in supply chain - E-Business in		9				
			Total Instructional Hours		45				
		Upon completion of the co	ourse, students can be able to						
		CO1- Understand about the	role, scope, importance and evolution of supply chain						
Cour	se	CO2- Understand about the	supply chain network design for network decisions						
Outco	mes	CO3- Determine about the l	ogistics in supply chain						
		CO4- Examine about the so	urcing and coordination in supply chain						
	(CO5- Understand about the	information technology in supply chain management and future						
TEXT I	BOOKS	:							

- 1. Sunil Chopra, Peter Meindl and Kalra, "Supply Chain Management, Strategy, Planning, and operation", Pearson Education, 2010.
- 2. Srinivasan G.S, "Quantitative models in Operations and Supply Chain Management", PHI, 2010.

REFERENCE BOOKS:

- 1. David J.Bloomberg, Stephen Lemay and Joe B.Hanna, "Logistics", PHI 2002.
- 2. James B.Ayers, "Handbook of Supply chain management", St.Lucle press, 2000.
- 3. Jeremy F.Shapiro, "Modeling the supply chain", Thomson Duxbury, 2002.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	I	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	I	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
Avg	3.0	2.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	2.0	3.0	2.0



Dean (Academics)

Programme B.Tech Course		Course Code	Name of the Course		L	Т	Р	С
B.T	`ech	21CH8306	PROCESS PLANT UTILITIES		3	0	0	3
Cou Objec	ırse ctives	• To enable the students various parameters in	to understand the process plant utilities and o chemical industries.	ptimization tech	niques	to opt	imize	r
UNIT			DESCRIPTION	1	NSTRU H	OUR	JNAI S	-
Ι	IMPO uses. N used fo	RTANT OF UTILITIES: H Methods of water Treatment s or Water Softening and Rever	lard and Soft water, Requisites of Industrial W uch as Chemical Softening and Demineraliza se Osmosis. Effects of impure Boiler Feed Wa	Vater and its tion, Resins tter.		9		
II	STEA Types Fluidiz	M AND STEAM GENERA of Steam Generator such a zed Bed Boiler. Scaling and T	TION: Properties of Steam, problems based s Solid Fuel Fired Boiler, Waste Gas Fired rouble Shooting. Steam Traps and Accessorie	l on Steam, Boiler and s.		9		
Ш	REFR Differe Brins.	IGERATION: Refrigeration ent Types of Refrigerants such Refrigerating Effects and Liqu	Cycles, Methods of Refrigeration used in I as Monochlorodifluro Methane, Chlorofluro (refaction Processes.	ndustry and Carbons and		9		
IV	COMI Stage Factor, Equipr	PRESSED AIR: Classificat and Two Stage Compresso Impeller Blade Shape. Prop nents used for Humidification	ion of Compressor, Reciprocating Compres r, Velocity Diagram for Centrifugal Comp erties of Air – Water Vapors and use of Hum n, Dehumidification and Cooling Towers.	ssor, Single ressor, Silp idity Chart.		9		
V	FUEL Power Combu	AND WASTE DISPOSAL Generation such as Natural Istion Engine, Petrol and Dies	: Types of Fuel used in Chemical Process Ir Gas, Liquid Petroleum Fuels, Coal and Co el Engine. Waste Disposal.	ndustries for oke. Internal		9		
			Total Instructiona	al Hours		45		
	1	Upon completion of the cour	rse, students can be able to					
	(CO1- Understand the impor	tance of various utility operations such as	Cher	nical So	oftenin	ig and	I
Cours	se ⁽	CO2-Illustrate the important equipment	ce of steam and its generation, properties	and steam proc	duction			
Outcon	nes	CO3- Examine about the var Industry	ious Refrigeration Cycles, different methods	of Refrigeration	used in			
	(CO4- Determine about the air Cooling Towers in the industrie CO5- Understand about the ty	compression, equipment used for Humidificati s pes of Fuel used in Chemical Process Industrie	on, Dehumidific s and the proper	ation an disposa	d l of fu	el wa	ste
TEXT B	BOOKS:							
1.	Indust	rial Chemistry by Shashi Cha	wla, Dhanpat Rai and Sons Publication.					
2.	P. L. E	Ballaney, "Thermal Engineeri	ng", Khanna Publisher New Delhi, 1986.					
3.	Heat	ransier by D.S. Kumar.						

Fuel Furances and Refractories by O.P. Gupta, Khanna Publishers.

REFERENCE BOOKS:

- 1. Perry R. H. Green D. W. "Perry's chemical Engineer's Handbook", McGraw Hill, New York, 2007.
- 2. P. N. Ananthanarayan, "Basic Refrigeration & Air conditioning", Tata McGraw Hill, New Delhi, 2007.
- 3. Plant Utilities by D.B. Dhone, NiraliPrakshan Publication.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	3.0	2.0	-	2.0	3.0	-	-	-	-	3.0	3.0	3.0
CO2	3.0	3.0	3.0	2.0	-	2.0	2.0	-	-	-	-	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	-	2.0	3.0	-	2.0	-	-	3.0	3.0	2.0
CO4	3.0	2.0	3.0	2.0	-	2.0	3.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	2.0	3.0	2.0	-	2.0	3.0	-	-	-	3.0	3.0	3.0	2.0
Avg	3.0	2.4	3.0	2.0	-	2.0	2.8	-	2.0	-	3.0	3.0	3.0	2.2



Progra	amme	Course Code	Name of the Course	L	Т	Р	С
B.T	ech	21CH8307	FERMENTATION TECHNOLOGY	3	0	0	3
Cou Objec UNIT	ırse ctives	• To enable the stu activities and conve	dents to understand the role of fermentation microorganismetrions that takes place during fermentations, and their impact o DESCRIPTION	ns and n qualit INSTR	(bio) y. UCT		iical L
Ι	INTR Micro Proce indust	CODUCTION TO FERM bbial Enzymes – Microbia ss – Microbial growth b trially important micro orga	ENTATION PROCESSES: Microbial biomass – al metabolites – Recombinant products – Transformation inetus – Isolation and preservation and improvement of unism.	J	9	N.S.	
Ш	INST Temp Pressu Contr	RUMENTATION AND erature and its control – are measurement and control ol Systems – Computer app	CONTROL: Measurement of process variables – Flow measurement and control – Gases and Liquids – rol – Cenline analysis – Control System – Combination of plication in termentation technology.		9		
Ш	III RECOVERY AND PURIFICATION OF FERMENTATION PRODUCTS : Removal of Microbial cells – Foam Separation – Precipitation Filtration – Different Filtration process - Centifugation – Different centrifuge cell description Different methods – Solvent recovery – Superfluid extraction – Chromatography Membrane processes – Drying – Crystallization – Whole growth processing.						
IV	EFFL Treatu treatu	JUENT TREATMENT: S ment Processes – Physical nent.	trength of fermentation effluent – Treatment and disposal – , chemical and biological – Aerobic process – Anareobic		9		
V	FERM indust Air st	MENTATION ECONON trial interest – Strain impro erilization – Heating and co	AICS: Introduction – Isolation of micro organisms of vement – Market potential – Plant and equipment – Media – poling – Recovery costs.		9		
			Total Instructional Hours		45		
		Upon completion of the c	ourse, students can be able to				
		CO1- Understand the basi fermentation proces	c fundamental of microbial cells, enzymes and recombinant teo	chnolog	y in		
Cours	se	CO_2 - Illustrate about the v	arious instrumental control techniques in fermentation operation	.S			
Outcon	nes	CO3- Indistrate about the v CO4- Determine the treat and its strength CO5- Understand the econ downstream	imment of fermentation effluent use of physical, chemical and omic production of fermented products and operation starts fro	biolog m upstr	tical m	iethod	S
TEXT B	BOOKS	:					
1.	Ferm	entation and Biochemical E	Engineering Handbook – C.C Haber. William Andrew II Edition	2007.			

