K. K. Wagh Institute of Engineering Education and Research, Nashik (Autonomous wef AY 2022-23)



Structure of S Y B. Tech (Chemical Engineering)

Pattern: 2023 (wef AY 2023-24)

		S.Y	. B. 1	Гech	. Che	emical Er	ngineering	wef A	Y 202	4-25							
						SEN	/I-III										
Course	Course	Title of Course	Te Se	achi chen	ng ne		Evaluati	ion Sc	heme	and	Marl	ks			C	red	its
Coue	туре		TH	TU	PR	INSEM	ENDSEM	CCE	TUT	TW	PR	OR	TOTAL	TH	TU	PR	TOTAL
2300201B	BSC	Applied Mathematics and Numerical Methods	3	-	-	20	60	20	-	-	I	-	100	3	-	-	3
2307202	PCC	Mechanical Operations	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2307203	PCC	Chemical Reactions and Synthesis I	3	-	-	20	60	20	-	-		-	100	3	-	-	3
2307204	PCC	Lab work in Mechanical Operations	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
2307205	PCC	Lab work in Chemical Reactions and Synthesis I	-	-	4	-	-	-	-	50	50	-	100	-	-	2	2
2307206	MDM	Heat Transfer Processes	3	-	-	20	60	20	-		-	-	100	3	I	-	3
2307207	MDM	Lab Work in Heat Transfer Processes	-	-	2	-	-	-	-	25	25	-	50	-	1	1	1
2307208	OE	Industrial Management	2	-	-	-	-	50	-		I	-	50	2	-	-	2
2307209	VEC	Universal Human Values	-	2	-	-	-		50		-	-	50	-	2	-	2
2307210	VSEC	Problem Solving using Scilab	-	1	2	-	-	-	25	25	-	-	50	-	1	1	2
Total Marks/Credits/hours				03	10	80	240	130	75	125	100		750	14	3	5	22



	S.Y. B. Tech. Chemical Engineering wef AY 2024-25																
						SEN	1-IV										
Course	Course	Title of Course	Te S	TeachingEvaluation Scheme and MarksScheme					Credits								
Code	Type		TH	TU	PR	INSEM	ENDSEM	CCE	TUT	TW	PR	OR	TOTAL	TH	TU	PR	TOTAL
2307211	PCC	Process Calculations	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2307212	PCC	Chemical Reactions and Synthesis II	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2307213	PCC	Thermodynamics	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2307214	PCC	Lab Work in Process Calculations	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
2307215	PCC	Lab Work in Chemical Reactions and Synthesis II	-	-	4	-	-	-	-	50	50	-	100	-	-	2	2
2307216	MDM	Fluid Mechanics	3	-	-	20	60	20	-		-	-	100	3	-	-	3
2307217	MDM	Lab Work in Fluid Mechanics	-	-	2	_	-	-		25	25	-	50	_	-	1	1
2307218	OE	Environmental Economics	2	-	-	-	-	50	-		I	-	50	2	1	-	2
2307219	VEC	Democracy, Election and Governance	-	2	-	-	-	-	50		-	-	050	-	2	-	2
2307220	AEC	Technical Writing	-	1	2	-	-	-	25	25	-	-	050	-	1	1	2
Т	Total Marks/Credits/hours			03	10	80	240	130	75	125	100		750	14	3	5	22



	Exit Courses at S.Y. B. Tech (To award Diploma)														
Course	Course Title of	Te S	eachii chem	ng e		Evaluation Scheme and MarksCredits							5		
Code	Туре	Course	ТН	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	ТН	TU /TW	PR	TOTAL
2307221	EXIT	Internship	0	0	0	0	0	0	100	0	100	0	2	0	2
2307222	EXIT	Chemical Process Industries	2	0	2	20	30	0	50	0	100	2	1	0	3
2307223	EXIT	Chemical Process Safety	2	0	2	20	30	0	50	0	100	2	1	0	3
Total Marks/Credits/hours				0	4	40	60	0	200	0	300	4	4	0	8

Description of various Courses:

Type of Course	Description	Type of	Description
		Course	
ESC	Engineering Science Courses	PCC	Program Core Course
BSC	Basic Science Courses	PEC	Program Elective Courses
CC	Co-curricular courses (Liberal learning courses)	OE	Open Elective Courses of other than particular program
CEP/FP	Community Engagement/ Field Project	VEC	Value Education Courses
OJT	On Job Training	ASM	Additional Specialized / MOOCs
MDM	Multidisciplinary Minor	HSSM	Humanities, Social Science and Management
AEC	Ability Enhancement Course	VSEC	Vocational and Skill Enhancement Course
RP	Research Project	RM	Research Methodology







	Semester III (SY - B. Tech.) Chemical Engineering					
	2300201	B: Applied Mathem	atics &	Numer	ical Met	hods
Teachi	ing Scheme:	Credit Scheme:3	Examin	ation scl	neme:	
Theory	v: 3 hrs/week		In Seme	ster Exar	n: 20 mark	S
			End Sen	nesters E	xam: 60 m	arks
			Continu	ous Com	orehensive 1	Evaluation: 20 marks
			Total: 10	00 Marks		
Preregi	uisite: Linear Al	gebra, Vector algebra, Di	fferential	calculus	and Integr	al calculus.
Course	Objectives:				0	
1. Find General solution of higher-order linear differential equation with constant &						
	variable coefficie	ent using different Method	ds.			
2. 1	Find Laplace trai	nsform of functions using	g definitio	on & proj	perties & s	olve Ordinary D.E.
	using L.T.	C (C 11 1	• 66	1.0	· · · 1	
3.	Recognize nature	e of vector fields, use d	ifferent v	ector dif	ferential o	perators & able to
	Solve boundary	value problems for N	a its app Jumerical	Method	le Lanlac	e's equation heat
	4. Solve boundary value problems for Numerical Methods, Laplace's equation, neat					
	Course Outcomes Bloom's Level					
CO1	O1 Define & understand basic concept of L.D.E, Transforms,					
	Numerical techniques and Vector Calculus.					
GO					•	Childerstanding
CO2	Solve the problemathed	lems on LDE, PDE, trans	storms usi	ng appro	priate	3- Apply
CO3	Apply numeric	al methods and vector cal	culus to s	olve real	life	
005	problems	ar methods and vector ca		orve rear	inc	3- Apply
CO4	Analyze compl	lex engineering problems	by using	concepts	s of	1 Analyza
	differential cale	culus and numerical tech	niques.	•		4- Analyze
CO5	Evaluate the re	al life problems by using	concepts	of differ	ential	5 -Evaluate
	calculus and nu	imerical techniques.				0 2,00000
		Course C	ontents:			
Unit	Linear Differ	ential Equations with C	onstant	(L08)	COs M	apped -CO1,
1		Coefficient			CO2, C	O4,CO5
LDE of	nth order with co	onstant coefficients, Com	plementa	ry Functi	ion, Particu	ılar Integral,
General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's						
DE, Sin	Applications of	ymmetric simultaneous I	JE.	(1.07)		nnad
$\frac{1}{2}$	Equations & P	Partial Differential Equa	ntions	$(\mathbf{L}01)$	COS Ma	$\frac{1}{2} CO4 CO5$
Applica	tions of LDE to	chemical engineering pro	blems an	ud mass s	pring syste	em. Basic concepts
modelin	g of Vibrating	string, Wave equation.	one and t	wo dime	nsional He	eat flow equations.
method	of separation of	f variables, use of Fouri	er series.	Applica	tions of P	DE to problems of
Chemic	Chemical and allied engineering.					