2. Principles of fermentation Technology P.Stanbury Buttuworth Hanman – 1999.

- 1. Bioprocess Engineering Hydersen B.K Nancy A.delaK.L.Nelsen Wiley Interscience, 1994.
- 2. Bioprocess engineering principles, Pauline M. Doran, Academic Press.
- 3. Biochemical Engineering, H.W. Blanch and D.S. Clark, Marcel Dekker, 1997.
- 4. Shigeo Katoh, Jun-ichiHoriuchi and Fumitake Yoshida, "Biochemical Engineering", Wiley, 2015.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
Avg	3.0	2.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	2.0	3.0	2.0

Chairman - BoS OHE - HICET

Dean (Academics)

Progr B.7	amme Fech	Course Code 21CH8308	Name of the Course FRONTIERS OF CHEMICAL TECHNOLOGY	L 3	Т 0	Р 0	C 3
Cor Obje	urse ctives	• Students will kr	now the latest trends to be followed in the process industries	2S			
UNIT			DESCRIPTION	INSTR H	RUCT IOU	fION RS	IAL
Ι	PROCI reaction	ESS INTENSIFICA and separation; use		9			
Π	CHEM needs a product manufa	ICAL PRODUCT and specifications; idea; process deve cture; economic aspe	DESIGN: Scope and importance; identification of sources of ideas and screening ideas; selection of clopment for product manufacture; specialty chemical ects.		9		
III	RENE Techno	WABLE ENERGY: logy, biofuel cells ar		9			
IV	MATE glasses,	RIALS ENGINEE colloidal dispersion		9			
V	BIOEN biomole	GINEERING: ecular and cellular er	Biomechanics, biotransport and biomaterials, ngineering, drug discovery and development.		9		

Total Instructional Hours 45

Upon completion of the course, students can be able to

CO1- Understand about the application of various unit operations, unit processes, chemical reaction principles for the design of advanced reactors and lab

Course CO2- Remember the fundamentals and chemical engineering principle for the design of chemical Outcomes products with economic aspects

CO3- Remember and apply the chemical technologies in the field of renewable energy production CO4- Understand about the various materials in the advancement of chemical engineering CO5- Understand about the various development in bioengineering

REFERENCE BOOKS:

- 1. Keil, F. J., Modeling of Process Intensification Wiley-VCH Verlag GmbH & Co. KGaA2007.
- 2. Cussler, E.I. and Moggridge, G.D., "Chemical product design" Cambridge University Press, Cambridge, 2001.
- 3. Hoffmann,P, Tomorrow's energy: hydrogen, fuel cells, and the prospects for a cleaner planet, MIT Press, Sabon, 2002.
- Mitchell, B.S., An introduction to materials engineering and science for chemical and materials engineers, 4. John Wiley and Sons Inc., New Jersey, 2004.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0

Dean (Academics)

Progra	amme	Course Code	Name of the Course	L	Т	Р	С		
В.Т	ſech	21CH8309	INDUSTRIAL NANOTECHNOLOGY	3	0	0	3		
Cou	urse	• To elucidate on adv	antages of nanotechnology based applications in each industry						
Objec	ctives	 To provide instance 	s of contemporary industrial applications of nanotechnology						
		• To provide an ov	verview of future technological advancements and incre-	asing ro	le of				
		nanotechnology in e	each industry						
UNIT			DESCRIPTION	INSTRI I	UCTI IOUR	ONAI S	L		
Ι	NAN circu Optic and I	O ELECTRONICS: Adva it chips – Lasers - Micro a ral switches, Bio-MEMS –E Displays – Filters (IR blockin	ntages of nano electrical and electronic devices – Electronic and NanoElectromechanical systems – Sensors, Actuators, Diodes and Nano-wire Transistors - Data memory –Lighting ng) – Quantum optical devices.		9				
II	BIO and H in Su	NANOTECHNOLOGY: N Prosthesis - Reconstructive I regry – Photodynamic Ther	Janoparticles in bone substitutes and dentistry – Implants intervention and Surgery – Nanorobotics any - Nanosensors in Diagnosis– Neuro-electronic Interfaces		9				
	– Pro	tein Engineering – Drug del	ivery – Therapeutic applications.						
III	NAN	OTECHNOLOGY IN CH	IEMICAL INDUSTRY : Nanocatalyts – Smart		9				
	mater recog appli electr	rials – Heterogenous nanos nition (Quantum dots, Na cations – Nanoporous roluminescent displays.	tructures and composites – Nanostructures for Molecular anorods, Nanotubes) – Molecular Encapsulation and its zeolites – Self-assembled Nanoreactors - Organic						
IV	NAN Nanc using Packa packa	OTECHNOLOGY IN AG technology in Agriculture nanotechnology – Potentia aging, Food processing - Fo aging.	FRICULTURE AND FOOD TECHNOLOGY : -Precision farming, Smart delivery system – Insecticides al of nano-fertilizers - Nanotechnology in Food industry - od safety and biosecurity – Contaminant detection – Smart		9				
V	NAN produ appli filled	OTECHNOLOGY IN action - Electrospinning – C cation– Polymer nanofibers polypropylene fibers - Bior	g. ECHNOLOGY IN TEXTILES AND COSMETICS: Nanofibre on - Electrospinning – Controlling morphologies of nanofibers – Tissue engineering on– Polymer nanofibers - Nylon-6 nanocomposites from polymerization - Nano- lypropylene fibers - Bionics– Swim-suits with shark-skin-effect,Soil repellence.						
			Total Instructional Hours		45				
Cour Outco	rse mes	Upon completion of the co CO1- Understand about nan CO2- Determine about nan CO3- Examine about nano CO4- Illustrate about nano CO5- Understand about na	burse, students can be able to notechnology in electronic industries and various products otechnology in biotechnology sectors and applications technology in chemical industries and various applications technology in agriculture and food technology sectors and vari notechnology in textiles and cosmetics sectors and various app	ous appli	cation	S			
BEEED	FNCE	BOOKS							
1.	Nee	lina H. Malsch (Ed.),Biomed	lical Nanotechnology, CRC Press (2005).						
2.	Udo Syst	H. Brinker, Jean-Luc M ems,Wiley Publishers (2010	Mieusset (Eds.), Molecular Encapsulation: Organic React	ions in	Cons	traine	d		
3.	Jenr	ifer Kuzma and Peter V	erHage, Nanotechnology in agriculture and food product	on, Wo	odrow	Wil	son		

International Center, (2006).
Lynn J. Frewer, WillehmNorde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri- food sector, Wiley-VCH Verlag, (2011).

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
Avg	3.0	2.0	2.2	2.0	2.0		2.0	-	2.0	-	2.4	2.0	3.0	2.0

Chairman - BoS OHE - HICET

Dean (Academics)

Progran	ime Course Code	Name of the Course	L	Т	Р	С
B.Te	ch 21CH8310	DRUGS AND PHARMACEUTICAL TECHNOLOGY	3	0	0	3
Cour Objecti	• To give the stude pharmaceutical inc	ents an understanding of the polytechnical nature of engineering and lustry involving Chemical Engineering.	drug disco	very in	the	
UNIT		DESCRIPTION	INSTRU	CTIO	NAL	
			H	IOURS	5	
Ι	and economics.	it of drugs and pharmaceutical industry; organic therapeutic agents uses		9		
Π	DRUG METABOLISM AND ANIMAL PRODUCTS: Dru drugs on human bodies. Antibic hormones.	PHARMACO KINETICS & MICROBIOLOGICAL AND g metabolism;physico chemical principles; pharma kinetics-action of otics- gram positive, gram negative and broad spectrum antibiotics;		9		
Ш	IMPORTANT UNIT PROCESS conversion processes; alkylati esterification, halogenation, oxid	SES AND THEIR APPLICATION : Chemical on; carboxylation; condensation and cyclisation; dehydration, lation, sulfonation; complex chemical conversions fermentation.		9		
IV	MANUFACTURING PRINC CONTROL: Compressed tablet granulation; direct compression, dosage forms; parential solutio manufacturing practice. Packing;		9			
V	PHARMACEUTICAL PRODU Vitamins; cold remedies; laxat: antacids and others. Analytical me chromatography, fluorimetry, pola	JCTS & PHARMACEUTICAL ANALYSIS: ives; analgesics; nonsteroidal contraceptives; external antiseptics; ethods and tests for various drugs and pharmaceuticals – spectroscopy, arimetry, refractometry, pH metry.		9		
		Total Instructional Hours		45		
	Upon completion of the co	ourse, students can be able to				
	CO1- Understan	nd in general about development of drugs and pharmaceutical industry				
Course Outcome	CO2- Determine the drug CO3- Examine about impo	metabolism and pharmaco kinetics & microbiological and animal p rtant unit processes and their application in drug manufacturing	roducts in	genera	1	
	CO4- Illustrate about the v					
	CO5- Understand about the	e various pharmaceutical products and its analysis				
TEXT BO	OKS:					
1.	Rawlines, E.A.; "Bentleys Text b	ook of Pharmaceutics ", III Edition, Bailliere Tindall, London, 1977.				
2.	Shayne Cox Gad. Pharmaceutical	Manufacturing Handbook, Published by John Wiley & Sons, Inc., 2008.				
REFEREN	ICES BOOKS:					
1.	Yalkonsky, S.H.; Swarbick. J.; " Marcel Dekkar Inc., New York, 1	Drug and Pharamaceutical Sciences ", Vol. I, II, III, IV, V, VI and VII, 1975.				

- 2. "Remingtons Pharmaceutical Sciences", Mack Publishing Co., 1975.
- 3. Bernd Meibohm. Pharmacokinetics and Pharmacodynamics of biotech drugs, Published by Wiley-VCH, 2006.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
Avg	3.0	3.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	3.0	3.0	2.0





Dean (Academics)

Programme	Course Code	Name of the Course	L	Т	Р	С
B.TECH.	21CH8311	MEMBRANE SEPARATION PROCESS	3	0	0	3
	The student sh	ould be able to				
Course Objective	1. Understa	nd the principle and technical concept of advanced separation proce	esses.			
	2. Describe	the process of Reverse Osmosis, Nanofiltration.				
	3. Summariz	ze the Types and choice of Adsorbents.				
Unit	Description				In He	structional ours
I	BASICS OF S preparation of p Equipment use separations invo	EPARATION PROCESS : Overview and membrane materials hase-inversion membranes, Review of Conventional Processes, Prod in cross flow Filtration, cross flow Electro Filtration, Surfa lying a second liquid Dual functional Filter	, Material pocess conception of the second s	properties pt, Theory solid – 1	and and iquid	9
П	MEMBRANE and hollow fibe Osmosis, Nano membranes, M	SEPARATIONS: Types and choice of Membranes, Plate and Fra r Membrane, Porous and non-porous membrane transport and Os ofiltration, Ultra filtration and Micro filtration, Preparation F and UF characterization and membrane transport, Problems an	me, tubular smosis conc of compos d solutions	, spiral w epts , Rev ite, inorg based on	ound verse ganic RO,	9
Ш	SEPARATION Exchange Chron	N BY ADSORPTION: Types and choice of Adsorbents, Affin matography and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography and Immuno Chromatography, Recent Trends in Adsorbergy and Immuno Chromatography and Immun	ity Chroma	tography	, Ion	9
IV	INORGANIC Problems and so	SEPARATIONS: Electrophoresis, Dielectrophoresis, , Electrophoresis, blutions based on ED, PV, Facilitated Transport, Membrane conta	ro dialysis, ctors and ot	Evapora her memb	ation, orane	9
V	OTHER TEC Membrane Dist	HNIQUES: Separation involving Lyophilisation, Liquid Men illation, zone melting, Adductive Crystallization, Supercritical flui	nbranes, G d Extractior	as separa	ation,	9
On completion of	the course the	atudanta will ba abla ta	otal Instru	cuonal H	lours	45
On completion of	col					
Course Outcome		Understand the Concept of Separation Process.			~	
course outcome	02	Analyze key concepts of separation processes including e contacting, limiting cases, efficiency and mass transport effects.	quilibrium	stages, 1	reflux,	countercurrent
	CO3	Illustrate the concept of adsorption and its application.				
	CO4	Acquire Knowledge in inorganic separations for the reaction.				
	CO5	Differentiate and determine various processes by performing the	e specific te	sts.		
TEXT BOOK:						
T1	Schoen, H.M., '	New Chemical Engineering Separation Techniques", Interscience	Publishers, 1	972.		
T2	Treybal, R.E., "	Mass Transfer Operations", 3rd Edition, McGraw Hill Book Co., 1	980.			
T3	B. K. Dutta, Ma	ss Transfer and Separation Processes, PHI,2007.				
REFERENCES:	Vine C L "C	negative Dragones" Tata McCraw Hill 1002				
KI D2	M H Mulder H	Paration Flocesses, Tata MCOTaw Hill, 1982. Basic Principles of Membrane Technology Springer, 2004				

- R3 Roussel, R. W., "Handbook of Separation Process Technology", John Wiley, New York, 1987
- **R4** Nakagawal, O. V., "Membrane Science and Technology" Marcel Dekkar, 1992.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
Avg	3.0	2.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	2.0	3.0	2.0



Dean (Academics) - HICET

Course Objectives To provide students with the production of energy from different types of wastes through thermal, biological and chemical routes. It is intended to help the young scientific professional keep their knowledge upgraded with the current thoughts and newer technology options alo with their advances in the field of the utilization of different types of wastes for ene production. UNIT DESCRIPTION INSTRUCTION HOURS I Introduction: Introduction to waste to energy conversion, characterization of wastes, Energy production form wastes through incineration, energy production through gasification of wastes 9 II Densification of biomass and waste plastic blends: Densification of solids, efficiency improvement of power plant and energy production from waste plastics, Energy production from waste: Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells 9 V Cultivation of microalgae for biofuel production: Energy production from wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae. 9 V Cultivation of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the process of energy production. 45 Upon completion of the process of energy production. CO3- Understand about the process of energy production. CO3- Understand about the process of energy production. CO3- Understand about the process of energy production from organic waste CO4- Understand about the ener	Progra B.T	amme ech	Course Code 21CH6401	Name of the Course WASTE TO ENERGY CON	VERSION	L 3	Т 0	Р 0	C 3
UNIT DESCRIPTION INSTRUCTION HOURS I Introduction: Introduction to waste to energy conversion, characterization of wastes, Energy production form wastes through incineration, energy production through gasification of wastes 9 II Pyrolysis: Energy production through pyrolysis and gasification of wastes, syngas utilization. 9 III Densification of biomass and waste plastic blends: Densification of solids, Energy production form wastes Plastic, gas cleanup. 9 IV Energy production form wastes Plastic, gas cleanup. 9 IV Energy production form waste: Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells 9 V Cultivation of microalgae for biofuel production: Energy production from wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae. 45 Upon completion of the course, students can be able to CO2- Understand bout the pyrolysis and gasification process for energy production. CO3- Understand about the process of energy production from plastics CO4- Understand about the energy production from organic waste CO5- Understand about the Energy production from wastes through fermentation and tra	Cou Objec	rse tives	To provide student thermal, biological a keep their knowled with their advance production.	s with the production of energy fr nd chemical routes. It is intended to h we upgraded with the current thought in the field of the utilization of	om different elp the young s and newer to different type	types of wa scientific pro- echnology o es of waste	astes ofess ptior s foi	thro tional tional s alc r ene	ugh ls to ong ergy
I Introduction: Introduction to waste to energy conversion, characterization of wastes, Energy production form wastes through incineration, energy production through gasification of wastes 9 II Pyrolysis: Energy production through pyrolysis and gasification of wastes, syngas 9 III Densification of biomass and waste plastic blends: Densification of solids, efficiency improvement of power plant and energy production from waste plastics, Energy production form wastes Plastic, gas cleanup. 9 IV Energy production from waste: Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells 9 V Cultivation of microalgae for biofuel production: Energy production from wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae. 9 V Cultivation of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the process of energy production from plastics Course CO2- Understand about the process of energy production from plastics CO4- Understand about the energy production from organic waste	UNIT		-	DESCRIPTION		INSTR H	UCT IOUI	TON RS	AL
II Pyrolysis: Energy production through pyrolysis and gasification of wastes, syngas 9 III Densification of biomass and waste plastic blends: Densification of solids, efficiency improvement of power plant and energy production from waste plastics, Energy production form wastes Plastic, gas cleanup. 9 IV Energy production from waste: Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells 9 V Cultivation of microalgae for biofuel production: Energy production from 9 9 wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae. 45 Upon completion of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the pyrolysis and gasification process for energy production. 45 Course Outcomes CO4- Understand about the energy production from organic waste 6	Ι	Introd wastes, through	uction: Introduction t , Energy production for a gasification of wastes	o waste to energy conversion, chara orm wastes through incineration, ene	cterization of rgy production	n	9		
III Densification of biomass and waste plastic blends: Densification of solids, efficiency improvement of power plant and energy production from waste plastics, Energy production form wastes Plastic, gas cleanup. 9 IV Energy production from wastes: Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells 9 V Cultivation of microalgae for biofuel production: Energy production from wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae. 9 V Upon completion of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the pyrolysis and gasification process for energy production. 45 Course Outcomes CO3- Understand about the energy production from organic waste CO5- Understand about the energy production from organic waste 60	Π	Pyroly utilizat	sis: Energy production	S	9				
IV Energy production from waste: Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells 9 V Cultivation of microalgae for biofuel production: Energy production from 9 wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae. 9 V Cultivation of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the pyrolysis and gasification process for energy production. CO3- Understand about the process of energy production from plastics CO4- Understand about the energy production from organic waste CO5- Understand about the Energy production from wastes through fermentation and transmitted for the course production from organic waste co5- Understand about the Energy production from wastes through fermentation and transmitted for the course production from organic waste	III	Densif efficien Energy	ication of biomass a acy improvement of po production form waste	nd waste plastic blends: Densification were plant and energy production from a plastic, gas cleanup.	ation of solids waste plastics	s, ,	9		
V Cultivation of microalgae for biofuel production: Energy production from 9 wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae. 9 Total Instructional Hours 45 Upon completion of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the pyrolysis and gasification process for energy production. CO3- Understand about the process of energy production from plastics CO4- Understand about the energy production from organic waste CO5- Understand about the Energy production from wastes through fermentation and training the standard sta	IV	Energy	y production from wa bic digestion and ferme	ste: Energy production from organic ntation, introduction to microbial fuel	wastes throug	h	9		
Course OutcomesTotal Instructional Hours45Course OutcomesUpon completion of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the pyrolysis and gasification process for energy production. CO3- Understand about the process of energy production from plastics CO4- Understand about the energy production from organic waste CO5- Understand about the Energy production from wastes through fermentation and tra	V	Cultivation wastes from w	ation of microalgae through fermentation a vastewater and energy p	for biofuel production: Energy p nd trans esterification, Cultivation of roduction from algae.	roduction from algal biomass	n	9		
Course OutcomesUpon completion of the course, students can be able to CO1- Understand to characterize the waste CO2- Understand about the pyrolysis and gasification process for energy production. CO3- Understand about the process of energy production from plastics CO4- Understand about the energy production from organic waste CO5- Understand about the Energy production from wastes through fermentation and tra				Total Instr	uctional Hou	rs	45		
Course Outcomes CO2- Understand about the pyrolysis and gasification process for energy production. CO3- Understand about the process of energy production from plastics CO4- Understand about the energy production from organic waste CO5- Understand about the Energy production from wastes through fermentation and tra		U	pon completion of the	course, students can be able to					
actorification	Cours Outcon	ie C nes C	201- Understand to cha 202- Understand about 203- Understand about 204- Understand about 205- Understand about	the pyrolysis and gasification process the process of energy production from the energy production from organic wa the Energy production from wa	for energy pro- plastics aste astes through	duction. fermentatio	n ar	nd tr	ans