Unit	Transforms	(L07)	COs Mapped	- CO1, CO2,				
<u> </u>	There are and (IT). Definition of IT Income		<u>CO4, CO5</u>					
Laplace	Iransform (L1): Definition of L1, Inverse	LI, Prop	luit Ston Ding	ems, LI OI				
	Paggal's function Applications of LT for solving	t in con di	fformatical acquati					
Fourier	Transform (ET) : Equipier transform Equipier Sing	Linear un	tronoform Inv	ons. Fourier				
Transfor	ms.	& Cosine						
Unit 4	Numerical Methods	(L07)	COs Mapped	-CO1,				
Numeric	al Solution of Algebraic and Transcendental equa	tion: Bise	ection, Secant, F	Regula-Falsi,				
Newton-	Raphson and Successive Approximation Methods	, Numeric	al Solution of	System of				
linear eo	quations: Gauss elimination, Gauss-Jordon Elimi	nation Ll	Decomposition	n, Cholesky,				
Jacobi a	nd Gauss-Seidel Methods.			CO1				
Unit 5	Vector Calculus	(L07)	COs Mapped CO3, CO4, C	-COI, 05				
Vector	differentiation, Gradient, Divergence & Cur	l, Direct	ional derivativ	e, Solenoid,				
Irrotatio	Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and							
Volume	Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem.							
Text Books								
1. High	er Engineering Mathematics, B.V. Ramana, Tata N	McGraw-l	Hill.					
2. High	er Engineering Mathematics, B. S. Grewal, Khann	a Publicat	tion, Delhi.					
3. Adv	anced Engineering Mathematics, Erwin Kreyszig,	Wiley Eas	stern Ltd.					
	Reference Books							
1. Adva	anced Engineering Mathematics,7e, Peter V. O'Nei	l (Thoms	on Learning)	_				
2. App	lied Mathematics" (Volumes I and II), P. N. War	rtikar and	J. N. Wartikar	, Pune				
V1d	yarthi Griha Prakashan, Pune.							
3. Adva	anced Engineering Mathematics, 2e, M. D. Greenb	erg (Pears	son Education).	D I				
4. Adva	anced Engineering Mathematics with MAILAB, 2	e, Thoma	is L. Harman, Ja	ames Dabney				
and	Norman Richert (Brooks/Cole, Thomson Learning	<u>;).</u>						
	Guidelines for Continuous Comprehensive Ev		of Theory Cou	rse				
Sr.	Components for Continuous Comprehensive E	valuation	1	Marks				
INO.	Tests on each unit using LMS			Anotteu				
1	(Each test for 15 M and total will be converted or	t of 05 M	()	05				
2	(Each test for 15 W and total will be converted of		l)	05				
2	Tutorial (1 tutorial on each unit for 15 marks and	totol will	be converted	05				
5	1 utof 13 marks and 1 out of 05 M)	iotai will	de conventeu	05				
4	Group Presentation on real life problem			05				
-	ersup riesentation on rear me problem		Total	20				



Topics for Tutorial								
Sr.	Sr. Title							
110.	Examples on LDE of ath order with constant coefficients	CO1 CO2						
1	Examples on LDE of hin order with constant coefficients.	CO1,CO2, CO3, CO5						
2	Examples on Applications of LDE to chemical engineering problems	CO1, CO2,						
	and mass spring system.	CO3, CO5						
3	Examples on transforms.	CO1, CO2,						
		CO3, CO5						
4	Examples on Numerical Methods	CO1, CO2,						
		CO4, CO5						
5	Examples on Vector calculus.	CO1, CO2,						
		CO4, CO5						





	Semester III (SY - B. Tech.) Chemical Engineering							
	2307202: Mechanical Operations							
Teachin	g Scheme:	Credit	Examination scheme	e:				
Theory:	3 hrs/week	Scheme:3	In Semester Exam: 20) marks				
-			End Semesters Exam	: 60 marks				
			Continuous Comprehe	ensive Eval	luation: 20 marks			
			Total: 100 Marks					
Prerequi	site: Courses o	f Engineering Mathe	ematics, Physics and C	hemistry				
Course C	Course Objectives:							
1. To	study properti	es of solids, separati	ion and size reduction of	of solids.				
2. To	o understand flu	id solid separation u	using sedimentation op	eration, Fl	uidization.			
3. To	o study mixing,	agitation and Filtrat	tion Operations.					
Course C	Outcomes: on c	ompletion of course	learner will be able to	-				
Sr. No.	Course Outo	comes			Bloom's Level			
CO1	Classify the	type of screening an	nd size reduction equip	pment for	3- Apply			
COI	different part	icle sizes						
CO2	Understand	different types sol	lid-liquid, solid-gas s	separation	2- Understand			
02	operation.							
	Explain fluidization applications in Chemical industries and able 3- Apply							
CO3	O3 to select a suitable type of conveyor for transportation of various							
	types of solids.							
CO4	Calculate the mixing index and select a suitable type of mixing 3- Apply							
0.04	equipment fo	r solids-solid and so	lid-liquid etc.					
CO5	Apply the co	oncepts of Filtration	operations for the se	lection of	3- Apply			
000	suitable type	of filtration equipme	ent.					
Course C	Dutcomes: on c	ompletion of course	learner will be able to	-				
1. Class	ify the type of	screening and size re	eduction equipment for	different	particle sizes			
2. Unde	erstand differen	t types solid-liquid,	solid-gas separation op	eration.				
3. Expla	ain fluidization	applications in Che	mical industries and a	ble to sele	ct a suitable type of			
conve	eyor for transpo	ortation of various ty	pes of solids.					
4. Calcu	ilate the mixin	g index and select a	a suitable type of mixi	ng equipn	nent for solids-solid			
and s	olid-liquid etc.			c · · 1				
5. Appl	y the concepts	of Filtration opera	tions for the selection	of suitab	le type of filtration			
equip	oment.	C						
TL \$4 1	C! D		se Contents:	(1.07)				
Unit I	Unit I Size Reduction and Screening Operations (L07) COs Mapped -							
Particle	size and shape	. specific surface ar	rea: measurement of si	urface area	a. necessity of size			
reduction, different size reduction equipment's, crushing efficiency, wet grinding, open circuit								
and clos	ed circuit grind	ing, industrial scree	ning equipment and its	types, scr	een analysis.			
Unit 2	Sedime	entation and Separa	ation Methods	(L07)	COs Mapped – CO2			
Sedimentation, Kynch theory of sedimentation equipment and its types, classifiers, centrifugal								
Sedimentation, Kynen theory of sedimentation equipment and its types, classifiers, centificgar								