TEXT BOOKS:

- 1. Ashok K. Rathoure, Zero Waste: Management Practices for Environmental Sustainability, CRC Press, 2019, 1st Edition.
- 2. M. Habibur Rahman, Abdullah Al-Muyeed, Solid and Hazardous Waste Management, ITN-BUET, 2010

REFERENCES BOOKS:

1. George Tchobanoglous, Frank Kreith Handbook of Solid Waste Management, McGRAW-HILL, 2002.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
Avg	3.0	2.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	2.0	3.0	2.0

Chairman - BoS OHE - HICET



Prog B.7	ramme Fech	Course Code 21CH7401	Name of the Course BIOMASS CONVERSION AND BIO-REFINERY	L 3	Т 0	Р 0	C 3
Co	urse	• This course w	ill provide an insight to the basics of biomass, various conv	ersion te	chno	logie	s
Obje	ectives	and the differe	ent types of products that can be obtained upon successful c	onversio	n.		
UNIT			DESCRIPTION	INSTR	UCT	ION	AL
				I	IOUI	RS	
Ι	Introd	uction: World ene	rgy scenario, consumption pattern, fossil fuel depletion		9		
	and en	vironmental issues.	Availability and abundance of biomass, photosynthesis,				
	compos	sition and energy p	potential, virgin biomass production and selection, waste				
	biomas	s availability, abur	idance and potential, biomass as energy resources, short				
т	rotation	n woody crops, oil (crops and their bio refinery potential, microalgae.		0		
11	BIOMA	tmont technologies	Barriers in lignocentulosic biomass conversion,		9		
	Conver	sion Process: Type	as fundamentals equipment's and applications: thermal				
	conver	sion products	es, rundamentais, equipment s and appreations, mermai				
Ш	Produc	tion of hiofuels.	Diesel from vegetable oils microalgae and syngas: trans		9		
	esterifi	cation: FT process.	. catalysts: biodiesel purification, fuel properties, Factors				
	affectir	ng bio oil, bio char	rs production, fuel properties, bio oil up gradation. Corn				
	ethanol	, lignocellulosie	ethanol, microorganisms for fermentation, current				
	industr	ial ethanol producti	ion technology.				
IV	Hydro	gen, Methane and	Methanol: Bio-hydrogen generation, metabolic basics,		9		
	feedsto	ck's, dark ferme	entation by strict anaerobes, facultative anaerobes,				
	thermo	philic microorgan	isms, integration of bio hydrogen with fuel cell;				
	fundan	nentals of biogas	technology, fermenter designs, biogas purification,				
	methan	ol production and u	utilization.				
V	Organ	ic Commodity Cho	emicals from Biomass, Integrated Biorefinery		9		
	Biomas	ss as feedstock for	synthetic organic chemicals, lactic acid, polylactic acid,				
	succini butonov	c acia, propionic	acid, acetic acid, butyric acid, 1,3-propanediol, 2,3-				
	butanet	non, PHA. Concep	of of biofermery, com/soydean/sugarcane biofermery.				
			Total Instructional Hours		45		
	U	pon completion of	f the course, students can be able to				
	C	O1- Understand ab	out the Biomass and Biorefinary				
C	C C		· · · · · · · · · · · · · · · · · · ·				

- Course CO2- Examine about the various various pretreatment and conservation process
- Outcomes CO3- Understand about the various production of biofuels
 - CO4- Illustrate about the biomass feedstock's
 - CO5- Understand about the process of Integrated Biorefinery

TEXT BOOKS:

- 1. Shibu Jose, Thallada Bhaskar, Biomass and Biofuels:Advanced Biorefineries for Sustainable Production and Distribution, 2015, CRC Press.
- 2. Donald L. Klass, Biomass for Renewable Energy, Fuels, and Chemicals, Academic Press, Elsevier, 2006

REFERENCES BOOKS:

1. Thallada Bhaskar Ashok Pandey S.Venkata Mohan Duu-Jong Lee Samir Kumar Khanal, Waste Biorefinery, 2018, Elsevier, 2018.

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
Avg	3.0	2.0	2.2	2.0	2.0	-	2.0	-	2.0	-	2.4	2.0	3.0	2.0

Chairman - BoS OHE - HICET

Programme		e Course Code	L	Т	Р	С				
B.E./B	B.Tec	n. 21LSZ401 O	21LSZ401 General Studies for Competitive Examinations				3			
Course Objectives		1. To provide awareness	to the students about higher education entrance e	xams and	vario	ous t	ypes			
Obje	ctive	s of jobs offered both in	the Central and State Government. (CAT, GMAT	, GRE, I	BPS TAV	, IEI	LTS,			
		2 To help the students to	SC, GATE, IES, INEB, AFCAT, DRDO, ISKO, I choose the area where they are interested	NCOME	ТАЛ	,LIC)			
		3. To develop competitiv	ye skills through various types of objective tests.							
		4. To train them by cond	ucting aptitude test based on verbal and quantitativ	ve skills.						
UNIT		·	DESCRIPTION	INSTR	UC7	FION	NAL			
				Н	IOU.	RS				
Ι	NU	MERICAL ABILITY								
	Sin	plification and Approximation								
	Der	Proportion - Partnership -	Time and Work – Pipes and Cisterns – Time		18					
	Spe	ed and Distance – Problems	on Trains Boats and Streams - Permutation							
	and	Combination- Probability	- Data Interpretation- Simple Interest and							
	Coi	npound Interest – Geometry,	Γrigonometry and Mensuration – Progressions.							
Π	RE	ASONING ABILITY								
	Alp	hanumeric series - Reasor	ing Analogies – Coding-Decoding – Blood							
	Rel	ations - Directions – Cale	ndars – Clocks – Data Sufficiency – Deductive		10	1				
	Rea	soning - Cubes and cuboids -	Critical Reasoning – Syllogism – Venn Diagram							
	– P	izzles.	ernieur reusennig Synogisin venir Diugrum							
III	LA	NGUAGE COMPETENCY								
	Rea	ding Comprehensions - Clo	ze Test - Sentence Completion - Match the							
	Columns – Error Detection – Jumbled word/Paragraphs – Vocabulary & Grammar – One Word Substitution – Idioms and Phrases – Antonyms and					10				
IV		MPUTER ACOUAINTANC	IIIS – Semence Correction – Misti/Out of Comext semence.							
1 V	Inte	ernet – Memory – Keyboard Shortcuts – Computer Abbreviation – Microsoft								
	Off	ce – Computer Hardware	- Computer Software - Operating System -		3					
	Net	working – Computer Fundame	ntals /Terminologies.							
V	GE	NERAL AWARENESS								
	Geo	ography – Culture – History	- Economic Science - Scientific Research -	4						
	Aff	airs	ours – books and Authors – State OK - Current							
			Total Instructional Hours		45					
		Upon completion of the cour	rse, students can be able to							
		CO1: Thinking critically	and applying basic mathematics skills to	interpret	da	ta, c	draw			
		conclusions, and solve pro	blems; developing proficiency in numerical	reasoning	; Ap	plica	ation			
		CO_2 : The ability to iden	billude tests.	their con	nlar	ity	and			
		considering alternative view	points and solutions to use the critical skills of	observat	ion.	anal	vsis.			
Cours	e	evaluation.			- ,		J ,			
Outcon	ies	CO3: Understanding and re-	easoning using concepts framed in words; Crit	tical verb	al re	easor	ning;			
		Reading Comprehension; App	plication of verbal reasoning in aptitude tests.							
		CO4: Students will possess t	he basic understanding of computer hardware and	software,	utili	zing	web			
		System	ang of network principles, Reyboard Shortcuts	and vario	us c	Jpera	ating			
		CO5: Students will be updat	ed with awareness and knowledge regarding the	occurrence	es ar	ound	1 the			
	world.									
REFER	ENO	CES BOOKS:								
R	1: Q	uantitative Aptitude for Comp	etitive Examinations – Abhijith Guptha							
R	2: T	The Pearson Guide to Quantitative Aptitude - Dinesh Khattar								
R.	3: A	nalytical Reasoning and Logic	al Reasoning- Peeyush Bharadwaj R4: A New Ap	proach to	Rea	Reasoning -				
B	S. Si	jwali & S. Sijwali Arihant R5:	Word Power made easy - Norman Lewis							
R	5: V	erbal Ability & Reading Comp	orehension for the CAT – Arun Sharma, Meenaksh	i Upadhya	ıy - N	Mcgr	aw-			
hi	ll Ed	ucation								

R7: Computer Awareness - Arihant Publication

R8: General Knowledge and General Awareness - Arihant Manhar Pandey

Programme		Course Code Name of the Course		L	T	P	C			
B.E./B	s. recn.	To sensitize the Engineering students to various espects of		3 hts	0	0	3			
		 To make them understand, the world level perspective relations 	ited to Huma	nns m Rio	hts					
COURSE		 To identify the constitutional rights of women 	ica to muna	in rug	nto					
OBJEC	TIVES	• To understand the various political rights and laws related	to women							
		• To understand the gender equality concepts								
UNIT		DESCRIPTION	IN	INSTRUCTIONAL HOURS						
Ι	Intro	duction								
	Huma Devel Rights	an Rights – Evolution of the concept of Human Rights - Meaning, or hopment. Notion and Classification of Rights – Natural, Moral and s, Civil and Political rights. Economic, Social and Cultural Rights - The	rigin and Legal eories		9					
п	OI HU	man Rights - Philosophical loundations of Human Rights								
11	Huma	an Rights in India – Constitutional Provisions / Guarantees – Re	drassal							
	Mecha Direct Huma Nation		9							
III	CON	STITUTIONAL RIGHTS OF WOMEN IN INDIA								
	Indian constitution relating to women - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation, the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers -									
	Legal	AID cells, Help line, State and National level Commission								
IV	POLI	ITICAL RIGHTS OF WOMEN IN INDIA AND LAWS								
V	Political Rights of Women in India - Electoral process - women as voters - candidates and leader - pressure group, Representation of women in local self government – women in Rural and urban local bodies – Reservation of women – Laws against violence & Sexual crimes: eve teasing – rape - indecent representation of women - immoral trafficking									
v	Gende	DER EQUALITY er roles: Biological vs cultural determinism – Private vs public, dichot	omy _							
	Gende and fo Gende dispar	er division of labour and asymmetric role structure Gender role sociali ormation of identity –Occupational segregation and wage discrimina er stereotyping in work place – Human development indicators and ity	ition – gender		9					
	uispui	Total Instructional	Hours		45					
	U	Jpon completion of the course, students can be able to								
	C	CO1: Engineering students will have the basic knowledge of human right	its							
Cours Outcon	se C nes C C	CO2: Initiates the students to know the various national and international CO3: Gives an orientation on the various rights of women CO4: Makes them to understand the role of women in politics	l perspective	es of l	ıuma	n rig	hts			
	C	CO5: Provides a direction on gender equalities								
TEXT I	BOOK	S					_			
	1.	Kapoor S.K, "Human Rights under International Law and Indian Laws" 2014	', Central Ag	;ency,	Alla	haba	d			
BEEED	Z ENCE	Empowerment". Deep & Deep, New Delhi.	velopment a	ua						
NET EN		Chandra II "Human Rights" Allahabad I aw Agency Allahabad 2014								
	2. 3.	Upandra Baxi "The Future of Human Rights, Oxford University Press, I Menonnivedita (2004). "Recovering Subversion: Feminist Politics beyo	New Delhi and the Law'	'. Peri	nane	nt				
		Black, Delhi.								
	4.	Cornick, J.C. and Meyers, M.K. (2009) <i>Gender Equality: Transforming</i> New York: Verso.	r Family Div	isions	of L	abor.	•			

Dean (Academics)

Prog B.E./J	ramme B.Tech.	Course Code 21LSZ403 1. To learn about India	Name of the Course Indian Ethos and Human Values an ethos and its importance today	L 3	T 0	P 0	С 3		
COURSE OBJECTIVES		 To know about busi To know the Indian To understand valu To know thics from 	ness concepts and philosophies from various perspectives. philosophical system of knowing oneself. es and its significance.						
UNIT	T DESCRIPTION				TRU L HC	CTI)UR	ON S		
Ι	INDIA Indian H	N ETHOS Ethos – Models of man	agement in Indian socio-political environment Indian		-	-	-		
	work et importa	thos and principles of nt Indian Spiritual leade	Indian Management – Goals of Life- Teachings of rs		9				
II	BUSIN Econom	ESS CONCEPTS AND nics of giving - Western	D PHILOSOPHIES economic system. Developing and implementing gross onomics - Islamic economics and Banking	9					
III	CONST	FITUTIONAL RIGHT	S OF WOMEN IN INDIA						
	Indian c state po remedy Women line, Sta	constitution relating to licy - right to equality - University Declaration and Children - Role of the and National level Co	women - Fundamental rights - Directive principles of - rights against exploitation, the right to constitutional n of Human Rights - Enforcement of Human Rights for Cells and Counseling Centers - Legal AID cells, Help ommission		9				
IV	POLIT	ICAL RIGHTS OF W	OMEN IN INDIA AND LAWS						
	Political and lead women violence	l Rights of Women in Ir der - pressure group, F in Rural and urban lo e & Sexual crimes: eve	ndia - Electoral process - women as voters - candidates Representation of women in local self government – ncal bodies – Reservation of women – Laws against e teasing – rape - indecent representation of women -		9				
V	immora GENDI	ER EOUALITY							
	Gender Gender formatio	roles: Biological vs cu division of labour and a on of identity –Occupa	Iltural determinism – Private vs public dichotomy – asymmetric role structure Gender role socialization and tional segregation and wage discrimination – Gender		9				
	Jun	on completion of the or	Total Instructional Hours		45	;			
	CO	1: To impart knowledge	e on Indian Ethos for inspirational life						
Cour Outcoi	se CO mes CO CO CO	 To apply Business co To familiarize studer To apply values in d To conceptualize eth 	oncepts and philosophies for broader perspective in societ nts about Indian philosophy system to handle life efficientl ay to day functioning for better standard of life. hics from western and Indian perspective	y y					
TEXT	BOOKS	- 	n D. N. Indian Ethan and Values in Management ICDN (7 9 0	07 1	0.7	70		
1 9 T H	1- Nandag . Tata Mc 2-Khande limalaya F	gopal. K and Ajith Sanka Graw Hill Education Pri Wal.N.M, Indian Ethe Publishing House 2011	vate Ltd, 2011. os and Values for Managers, ISBN 978-93-5024-452	978-0 2-4,	3rd	Editi	ion,		
REFE	RENCES	BOOKS:							
R R R N	1-Manage coad, New 2-Dr. Rad 3-Soham, fission Tr	ement Thoughts in Third Delhi 110 002. 2010 Ihakrishnan Pillai, Corp LEEP (Life Empowern ust, 2017	ukkural by K. Nagarajan – ANMOL Publications PVT Ltc orate Chanakya, ISBN 978-81-8495-133-2, Jaico Publishi nent and Enrichment Program), ISBN 9788175977259 Ce	l 437 ng H entral	4/4B ouse, Chin	Ansa 201 Imay	ari 6 7a		