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eq	uipment,	forth-flotation	ı cell, mag	netic s	separator,	cyclone	separator,	liquid	cyclone,

electros	tatic separator, precipitator, mineral jig.						
Unit 3	Fluidization and Transportation of solids	(L08)	COs Mapped – CO3				
Concept	t of fluidization, fluidized bed systems, determination of min	imum flui	dization velocity,				
flow thr	ough packed bed, applications of fluidized bed. Spouted bed	and fixed	bed. Conveyors:				
principl	e, construction and working. Advantages, disadvantages and	design ca	lculations of belt				
conveyo	ors, screw conveyors, chain & flight conveyors, bucket eleva	tors and p	neumatic				
conveyo	ors.	-					
Unit 4	Mixing Operation	(L07)	COs Mapped – CO4				
Necessi	ty of mixing and agitation in chemical industries, axial flow	and radia	l flow agitators and				
its types	s agitation vessel, un-baffled and baffled tanks, draft tube, j	power req	uirement in mixing				
calculat	ions, performance of mixers, mixing index, types of mixin	ng equipm	ent's sigma mixer,				
Static m	ixer, ribbon blender, bunbury mixer, pug mill.						
Unit 5	Filtration	(L07)	COs Mapped – CO5				
Filtratio	Filtration theory: constant pressure, constant rate, and variable pressure-variable rate filtration.						
classification of filtration and filters, filtration equipment, selection, sizing filter media and filter							
aids, cl	aids, classification of filtration, pressure drop through filter cake, filter medium resistance,						
specific	specific cake resistance, types of filters – plate and frame, rotary vacuum filter, horizontal						
pressure	e leaf filters. Centrifugal filters.						
	Text Books						
1. Unit publi	operation in Chemical Engineering, R.S. Hiremath a cation.	nd A.P.	Kulkarni, Everest				
	Reference Books						
1. Unit Publ	Operations in Chemical Engineering McCabe W. L. & cations.	z Smith J	.C., McGraw Hill				
2. Coul	son & Richardson's Chemical Engineering, Volume 2, J	ohn Metc	alfe Coulson, John				
Fran	cis Richardson, John Hadlett Harker, J. R. Backhurst, Elsevie	er Science	•				
3. "Int	oduction to Chemical Engineering", Badger W. L and I	Banchero	J.T. McGraw Hill				
Publ	cations.						
4. Perry's Hand book- 4 th edition McGraw Hill Publications.							
Guidelines for Continuous Comprehensive Evaluation of Theory Course							
Sr.	Components for Continuous Comprehensive Evaluation	1	Marks				
No.			Allotted				
1	Three Assignments on unit-1, Unit-2, Unit-3 & 4		10				
2	Group Presentation on Unit-5		05				
3	LMS Test on Each Unit		05				
		Total	20				



	Semester III (SY - B. Tech.) Chemical Engineering						
	230	7203: Chemica	I Reactions	s and Synth	nesis I		
Teachi	ng Scheme:	Credit Sahamar ²	Examinatio	on scheme:	- # 1 * -		
Ineory	3 nrs/week	Scheme:5	In Semester	r Exam: 20 m	arks		
			Continuous	Comprohensi	marks vo Evoluction	n: 20 marks	
			Total: 100 I	Vorbe		11. 20 IIIai KS	
Prerequ	isite Knowled	lge of fundament	al Chemistry	viarks	standard a	nd first year	
Engineer	ing Chemistry	ige of fundament	ar Chennistry	up to An	standard a	ild ill'st year	
Course	Objectives:						
1. T	o impart the ba	sic concepts of org	ganic chemist	rv			
2. T	o develop unde	erstanding about co	oncepts of org	anic reactions	s for analysi	s of unit	
3 . T	o study the diff	ferent analytical in	strumentation	techniques	j.		
Course	Outcomes: On	completion of the	course, stude	nts will be ab	le to-		
Sr.	Course Outco	omes				Bloom's	
No.						Level	
CO1	Analyse the t	type of forces and	d synthesize (the materials	based on	2	
COI	their properties Understand						
CO2	Estimate the l	kinetics of reaction	n and analyze	the factors c	ontrolling	2 Apply	
02	the rate of rea	ctions.				5 Apply	
CO3	Analyze the g	given chemical sul	bstance by di	fferent Instru	mentation	3 Apply	
005	techniques.						
CO4	Estimate the d	quantity of solute a	and synthesize	e the solution	based on	3 Apply	
	the properties.	•				o rippij	
CO5	Evaluate the	mechanism of rea	actions and a	pply proper	factor for	4 Analyze	
	increasing the	yield of the desire	ed product.				
		Cou	irse Contents	;			
Unit 1	Bo	onding and Reactiv	ity	(L07)	COs Mapp	ed – CO1	
Covaler	nt Bonding- Ir	ntroduction to VB	Γ, Molecular o	orbital theory	, MO structi	ures of s-s, s-	
p , p-p	overlaps, mo	lecular orbital stru	cture of buta	diene, benzen	e, MO ene	rgy diagrams	
for diat	omic molecules	s N2, O2 , CO. Are	omaticity-con	ditions neces	sary for delo	ocalization of	
electror	ns, resonance s	tructures stability	rules, resonat	nce in pheno.	l, aniline, ,t	enzaldehyde	
,nitrobe	nzene molecul	es, Inductive effec	t and Reson	ance effect o	n pKa and p	Kb values of	
acids and bases.							
Unit 2Reaction Dynamics & Photochemistry(L08)COs Mapped - CO2							
Kinetics: Rate of reaction, rate constant, order of reaction, kinetics of first and second order							
reactions	s, numerical on	above, Activated	complex theo	ry of reaction	rates kineti	cs of complex	
reactions	S. Photochemis	try: Introduction a	and important	ce, Stark-Ein	stein law, j	photochemical	
rate law,	examples of pl	notocnemical react	Change in the second se	OI 1) H_2 , Cl_2	reaction 11)	Dimerisation	
of anthr	acene. Types	01 Photochemical	Organic rea	ictions, Laws	s or photoc	chemistry and	
quantum yields-problems, Photosensitized reactions.							
1							