Chairman - BoS OHE - HICET

Dean (Academics)

Programme B.E./B.Tech. COURSE OBJECTIVES UNIT		Course Code 21LSZ404	Course Code Name of the Course 211 SZ404 Indian Constitution and Political System			P 0	C 3					
		 Teach history and philosophy of Political Science. Describe the Indian Constitution and fundamental rights. Summarize powers and functions and Emergency rule of Indian gov Explain Local Governance. Converse the challenges to Indian Democracy DESCRIPTION 				overnment. INSTRUCTION						
Ι	INTRODUCTION Meaning, Nature and Scope of Political Science – Significance of Political Science as a Discipline - Approaches to the study of Political Science – Key Concepts: State, Nation and Sovereignty - Political Science as a Science or an Art.					9						
Π	CONST Meaning the const India. Scheme The din Constitu	TITUTION OF INDL g of the constitution la stitution of India – sal of the fundamental r rective principles of ational Remedies for c	A & FUNDAMENTAL RIGHTS aw and constitutionalism – Historical perspective of ient features and characteristics of the constitution of ights – fundamental duties and its legislative status – state policy –Rights of women and Children - citizens		9							
Ш	PARLIAMENTARY FORM OF GOVERNMENT AND EMERGENCY PROVISIONS The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – Emergency provisions: National											
IV	LOCAI Panchay Signific empowe	GOVERNANCE vati Raj and Munici ance of 73rd and 74th erment of the marginal	ipal Government; Structure, Power & Functions; Amendments; Changes in Rural Power structure and lized groups such as SCs/STs and Women									
v	CHALL Caste, cl politics	lass, ethnicity and gen of regionalism, comm	In DEMOCRACY Ider in Indian politics; Criminalization and corruption, Junalism, backward class and Dalit movements, Tribal or gender justice		9							
Corre	Up	on completion of the	Total Instructional Hours course, students can be able to		45							
Outcom TEXT	nes CO CO BOOKS 1 - Durga 2 - Agarwa	 Onderstand the fils Understand fundan Understand the Par Das Basu, "Introducti R C "Indian Politi 	nental rights and fundamental duties. rliamentary form of Government and Challenges to India ion to the Constitution of India ", Prentice Hall of India, ical System" S Chand and Company New Delbi 1997	an Demoi New De	rcracy lhi, 1	y 997.						
T	3 - Johari,	J.C. Principles of Mod	dern Political Science. New Delhi: Sterling, 1989.									

T4 - Sharma K L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.

- R1 Sharma, Brij Kishore, "Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
- R2 Gahai U R., "Indian Political System ", New Academic Publishing House, Jalaendhar. R3 Sharma R N., "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Chairman - BoS OHE - HICET

Dean (Academics) HICET

Programme B E /B Toch		Course Code Name of the Course					T	P	C_{2}
D.E./I	5. Tech.	Understanding of	i oga ior numan ex	cenence	Z		0	Z	3
COU OBJEC	URSE CTIVES	 (1) Structure and functions of Human Body, (2) Importance of Physical Exercises and various Medical systems (3) Life force and Philosophy of Kaya Kalpa (4) Mind and its functions and Meditation Practices. 							· . -
UNIT			INSTRUCTIONA						
I II	 PHYSIC Purp Phys Bloo Nerv FUNCT 	CAL STRUCTURE ose of life - life - yoga - 1 ical structure - combination d circulation system - Re ous system - Digesting sy TONS OF PHYSICAL I	nodern life style - importance n of five elements - three form spiratory system. stem. ODY	of physical health ns of body.			9	10	
	 Three ci Limit thought. Impor regulation Food a systems: 	rculations - disease, pain and method in five asp tance of physical exercisons. and Medicine - yogic foo Allopathy. Siddha.	nd death - causes for disease. ects - food, work, sleep, se es - Simplified Physical Exc habits - natural food - natur Avurvedha, Unani a	ensual pleasure and ercises - Rules and ropathy - Medical and Homeopathy.			9		
III	REJUV Philosop Magneti • Anti- • Sex a • Func	ENATION OF LIFE-F(oby of Kaya kalpa - Phys sm - Mind. ageing and postponing de and spirituality - value of tional Relationships of bo	PRCE cal body - Sexual vital fluid th - Kayakalpa Practical - ber exual vital fluid - married life	- Life force - Bio- nefits. e - chastity.			9		
IV	MIND Bio-mag living be • Men • Ten understa • Impo	gnetic wave - Mind - imp eings. tal Frequency - functions stages of mind Be undable imprints. ortance of meditation - ber	inting and magnifying - Eight of mind - five layers. refits of meditation - h efits of meditation.	t essential factors of abitual imprints -			9		
V	MEDII Simplifi • Agna • Sant benefits. • Thur explanat	ATION ed Kundalini Yoga - grea meditation - explanation hi meditation - explana iam meditation - explan ion - benefits.	ness of guru - types of meditate benefits. tion - benefits - clearance tion - benefits - Thuriyathe	tion of spinal cord - etham meditation -			9		
TEXT	BOOKS		1 otal 1	Instructional Hours			43		
T REFEF	1 - Yogic RENCES	Life - VISION, Vethat BOOKS:	iri Publications.						
р	1 Wathat	hiri Maharishi Voca far	Jodam and 2017 Vathathini	Dublications Erada					

- R1 Vethathiri Maharishi, Yoga for Modern age, 2017, Vethathiri Publications, Erode.
- R2. Vethathiri Maharishi, Mind, 2017, Vethathiri Publications, Erode.

- R3. Dr.Mathuram Sekar, Medicine and Health, Narmadha Publications.
- R4. Vethathiri Maharishi, Simplified Physical Exercises, 2013, Vethathiri Publications, Erode.
- R5. WCSC-VISION for Wisdom, Yogasanas, 2012, Vethathiri Publications, Erode.

Chairman - BoS OHE - HICET

Dean (Academics) HICET

Programme	e Cours	se Code	Course Title	L	Т	Р	С
BE/BTECH	I 21H	E1074	NCC General and National Integration	1	0	0	1
Course Objectives:	1. 2. 3. 4. 5.	Know abou prospects. Understand Understand Be motivat Appreciate	It the history of NCC, its organization and incentives of NCC cadets for I the concept of national integration and its importance. I the practices of health and hygiene and importance. ed to serve the nation by joining Armed forces . grace and dignity in the performance of foot drill.	r thei	ir ca	reer	
Unit			Description	Ins	truc Hoi	ction urs	al
Ι	ORGANIZA NCC Gener song - Histor	ATION OF N al - Aims an ry of NCC - In	ICC d Objectives - Motto of NCC - Organization - training and NCC ncentives of NCC - Duties of NCC cadets.		3	3	
Ш	NATIONAI Introduction National inte national secu	INTEGRA to National I egration - Un urity - Benefit	FION ntegration - Major religions in India - Importance and Necessity of ity in diversity - Factors affecting National integration - Threats to s of National Integration.		3	3	
	HEALTH AND HYGIENE						
III	Structure and diseases and	l function of a its prevention	a human body - health and sanitization - Infectious and contagious 1.		3	3	
	ARMED FORCES AND GENERAL SERVICE KNOWLEDGE						
IV	Basic Organization of Armed Forces - Army, Navy and Airforce - Equivalent Ranks in Defence services - History of the Armed Forces - modes of entry in Indian Armed forces.						
	FOOT DRILL						
V	Basics of dri Aram se - Th	ll - File forma nahine mud -	ation -Basics of foot drill - word of command - Savdhan - Vishram - Baye mud - piche mud - Thej chal - Tham - kadham thal.		3	3	
Course Outcome:	CO1: CO2: CO3: CO4: CO5:	Imbibe the c Respect the Provide good Understand Provide and	onduct of NCC cadets. And exposure of NCC organization diversity of different Indian culture. d health by hygiene living. about Indian Armed forces and effective contribution. follow the different word of command				
Reference	e :						
1	. UGC and A	JCTE circula	ted syllabus.				

Text Books :

- NCC cadet Guide (SD/SW) Army
 NCC cadet Guide (SD/SW) Airforce.
- ANOS Guide (SD/SW) by DG NCC, Ministry of Defence, New Delhi
 Digital Forum App 1.0 & 2.0, by DG NCC DG NCC, Ministry of Defence, New Delhi

Chairman - BoS OHE - HICET

Dean (Academics) HICET -
Programme	e Course Code	Course Title		Т	Р	С
BE/BTECH	21HE2074	Social services and community development	L	0	0	1
Course Objectives:	 Acquire th activities. Understan Understan Understan Know about 	e knowledge and active participate in social service and community developed the concept of disaster management and role of NCC cadets in disaster n d the concept thinking and reasoning process d about maps and use of bearing and service protector at the principles of flight and Aerofoil structure and ATC procedures.	opm nana;	ent ger	nent	
Unit		Description	instr H	uct	tiona	ત્રી
	SOCIAL SERVICES A	ND COMMUNITY DEVELOPMENT	11	lou	115	
Ι	Basics of social services towards social welfare - Mission Indra danush - B	and its need - Rural development programs - Contribution of youth NGOs in social services Swach bharath Abhiyan - Social evils - eti bacho Beti pado - Digital awareness - Constitution day.		3		
	DISASTER MANAGEN	IENT				
Π	Organization of Disaster management -Types of emergencies - Natural and manmade disasters - fire service and fire fighting - prevention of fire.					
	PERSONALITY DEVE	LOPMENT				
III	Introduction to personalit awareness - critical think	y development - public speaking Intra and Inter personal skills -self ing - Decision making and problem solving.		3		
	MAP READING					
IV	Types of maps - convent cardinal points - Types o compass and its uses - set	ional signs - scales and Grid system - relief and contour gradient - of North - types of bearing and use of service protector - Prismatic ting of map - finding North and own position.		3		
	PRINCIPLES OF FLIG	HT AND AIRMANSHIP				
V	Introduction to principle incidence - Newton's - 1 Airfield layout - ATC (A	of flight - Forces acting on the aircraft - Angle of attack - Angle of aw of motion - Bernauli's theorem and Venturi effect - Aerofoil - ir Traffic Control) - circuit procedures - Aviation medicine.		3		
Course	CO1: Perform the CO2: Appreciate	social services on various occasions for better community and social life the need and requirement for disaster management and NCC rol	e in	d	isast	ter

Course Outcome:

- CO2: management activities.CO3: Define thinking, reasoning, critical thinking and creative thinking
- CO4: Use of bearing and service protector and locate the places and objects on the ground.
- CO5: Understand the principles of flight and Aerofoil structure.

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Programme	e Course Code	Course Title	L	Т	Р	С
BE/BTECH	1 21HE3074	Leadership Qualities and camp activities	1	0	0	1
Course Objectives:	 Identify the Understand Acquiring a Use of terra Obtain Kno 	leadership traits. importance of Environmental awareness and conservation. wareness about the basic obstacles and weapon system in training in effectively for concealment, camouflage, indicate landmarks and gi wledge about Airframes, types of wings and instruments for flying.	ve fie	eld s	igna	ls.
Unit		Description	Ins	truc Hor	tion rs	al
	LEADERSHIP DEVELO	DPMENT		1101	115	
Ι	Introduction to Leadershi values - Honor code - Bas	p - Leadership traits - indicators - motivation - ethics and Moral ics of OLQ (Officer like Qualities).		3		
	ENVIRONMENTAL AV	VARENESS				
П	Water conservation - Sou pollution - Energy source conversion - waste manage	rces of water - water cleaning management - Pollution - Types of es - Solar, wind, Tidal - Renewable and none renewable energy ement - Tree plantation		3		
	OBSTACLES AND WEA	APON TRAINING				
Ш	Introduction to weapons - position - short range fi Understanding about ob Precautions carrying on tra	Types of rifles - SLR, .22, INSAS etc., - Firing - Types of Firing ring - Principles of firing - Holding, Aiming and Triggering. stacle training - Analysis and Process of obstacle training. aining		3		
	FIELD CRAFT AND BA	TTLE CRAFT				
IV	Introduction to FCBC- Description of ground - Re	Observation, camouflage and concealment. Judging distance - ecognition, description and indication of land mark and target		3		
	AIR FRAMES AND INSTRUMENTS					
V	Aircraft control surfaces - Basic Flight Instruments -	Types of Air frames - Types of wings and plane. Landing gear - Air speed Indicator (ASI) - Altimeter -Artificial Horizon (AH).		3		
Course Outcome:	CO1: Imbibe leade CO2: Contribute ir CO3: Understand a	rship qualities. environmental awareness and conservation activities. and execute obstacles course and uses of weapons.				

- CO4:
- Observe surroundings in better way. Understand the design of Aircraft, control surfaces and Airspeed indicator. CO5:

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Programme	Course Code	Course Title	L	Т	Р	С
BE/BTECH	21HE4074	General awareness, communication and Aero engines	1	0	0	1
Course Objectives:	 Understa Show Ar Get Acqu Understa Arms. Obtain Ka 	nd importance of General Awareness. m drill and ceremonial drill sequences. mainted with the procedure to treat the wounds and fractures during emerg and and knowledge about communications networks and Infantry weapon nowledge about Aero engine, Aero modeling and flying basics.	encies. s and s	upp	orti	ng
Unit		Description	Instı F	ruct Iou	tiona rs	al
	GENERAL AWAREN	ESS				
Ι	Constitution of India - C and geographical structu	Current affairs - logical reasoning - Types of awards - Indian history are - Indian culture - know your country - freedom fighters.		3		
	ARM DRILL AND CH	EREMONIAL DRILL				
Π	Arm Drill - Rifle ke sat Rifle ke saath visarjan, Shastra. Salami sasthra ceremonial Drill - Guard	h savdhan, Vishram aur Aram se - Rifle ke saath Parade par aur Saj, Line Tod - Bhumi Shastra aur Uthao Shastra, Bagal Shastra aur Baju - Squad Drill with Arms – Salute - General Salute - National Salute - d of Honour - Gurad mounting.		3		
	FIRST AID AND WEI	LLBEING OF HUMAN BODY				
Ш	First Aid common med daily exercise - Types Health monitors - Immu	ical Emergencies - treatment of wounds - Introduction to yoga and of Asanas - benefits of yoga and exercises - Balanced Diet food - nity development - fight against spread of diseases.		3		
	COMMUNICATION,	INFANTRY WEAPONS AND SUPPORTING ARMS				
IV	Types of communication 7.65 m SLR - Ammuniti - INSAS, Rocket Launcl	ons - characteristics of wireless communication - Characteristics of on - fire power - Stripping, Assebling and Aiming - Supporting Arms her, Tanks - Army Defence system.		3		
	AERO ENGINES, AE	RO MODELING AND FLYING				
V	Introduction to Aero En working of Aero Engine flying of Aero models techniques.	gine - types of Aero Engines - Piston and Jet Engines - Principles and es - history of Aero modeling - types of Aero models - Building and - Pre flight checking - Start up, taxi and take off - forced landing		3		
Course Outcome:	CO1: Keep abrea CO2: Observe an CO3: Follow hea CO4: Observe an CO5: Understand procedures	ast of current affairs and general awareness. nd practice Arm drill with rifle and General salute. althy personal hygiene practices and provide first aid in emergencies. nd characteristics of Radar communication, SLR characteristics and funct d principle and working of piston engine and jet engine. Aero s and flying controls.	ioning model	; of ling	tank	s.