Unit 3	Instrumental methods of Analysis	(L07)	COs Mapped – CO3				
Chromat	ography: Adsorption and partition principles,	Study of TI	LC, column, HPLC, Gas				
Chromat	ography and their applications. b) Optical	methods: UV	7, Lambert-Beer law, IR				
spectroso	copy-introduction, instrumentation, applicati	ons. Flame	photometry- principle,				
instrume	ntation and applications.						
Unit 4	Solution	(L07)	COs Mapped – CO4				
Solution	- definition, solution of gas in gas, gases in l	iquid, Henry	s law, the ideal solution,				
Raoult'1s	s law of ideal solution, solutions of liquids	in liquids, t	heory of dilute solution.				
Colligati	Colligative properties, osmosis, osmotic pressure, Colligative properties of dilute solution-						
lowering	of vapor pressure, elevation of boiling p	oint and the	ermodynamic derivation,				
depressio	on in freezing point and thermodynamic derivat	ion. Abnorma	al behavior of solutions of				
electroly	tes, Van't Hoff factor. Numerical on all above.	1					
Unit 5	Reaction Mechanisms	(L07)	COs Mapped – CO5				
Substitut	ion at saturated carbon (SN ¹ , SN ²) - mechan	ism, kinetics	, stereochemistry, factors				
favoring	it. Electrophonic aromatic substitution in ber	nzene and mo	ono substituted benzenes,				
activatin	activating and deactivating groups, nitration, Friedel-Craft reactions, sulphonation, and						
diazotization. Nucleophilic substitution on carbonyl carbon. Addition of HX on C=C, 1, 2							
Eliminations- E1 mechanism, E2, (Saytzeff, Hoffman products), factors favoring it.							
Rearrangements- Beckmann, Claisen, Favorskii.							
Text Books							
1. Conci	se Inorganic Chemistry J.D. Lee, Wiley India F	\mathbf{P} vt Ltd. 5^{m} ed	ition				
2. Advar	nced Inorganic Chemistry Cotton, Wilkinson	Murillo, Boch	nmann, 6 th edition				
3. Physic	cal chemistry, P L Soni, Sultan Chand & Sons,						
4. Physic	cal Chemistry, Peter Atkins, Julio de Paula, Jan	nes Keeler, In	ternational Eleventh				
	Reference Books	<u>s</u>	The second second				
I. Funda	imentals of Analytical Chemistry- Skooge and	d West, Ceng	age Learning EMEA, 9 th				
editio	n	th 1.					
2. Advai	nced Organic Chemistry, Jerry March, Wiley, 4	edition	the second se				
3. Organ	ic Chemistry, Morrison Boyd & Bhattacharjee	Pearson Educ	cation India, 7 th edition				
4. Instru	mental Methods of Analysis, H.H.Willard, L.I	. Merritt and	J.A. Dean & F.A Settle,				
CBS	Publishers, /" Edition						
9	Guidelines for Continuous Comprehensive Evaluation of Theory Course						
Sr.	Components for Continuous Comprehensiv	e Evaluation	Marks Allotted				
NO. 1		4	10				
	Four Assignments on unit-1, Unit-2, Unit-3 &	, 4	10				
2	Group Presentation on Unit-5		05				
5	LIVIS Test on Each Unit	_	05				
		T	otal 20				



Semester III (SY - B. Tech.) Chemical Engineering					
2307204: Lab work in Mechanical Operations					
Teachi	ng Scheme:	Credit	Examination scheme:		
Practica	al: 2Hrs. /Week	Scheme:1	TW: 25 marks		
			Practical: 25 marks		
	Total: 50 Marks				
Prereq	uisite: Courses of	Engineering Matl	hematics, Physics and Chemistry		
Course	Objectives:				
1. T	'o study properties	of solids, separat	ion and size reduction of solids.		
2. T	o understand fluid	solid separation	using sedimentation operation, Flui	dization.	
<u> </u>	o study mixing, ag	gitation and filtrat	tion operations.		
Course	Outcomes:				
Sr. No.		Course (Dutcomes	Bloom's Level	
CO1	Evaluate the sep	paration methods	for solid & fluids.	3-Apply	
CO2	Apply the princ	iples of size redu	ction equipment's for solids.	3-Apply	
CO3	Determine mixi	ng Index and app	ly the knowledge on mixing	2 Apply	
005	principles for so	olid-solid / solid-l	iquid mixing.	5-Apply	
CO4	Evaluate the filt	3-Apply			
CO5	Understand the	various solid tran	sportation techniques.	2- Understand	
Lis	t of Laboratory E	Experiments (con	duct at least 8 experiments from	the below list)	
Sr.	-	Laboratory	Experiments	CO Mapped	
No.		-	-		
1.	To determine eff	ectiveness of give	en set of standard screen	CO1	
2.	To find efficienc	y of cyclone sepa	rator.	CO1	
3.	To study batch se	edimentation oper	ration.	CO1	
4.	To determine sep	paration efficiency	y by using magnetic separator.	CO1	
5.	To determine end jaw crusher	ergy consumption	and crushing law constants for	CO2	
6.	To determine Cr	itical speed of Ba	ll mill & Average particle size of	CO2	
	the product obtain	ned in ball mill			
7.	To determine mi	xing Index in Sig	ma Mixer	CO3	
8.	To study Static N	Aixer.		CO3	
9.	To determine filt	er medium resista	ance and specific cake resistance	CO4	
10	by using Plate &	trame filter Press	•	~~-	
10.	To study various	conveyor system	8.	CO5	
		Guidelines for	Laboratory Conduction		
• Tead	cher will brief th	ne given experir	nent to students with its proced	ure, observations,	
calculation, and outcome of the experiment.					



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- Apparatus and equipments required for the allotted experiment will be provided by the lab assistants using SOP.
- Students will perform the allotted experiment in a group under the supervision of faculty and lab assistant.
- After performing the experiment, students will perform calculations based on the obtained readings and get it verified from the teacher.
- Students will then complete the experimental write up.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, results, conclusions, etc.

Guidelines for Termwork Assessment

- 1. Each experiment from lab journal is assessed for 30 marks based on three rubrics.
- 2. Rubric R-1 is for timely completion, R-2 for understanding and R-3 for presentation/journal. Each rubric carries 10 marks.



Semester III (SY - B. Tech.) Chemical Engineering					
	2307205: L	ab work in Che	emical Reactions and Synthe	sis I	
Teach	ning Scheme:	Credit	Examination scheme:		
Practi	cal: 4 Hrs. /Week	Scheme: 2	TW: 50 marks		
			Practical: 50 marks		
			Total: 100 Marks		
Prere	quisite: Knowledge	e of fundamental Ch	nemistry up to XII standard and first	t year	
Engin	eering Chemistry.				
Course	e Objectives:				
1. To	impart the basic co	incepts of organic, i	norganic and physical chemistry		
2. To	develop understand	ling about concepts	of organic reactions for analysis of	i unit Pro	ocesses
3. To	study the different	analytical instrume	ntation techniques and their applica	tions	
Course	e Outcomes: On co	mpletion of the cou	rse, students will be able to–	<u> </u>	
Sr. No	. Course Outcon	mes		Bloom	's Level
CO1	Analyze the st weight of the m	rength of forces an nolecule.	d evaluate the size and molecular	2-Unde	erstand
CO2	Estimate the k the rate of react	inetics of reaction a tions.	and analyze the factors controlling	3-Appl	y
CO3	Analyze the given chemical substance by different Instrumentation 3-Apply				v
techniques.				5	
CO4 Prepare and analyze the quality of organic compounds by different 3-App 3-App			3-Appl	y	
		List of Labo	ratory Experiments		
Sr.		Laboratory	Experiments		CO
No.]	Mapped
1	To determine diam	neter of solute mole	cule by viscosity measurements.		CO1
2	To determine rate	constant of first ord	ler reaction of acid catalyzed		CO2
	hydrolysis of ester				
3	Preparation of ben	zoic acid from benz	zamide, crystallization and purity		CO4
	checking by TLC.				
4	To find molecular	wt. of solute by de	pression in freezing point of solvent	ī	<u>COI</u>
5	Estimation of Cu ⁺	ions by spectroph	otometer		<u>CO3</u>
6	Identification of g	iven organic compo	ound (Acid)		<u>CO4</u>
7	Identification of g	given organic compo	ound (Base)		<u>CO4</u>
8	Identification of g	given organic compo	ound (Phenol)		<u>CO4</u>
9	Identification of given organic compound (Neutral)			<u>CO4</u>	
10	To determine mole	ecular weight of sol	id by Elevation in B.P		CO4
		Te	ext Books		
1. Labo	1. Laboratory manual on general and applied chemistry, Dr. S. K .Bhasin, Dhanpatrai publication.				
2. Labo	oratory manual on e	ngineering chemisti	ry, Dr. S. K. Bhasin, Dhanpatrai pul	olication	l .
3. Instr	rumental methods of	t chemical analysis,	Chatwal Anand publication		
		Refe	rence Books		
1. Inst	rumental Methods	of Analysis, H. H.	Willard, L.L. Merritt and J.A. De	ean & F	.A Settle,

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(Autonomous from Academic Year 2022-23)

CBS Publishers, 7th Edition, 1988

2. Vogel's analytical chemistry, J. Mendham, Pearson Education, 6th Edition

Guidelines for Laboratory Conduction

- Teacher will brief the given experiment to students with its procedure, observations, calculation, and outcome of the experiment.
- Apparatus and equipments required for the allotted experiment will be provided by the lab assistants using SOP.
- Students will perform the allotted experiment in a group under the supervision of faculty and lab assistant.
- After performing the experiment, students will perform calculations based on the obtained readings and get it verified from the teacher.
- Students will then complete the experimental write up.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, results, conclusions, etc.

Guidelines for Termwork Assessment

- 1. Each experiment from lab journal is assessed for 30 marks based on three rubrics.
- 2. Rubric R-1 is for timely completion, R-2 for understanding and R-3 for presentation/journal. Each rubric carries 10 marks.





	Semester III (SY - B. Tech.) Chemical Engineering					
		2307206: Hea	at Transfer	Processe	es	-
Teaching	g Scheme:	Credit	Examinatio	n scheme	:	
Theory: 3	3 hrs/week	Scheme:3	In Semester	Exam: 20	marks	5
			End Semeste	ers Exam:	60 ma	ırks
			Continuous	Comprehe	nsive E	Evaluation: 20 marks
			Total: 100 M	Iarks		
Prerequis	ite: Applied I	Mathematics, Therr	nodynamics			
Course O	bjectives:					
1. To use	heat transfer	principles to under	stand the behav	vior of the	rmal s	ystems.
2. To pro	vide the basi	c knowledge in the	ermal system d	esign and	to en	lighten heat transfer
applica	ations.			_		
3. To cla	ssify and des	ign of the various	heat exchanger	s and eva	porato	ors used in chemical
industi	ries.	1	1 11			
Course O	utcomes: on	completion of cours	se, learner will	be able to	-	
Sr. No.	Course Out	comes	1 1 0 1	1 0		Bloom's Level
COI	Acquire the transfer and	study its applicatio	vledge of the n.	modes of	heat	2-Understand
CO2	Demonstrate	the concepts of o	convective hea	t transfer	with	
	empirical equations and examples. 3-Apply			3-Apply		
CO3	Acquire the	basic concepts of the	nermal radiation	n.		2-Understand
CO4	Identify an	d design of he	at exchanger	for spe	ecific	5-Evaluate
	applications	in chemical industr	ry.			
CO5	Classify and industrial ap	d design of evapo plications.	oration system	based or	n the	4-Analyze
	1	Cou	rse Contents:			
Unit 1		Introduction		(L07)	COs	Mapped - CO1
Modes of	of heat trans	fer- radiation, co	nduction and	convectio	on, Tl	hermal conductivity,
dimensio	nal analysis.	Steady state heat	conduction the	rough a p	lane s	slab, composite slab,
hollow c	ylinder, com	posite cylinder and	d hollow sphe	re. Conta	ct resi	istance, heat transfer
between	surfaces and	surrounding, Ther	mal Insulation	, Hot and	l cold	insulating materials,
critical th	ickness of ins	sulation. Heat trans	fer through ext	ended sur	faces ((fins). Introduction to
transient/	unsteady state	e heat conduction.				
Unit 2		Convection		(L07)	COs	Mapped - CO1,
					CO2	2, CO4
Natural a	and forced con	nvection, Equations	s for convectiv	e heat tra	nsfer t	hrough annulus and
over a fl	at plate. Con	densation: Modes	and features, N	Jusselt's e	equation	on, condensation on
vertical a	nd horizontal	plate Boiling: Pool	l boiling and nu	cleate boi	iling	
Unit 3		Radiation		(L07)	COs	Mapped - CO3
Thermal	radiation, bla	ck body radiation,	properties of r	adiation,	laws o	of radiation. Various
cases of 1	adiation betw	een two surfaces, r	adiation shield	8	1	
Unit 4		Heat Exchanger	rs	(L08)	CO	s Mapped – CO4
Basic typ	bes of heat exe	changers, overall he	eat transfer coe	fficient, fo	ouling	factor, Double pipe



6

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heat excha	anger design by LMTD, correction to mean ten	nperature	e difference due to cross			
flow, mult	flow, multi-pass exchangers. and effectiveness-NTU methods (calculations of overall heat					
transfer co	befficient and area), Tubular Heat Exchanger:	Shell an	d tube heat exchangers,			
Compact 7	Compact Type Heat Exchangers : Plate type heat exchange, Spiral type Heat Exchangers					
Unit 5	Unit 5Evaporation(L07)COs Mapped - CO5					
Introduction	n, types of evaporators, material and energy	balance,	boiling point elevation,			
capacity and	d economy, multiple effect evaporators					
	Text Books					
1. Fundar	nentals of Engineering Heat and Mass Transfer	r (SI Un	its), R.C. Sachdeva, New			
Age In	ternational Publishers, 5th edition					
2. Heat an	nd Mass Transfer, P K Nag, McGraw-Hill publica	ations, 31	rd Edition			
	Reference Books					
1. Process Edition	1. Process Heat Transfer, D. Q. Kern, Tata McGraw Hill Publication, New Delhi, 11 th Edition.					
2. Heat T	ransfer, J P Holman, Tata McGraw Hill Publicati	ons, Nev	v Delhi, 9 th Edition.			
3. A Text	book on Heat Transfer, S. P. Sukhatme, Universit	ties Pres	s (India), 4 th Edition			
4. Transp	ort phenomena, Bird R.B., Stewart W.E., Lightfo	ot E.N, Y	Wiley Publications, 2 nd			
Edition		,	5			
5 Heat at	nd Mass Transfer, Vunus A. Cangel – McGraw H	GII Dubli	cations New Delbi 3 rd			
5. Iteat an Edition	ia mass fransier, funds A. Cengel,., meetaw fr		eations, new Denn, 5			
G	uidelines for Continuous Comprehensive Evalu	ustion o	f Theory Course			
Sr No	Components for Continuous Comprehensive		Marks Allotted			
51. 110.	Fyaluation		Marks Anotteu			
1	Three Assignments on unit-1 Unit-? Unit-3 &	4	10			
2	Group Presentation on Unit-5	•	05			
3	2 Group Presentation on Unit-5 05 3 LMS Test on Each Unit 05					