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Course Objective:

• To make the students program PLC module using ladder logic method through powerful software package and enhance the student knowledge on integrated industrial automation using PLC

Module No	Heading	Subheading	Hours
Module 1	Introduction to PLC, CPU and Programming	 Introduction to PLC, PLC size and Application CPU Block diagram & Memory PLC Programming Language Installation and wiring guidelines 	4
Module 2	Hardware, Logic and Control Instructions	 Addressing & Hardware configuration NO/NC Concept Bit Logic Instructions Control Instructions 	5
Module 3	Various Operations	Comparison operationConversion OperationsMath Instructions	3
Module 4	Tools	TimersCounters	4
Module 5	Programming with PLC	 For the Lamp Circuit For Actuating Single Acting Cylinder For Water Level Control of Two Different Water Tanks For Material Handling System For Stamping System For Spray Painting System For Bottle Filling System 	14
		Total Contact Hours	30
			Hours

Course Outcomes:

At the end of the course the students will able to

- Interface the hardware component in real time environment
- Program, Simulate and run the various industrial applications through PLC module

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Course Name Bulk Solid Handling for Chemical Engineers

Course Objective:

• To study about detailed design, safety and environment aspects, commissioning of value chain and equipment procurement to handle bulk solids. And also, the persons who involved to solve and prevent the flow problems.

Module No	Heading	Subheading	Hours
Module 1	Introduction on bulk solid and handling of bulk solids	 Concepts and role of unit operation in process industries, Introduction on bulk solid and handling of bulk solid. Explanation in coal industry. 	3
Module 2	Classification and Flow ability	 Particle shape, particle size, classification of bulk solids, comparison of solids and liquids in flow ability of solids. Explanation of Iron and Steel Industries 	3
Module 3	Bulk solid flow	 Hourglass flow, flow through model deflector, flow patterns, bulk solid flow differ from fluid flow, wall friction, compressibility, permeability. Other properties affect the flow of solids through various types of feeders, blenders, chutes, bins, and hoppers. 	6
Module 4	Mixing	• Reduction of segregation, sampling, size reduction, energy requirement and product size distribution, mixing and agitation - mixing of liquids (with or without solids), mixing of powders, selection of suitable mixers.	3
Module 5	Blending and Segregation	 Blending- convection, diffusion, blend quality, segregation testing of powders and solids-fluidization, shifting, vibration. Explanation of mining industry 	3
Module 6	Bulk Solid handling Fertilizer Plants	 Process Flow diagram, equipment specification process, parameters, control the process and case study. Explanation of fertilizer industry for bulk handling 	3
Module 7	Solid bulk material handling in Refineries & Petrochemical plant	 Practical Application and role of chemical engineers in Solid bulk material handling in Refineries & Petrochemical plant, Equipment's used in refineries. Explanation of Refinery Industries 	3
Module 8	Case study, Group Discussion & Assessment	 Transfer Chute Plugging Solved at Iron Ore Export Terminal Gypsum Flow Problems Solved at Lafarge Cement <i>Coal Feeding: Pressure-Sealing Solids Pump Improves Feed</i> 	6

Total Contact Hours 30 Hours

Course Outcomes:

- To Understand how to specify and select hardware recommended for bulk solid flow problems and objectives; also, to remodel of equipment to correct the flow problems.
- To Understand the handling of solid materials in fertilizer industry, Refinery Industry and the equipment's used in varying configurations in order to meet their specific needs
- To Understand and solve flow problems which involve production lost, extra labor, unreliable equipment, poor quality control, downtime of plant and waste material

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Course Code 21VACH03

Course Name Fundamentals of AI and it's Chemometric Applications

Course Objective:

• This course will provide an insight to Apply AI into Chemical Engineering.

Module No	Heading	Subheading	Hours
Module 1	Introduction to AI	• Definition, types of tasks (classification, regression, etc.), supervised vs unsupervised learning, major AI techniques & applications, basic terminology (data, label, machine learning vs deep learning, etc.)	5
Module 2	Workflow	• Data collection, exploratory data analysis (EDA), pre- processing, model selection, model evaluation, deployment	5
Module 3	Exploratory data analysis	• Wine quality dataset background, physico-chemical data (input variables) explanation, basic metrics (count, mean, quartiles, etc), graphical visualization (histogram, box plot, scatter plot, correlation matrix, etc), dimensionality reduction (PCA, LDA, LLE, etc).	5
Module 4	Data pre-processing	• Standardization, normalization, scaling.	5
Module 5	Model selection, training & evaluation	• Train/dev/test sets, commonly used models - linear regression, logistic regression, SVM, kNN, random forest, neural networks. Evaluation metrics (loss functions), model selection criteria's (resampling methods - train-test split, cross-validation).	5
Module 6	Improving ML models.	• Bias & variance, hyper parameter tuning (orthogonalization strategy), overfitting & underfitting, regularization, training final model	5
		Total Contact Hours	30 Hours

Course Outcomes:

- To Understand about the AI techniques & and its applications.
- To Understand about the data collection, evaluation and data analysis.
- To Understand about data processing and normalization.
- To Understand about the model selection and evaluation.
- To Understand about regularization and final model

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Course Code	Course Name	Course Duration
21VACH04	Introduction to Chemical Engineering MATLAB	30 Hrs.

Course Objective:

To enable the students to carry out mathematical modelling related to process design, control and • optimization by using MATLAB.

Module No	Heading	Subheading	Hours
Module 1		Basics of MATLAB	
	Introduction to MATLAB	programming	
	Programming	 Array operations in MATLAB Basic notations in MATLAB 	7
Module 2		• Loops and execution control	
	MATLAB Components	Working with files: Scripts and Functions	7
		 Plotting and program output 	
Module 3		• Introduction to ODEs	
	(ODE) in MATLAB	• MATLAB ode45 algorithm in single variable	4
		• MATLAB ode45 algorithm in multiple variables	
Module 4	Simu Link Basics	•Introduction to Simulink	
		• Components of Simulink	4
Module 5	Final Project	•In this Module, you will do a project based on what you have learned so far, for example: -	
		• Iso-Thermal Batch Reactor	
		 Dynamic Simulation of Two tank Interacting system. 	8
		• Simulation of Double pipe Heat Exchanger using Simulink.	
		Total Contact Hours	30 Hours

Course Outcomes:

- To understand the mathematical operation using MATLAB programming. •
- To understand the components of MATLAB programming and its executions. •
- To understand the simulation and optimization of Chemical Engineering Unit Operation system using Simulink.

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Course CodeCourse NameCourse Duration21VACH05IoT- Basics and Application in unit operations.30 Hrs.

Course Objective:

• To develop the ability to apply the IoT tools and its components in the field of various Unit Operations.

Module No	Heading	Subheading	Hours
Module 1	Introduction to IoT	 IoT definition ad Characteristics IoT Complete Architectural Stack IoT enabling Technologies IoT Challenges 	6
Module 2	Sensors and Hardware for IoT	• Hardware Platforms – Arduino, Raspberry Pi, Node MCU.	6
Module 3	Protocols for IoT	 Infrastructure protocol (IPV4/V6/RPL), Identification (URIs), Transport (Wifi, Lifi, BLE), Discovery, Data Protocols, Device Management Protocols. 	5
Module 4	Lab Practice	 A Case study with any one of the boards and data acquisition from sensors. A Case Study with MQTT/CoAP usage-IoT privacy, security and vulnerability solutions. 	6
		 IoT based performance monitoring and control in counter flow double pipe heat exchanger. IOT-based monitoring of lab scale constitutive landfill model of food waste. 	7
Module 5	Final Project		

Total Contact Hours

30 Hours

Course Outcomes:

- To Understand the definition and significance of the Internet of Things.
- To Understand the characteristics of IoT components and its Tools.
- To Understand the Design and development of IoT based sensor systems.
- To Understand the need for IoT Trust and variants of IoT

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