Total

20



Semester III (SY - B. Tech.) Chemical Engineering 2307207: Lab work in Heat Transfer Processes					
Teacl	hing Scheme:	Credit Scheme: 1	Examination scheme:		
Practi	ical: 2Hrs. /Week		TW: 25 marks		
			Practical: 25 marks		
			Total: 50 Marks		
Prere	Prerequisite: Engineering Mathematics, Thermodynamics				
Cours	e Objectives:	-			
1. To	o use heat transfer p	rinciples to understand	the behavior of thermal systems.		
2. To	o provide the basic	knowledge in therma	l system design and to enlighten	heat transfer	
aj	pplications.	-			
3. To	o classify and desig	gn of the various heat	exchangers and evaporators used	d in chemical	
in	ndustries.				
Cours	e Outcomes: on con	mpletion of course, lear	mer will be able to-		
Sr.	Course Outcome	8		Bloom's	
No.				Level	
CO1	Acquire the fund study its application	amental knowledge of on.	the modes of heat transfer and	2-Understand	
CO2	2 Demonstrate the concepts of convective heat transfer with empirical 3-Apply				
CO3	Acquire the basic	concepts of thermal rad	liation	2-Understand	
CO4	Identify and desig	n of heat exchanger for	specific applications in chemical	5-Evaluate	
001	industry.		·····		
CO5	Classify and des	sign of evaporation s	system based on the industrial	4-Analyze	
	applications.	List of Laborat	w Exportmonts		
Sr		List of Laboratory Fx	norimonts	CO	
No			periments	Manned	
1	Determination o	f thermal conductivity of	of composite wall	CO1	
2	Determination of	f thermal conductivity of	of insulation powder	CO1	
3.	Calculation of he	eat transfer coefficient	using natural convection		
4	Calculation of he	eat transfer coefficient	using forced convection	CO2	
5.	Determination of	f Stephan Boltzmann co	onstant	CO3	
6.	Determination o	f emissivity using therr	nal radiation	CO3	
7.	Determination o	f heat transfer coefficie	nt of Double pipe heat exchanger	CO4	
8.	Determination o	f heat transfer coefficie	nt of shell and tube heat exchanger	CO4	
9.	Heat Transfer in	agitated vessels		CO4	
10.	Material balance	and energy balance of	Single effect evaporator	CO5	
		Text	Books		
1. 2.	Fundamentals of E International Public Heat and Mass Tra	ngineering Heat and M shers, 5th edition nsfer, P K Nag, McGra	ass Transfer (SI Units), R.C. Sach	deva, New Age	



Reference Books

- 1. Process Heat Transfer, D. Q. Kern, Tata McGraw Hill Publication, New Delhi, 11th Edition.
- 2. Heat Transfer, J P Holman, Tata McGraw Hill Publications, New Delhi, 9th Edition.
- 3. A Textbook on Heat Transfer, S. P. Sukhatme, Universities Press (India), 4th Edition
- 4. Transport phenomena, Bird R.B., Stewart W.E., Lightfoot E.N, Wiley Publications, 2nd Edition
- 5. Heat and Mass Transfer, Yunus A. Cengel,., McGraw Hill Publications, New Delhi, 3rd Edition

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Semester III (SY - B. Tech.) Chemical Engineering						
		2307208: Indus	trial Manage	ment		
Teaching	Scheme:	Credit Scheme: 2	Examination s	scheme:		
Theory: 2	hrs/week		Continuous Co	mprehens	ive Evaluation: 50 marks	
			Total: 50 Mark	(S		
Prerequisit	Prerequisite: Basic management terms					
Course Ob	jectives:					
1. To i	ntroduce the	fundamental concepts	of Industrial Ma	inagemen	t.	
2. To s	tudy the var	ious organization struc	tures and their w	orking.		
3. To i	nterpret the	production management	it concept in pro	fessional	life.	
4. To 1	ntroduce qua	ality objectives during	the manufacturin	ng/ produc	ction applications.	
Course Ou	tcomes: on	completion of course l	earner will be ab	le to-		
Sr. No.	Course Ou	itcomes	с т	1 . 1 1	Bloom's Level	
COI	Apply th Manageme	ne fundamental co nt.	ncepts of I	ndustrial	3-Apply	
CO2	Apply the professional	e production man al career.	agement conc	ept in	3-Apply	
CO3	Apply mat	erial planning, store	keeping proced	lure and	3-Apply	
	analyze im	portance of inventory of	control			
CO4	Apply qu	ality objectives duri	ng the manufa	acturing/	3-Apply	
	production	process.				
		Course	Contents:			
∐nit 1	E					
	Fu	ndamentals of Mana;	gement	(L06)	COs Mapped - CO1	
Administra	ru ation Definit	ion – Henry Fayol's p	gement	(L06) agement]	COs Mapped - CO1 Business Functions of	
Administra Manageme	ation Definit ent – Plannii	ion – Henry Fayol's p ng Definition Function	gement rinciples of man s Organisation I	(L06) agement] Definition	COs Mapped - CO1 Business Functions of types of organisation	
Administra Manageme –Line Fun	ation Definit ent – Plannii ctional Line	ion – Henry Fayol's p g Definition Function & staff advantages an	gement rinciples of man s Organisation I nd disadvantages	(L06) agement] Definition E Leadersl	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of	
Administra Manageme –Line Fun good leade	ation Definit ent – Plannin ctional Line er. Motivatio	ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs	gement rinciples of man s Organisation I nd disadvantages Communication	(L06) agement Definition Leadersl – Process	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication –	
Administra Manageme –Line Fun good leade Barriers	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv	ndamentals of Manage ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. I	rinciples of man s Organisation I ad disadvantages Communication ntroduction and	(L06) agement Definition Leadersl – Process Meanin	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization,	
Administra Manageme –Line Fun good leade Barriers f Organizati	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. I cess, Span of Control	rinciples of man s Organisation I nd disadvantages Communication ntroduction and , Authority, Resp	(L06) agement Definition Leadersl – Process Meanin ponsibilit	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability,	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegatior	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a	gement rinciples of man s Organisation I ad disadvantages Communication ntroduction and , Authority, Resp uthority.	(L06) agement Definition E Leadersl – Process Meanin ponsibilit	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability,	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegatior Unit 2	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. I cess, Span of Control y, Decentralization of a Production Managen	gement rinciples of man- s Organisation I nd disadvantages Communication ntroduction and , Authority, Resp uthority. nent	(L06) agement Definition Leadersl – Process Meanin ponsibilit	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegatior Unit 2 Productior	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a Production Managem	gement rinciples of mana s Organisation I ad disadvantages Communication ntroduction and Authority, Resp uthority. nent	(L06) agement Definition Leadersl – Process Meanin ponsibility (L06) facturing	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegation Unit 2 Production manageme	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority on f authority m Managen ent. Manufa	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap- cturing / Operations	gement rinciples of many s Organisation I ad disadvantages Communication ntroduction and Authority, Resp uthority. nent oproach, Manu Strategy – Prin	(L06) agement Definition Leadersl – Process Meanin ponsibilit (L06) facturing ciples &	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment	
Administra Manageme –Line Fun good leade Barriers d Organizati Delegation Unit 2 Production manageme strategy, C	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority on as a pro of authority m Managen ent. Manufa Capacity stra	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. It cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap- cturing / Operations tegy, Quality strategy,	gement rinciples of mana s Organisation I nd disadvantages Communication ntroduction and , Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra	(L06) agement Definition Leadersl – Process Meanin ponsibility (L06) facturing ciples & ategy, Cus	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment stomer focus strategy,	
Administra Manageme –Line Fun good leade Barriers d Organizati Delegation Unit 2 Production manageme strategy, C Facility loo	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority on Managen ent. Manufa Capacity stra cation strate	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap cturing / Operations tegy, Quality strategy, gy, Product flexibility	gement rinciples of man s Organisation I ad disadvantages Communication ntroduction and , Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra strategy, Short d	(L06) agement Definition E Leadersl – Process Meanin ponsibility (L06) facturing ciples & ategy, Cus lelivery pr	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment stomer focus strategy, cocess strategy, Quick	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegation Unit 2 Production manageme strategy, C Facility loo time deliv	tion Definit ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority on of authority m Managen ent. Manufa Capacity stra cation strate	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. I cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap cturing / Operations tegy, Quality strategy, gy, Product flexibility y, Concepts of Produ	gement rinciples of man s Organisation I nd disadvantages Communication ntroduction and , Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra strategy, Short d activity, Measure	(L06) agement Definition Leadersl – Process Meanin ponsibility (L06) facturing ciples & ategy, Cus lelivery pre-	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment stomer focus strategy, cocess strategy, Quick Improvement, Lean	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegatior Unit 2 Productior manageme strategy, C Facility loo time deliv Manufactu	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro n of authority m Managen ent. Manufa Capacity stra cation strate very strategy	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap cturing / Operations tegy, Quality strategy, gy, Product flexibility y, Concepts of Produce e Engineering, Busi	gement rinciples of mana s Organisation I ad disadvantages Communication ntroduction and Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra strategy, Short d activity, Measure ness Process I	(L06) agement Definition Leadersl – Process Meanin ponsibility (L06) facturing ciples & ategy, Cus lelivery prement & Re-engine	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment stomer focus strategy, cocess strategy, Quick Improvement, Lean eering. World Class	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegation Unit 2 Production manageme strategy, C Facility loo time deliv Manufactu	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority on df authority m Managen ent. Manufa Capacity stra cation strate very strategy uring, Value uring (WCM	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap cturing / Operations tegy, Quality strategy, gy, Product flexibility y, Concepts of Produce Engineering, Busi	gement rinciples of mana s Organisation I ad disadvantages Communication ntroduction and , Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra strategy, Short d activity, Measura ness Process I	(L06) agement Definition Leadersl – Process Meanin ponsibilit (L06) facturing ciples & ategy, Cus lelivery pre- ement & Re-engine	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COS Mapped – CO2 systems, Interface concept. Investment stomer focus strategy, cocess strategy, Quick Improvement, Lean eering. World Class	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegation Unit 2 Production manageme strategy, C Facility loo time deliv Manufactu Manufactu Unit 3	ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro of authority on as a pro of authority on as a pro of authority an Managen ent. Manufa Capacity stra cation strategory very strategoring, Value uring (WCM	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap cturing / Operations tegy, Quality strategy, gy, Product flexibility y, Concepts of Produce Engineering, Busi) Material managemet	gement rinciples of mana s Organisation I ad disadvantages Communication ntroduction and , Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra strategy, Short d activity, Measure ness Process I	(L06) agement Definition Leadersl – Process Meanin ponsibility (L06) facturing ciples & ategy, Cus lelivery present & Re-engine (L06)	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment stomer focus strategy, cocess strategy, Quick Improvement, Lean cering. World Class	
Administra Manageme –Line Fun good leade Barriers d Organizati Delegation Unit 2 Production manageme strategy, C Facility loo time deliv Manufactu Manufactu Unit 3	Ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro n of authority on as a pro n of authority an Managen ent. Manufa Capacity stra cation strate very strategy uring, Value	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control y, Decentralization of a Production Managen nent – Modern Ap cturing / Operations tegy, Quality strategy, gy, Product flexibility y, Concepts of Produ e Engineering, Busi) Material manageme	gement rinciples of mana s Organisation E ad disadvantages Communication ntroduction and , Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra strategy, Short d activity, Measure ness Process I	(L06) agement Definition Leadersl – Process Meanin ponsibility (L06) facturing ciples & ategy, Cus lelivery prement & Re-engine	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment stomer focus strategy, cocess strategy, Quick Improvement, Lean pering. World Class COs Mapped – CO3	
Administra Manageme –Line Fun good leade Barriers f Organizati Delegation Unit 2 Production manageme strategy, C Facility loo time deliv Manufactu Manufactu Unit 3	Ation Definit ation Definit ent – Plannin ctional Line er. Motivatio for effectiv on as a pro n of authority on as a pro n of authority m Managen ent. Manufa Capacity stra cation strate very strategy uring, Value uring (WCM	ndamentals of Manag- ion – Henry Fayol's p ng Definition Function & staff advantages an n, Hierarchy of needs e communication. If cess, Span of Control /, Decentralization of a Production Managen nent – Modern Ap cturing / Operations tegy, Quality strategy, gy, Product flexibility y, Concepts of Produce Engineering, Busi) Material management	gement rinciples of many s Organisation I ad disadvantages Communication ntroduction and , Authority, Resp uthority. nent oproach, Manu Strategy – Prin Technology stra strategy, Short d activity, Measure ness Process I ent s, different met	(L06) agement Definition Leadersl – Process Meanin ponsibility (L06) facturing ciples & ategy, Cus lelivery pr ement & Re-engine (L06) hods of	COs Mapped - CO1 Business Functions of types of organisation nip Types –Quality of s of Communication – ng of Organization, y and Accountability, COs Mapped – CO2 systems, Interface concept. Investment stomer focus strategy, cocess strategy, Quick Improvement, Lean bering. World Class COs Mapped – CO3 purchasing -Purchase	



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classification of stores - Functions of store keeper. Store management Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-Inventory Management- Definition - functions of Inventory Control- concept, features and applications.- Material Requirement Planning (MRP)-concept, applications

Unit 4	Quality Management	(L06)	COs Mapped –
			CO4

Concept - Quality control- Definition - Factors affecting quality- Advantages of quality control –Inspection - Different types of inspection.

Total Quality Management-Meaning- Principles of total quality management-PDCA cycles Quality Circles-definition-Function. Modern approach to Quality Management, Acceptance sampling and statistical quality control, Deming's 14 points of QM, TQM Principles & implementation, ISO 9000–2000, ISO 14000 (Environment) & ISO 50000 (Energy) quality standards

Text Books

1. Industrial Engineering and Management, O.P. Khanna, Dhanpat Rai Publications

2. Business Organization and management- M. C. Shulka, S Chand & Co Ltd

Reference Books

- 1. Indian Economy, Agarwal, A. N., Vikas Publishing House Pvt. Ltd., New Delhi.
- 2. Principles of management- Knoots and O. Donnell, McGraw Hill Publishing company
- 3. The Practice of Management, Peter F. Drucker, Allied publishers pvt. ltd., Bombay.
- 4. Production management & Control, Barat & Nikhil, Academic Publishers, Calcutta.
- 5. Financial Management: An- Analytical & Conceptual Approach, Kuchhal, S. C. Chaitanya Publishing House, Allahabad.
- 6. Marketing Management: Analysis, Planning & Control, Kotlel, Philip, Prentice –Hall of India Pvt. Ltd., New Delhi
- 7. Marketing and Salesmanship, Sinha, J. C., S. Chand & Co., Delhi

Guidelines for Continuous Comprehensive Evaluation of Theory Course				
Sr. No.	Components for Continuous Comprehensive	Marks Allotted		
	Evaluation			
1	Three Assignments on unit-1, Unit-2, Unit-3 & 4	30		
2	Group Presentation on Unit-4	10		
3	LMS Test on Each Unit	10		
	Total	50		



	Semester III (SY - B. Tech.) Chemical Engineering				
Tor	ahing Sahama	2507209: Ulliversal H	Examination schom		
	acting Scheme:	Credit Scheme: 2	Examination schem	e:	
Iuu	orial: 2 nrs/week		Total: 50 Marks		
Prer	equisite: NA		Total. 50 Warks		
Cou	rse Objectives:				
1.	To help the stude	ents appreciate the essential co	omplementarity betwe	en 'V	ALUES' and
	'SKILLS' to ensur	e sustained happiness and pro	sperity which are the	core a	spirations of
	all human beings.		1 2		1
2.	To facilitate the d	levelopment of a Holistic pers	pective among studen	ts tow	ards life and
	profession as well	as towards happiness and pro	sperity based on a co	rrect u	nderstanding
	of the Human real	ity and the rest of existence. S	uch a holistic perspect	ive for	rms the basis
	of Universal Hum	an Values and movement towa	rds value-based living	; in a n	atural way.
3.	To highlight plaus	sible implications of such a H	lolistic understanding	in teri	ms of ethical
	human conduct, ti	rustful and mutually fulfilling	human behavior and	mutua	lly enriching
	interaction with N	ature.			
Thus	s, this course is int	ended to provide a much-need	ed orientation input in	value	education to
the y	oung enquiring m	inds.			
Cou	rse Outcomes: on	completion of course learner	will be able to-		
Sr. No.	Course Outcom	les			Bloom's Level
1.	Evaluate the sig	inificance of value inputs in	formal education and	start	5- Evaluate
	applying them in	their life and profession			
2.	Distinguish betw	veen values and skills, happi	iness and accumulation	on of	3-Apply
	physical facilitie	s, the Self and the Body, Inten	tion and Competence	of an	
	individual.				
3.	Analyze the value	ue of harmonious relationship	based on trust and re	spect	4-Analyze
	in their life and p	profession			
4.	Examine the role	e of a human being in ensuri	ng harmony in society	y and	4-Analyze
	nature.				
5.	Apply the under	standing of ethical conduct to	o formulate the strateg	y for	3-Apply
	ethical life and profession.				
T T •4	1 7 4 7 4	Course Conte	nts:	00	
Unit	I Introduct	tion-Basic Human Aspira	ation, its (L05)		Mapped -
The	hagia human agni	rations and their fulfilment thr	Resolution		d Desclution
Rig	b understanding a	and Resolution as the activities	of the Self Self bein	nig all o cent	ral to Human
Fri	stence: All-encon	massing Resolution for a H	iman Being its deta	ils and	a solution of
pro	blems in the light	of Resolution	inan Denig, its deta	us and	
Unit	2 Right Und	erstanding (Knowing)- Know	ver. Known (L05)	COs	Mapped –
	& the Proc	Cess		CO2	
The	e domain of righ	t understanding starting from	n understanding the	huma	n being (the
kno	knower, the experiencer and the doer) and extending up to understanding nature/existence –				



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its interco	onnectedness and co-existence; and finally understandice (human conduct).	ng the ro	le of human being		
Unit 3	Understanding Human Being	(L05)	COs Mapped – CO3		
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self					
Unit 4	Understanding Nature and Existence	(L05)	COs Mapped – CO4		
A compre need and evaluatio Contemp Nature a comprehe	A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to				
Unit 5	Understanding Human Conduct, All- encompassing Resolution & Holistic Way of Living	(L05)	COs Mapped – CO5		
Understand (understand encompass thought, b levels from	ding Human Conduct, different aspects of Al ding, wisdom, science etc.), Holistic way of living f sing Resolutioncovering all four dimensions of huma behavior and work (participation in the larger order) n Self to Nature and entire existence.	l-encomp for Huma n endeav leading	assing Resolution in Being with All- or viz., realization, to harmony at all		
10,010 1101	Text Books				
1. A Fou G P B	indation Course in HumanValues and Professional Ethic agaria, Excel Books Publication New Delhi, 2nd Revise	cs, R R G d Edition	aur, R Asthana and		
	Reference Books				
 Energy Small is &Brigg 	& Equity, D. Ivan Illich, The Trinity Press, Worcester, as Beautiful: a study of economics as if people mattered, as, Britain.	and Harpe E.F. Schu	er Collins, USA. macher, Blond		
 How the Other Half Dies, Sussan George, Penguin Press. New Edition. Limitsto Growth – Club of Rome's report, Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, Universe Books. 					
 Jeevan Science Human 	 Jeevan Vidya EkParichay, A Nagraj, Divya Path Sansthan, Amarkantak. Science and Humanism, P L Dhar, RR Gaur, Commonwealth Publishers. Human Values, A N Tripathy, New Age International Publishers. 				
 How to practice Natural Farming, Subhas Palekar, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati. 					
 Fundamentals of Ethics for Scientists & Engineers, E G Seebauer & Robert L. Berry, Oxford University Press Engineering Ethics (including Human Value). M Castin Letter S N (2010) and 1000 (1000). 					
Kumar,	Eastern Economy Edition, Prentice Hall of India Ltd.	u, o maira Rooks Put	yana v.o. senum		
12. Indian	Ethos and Modern Management, B L Bajpai, New Roya	al Book C	ompany.		



Sr. No.	Components for Tutorial Evaluation	Marks Allotted
1	Three Assignments on Unit 1, Unit 2, Unit 3	30
2	Group Presentations on Unit 4 and Unit 5	20
	Total	50



Semester III (SY - B. Tech.) Chemical Engineering 2307210: Problem Solving using Scilab						
Teachi	ng Scheme:	Credit Scheme:	Examination scheme:	·		
Tutoria	l: 01 hrs/week	TUT: 1	Tutorial:25 Marks			
Practical: 02 hrs/week TW: 1			TermWork: 25 Marks			
			Total :50 marks			
Prerequisite: NA						
Course	Objectives:					
I. To u	inderstand the bas	sics of Scilab, its imp	portance, relevance, and a	pplications in chemical		
engi	neering	algulations Vector	Matrix Oranationa (anditional Dranahing		
2. 10	periorin basic o	Eurotions, Vector,	File Handling User def	ined Input and Output		
Inter	aration Solving	Non-linear Equation	The Hallulling, User der	ineu input and Output, ssian Methods Linear		
	ations Iterative	Methods Interpolati	on ODE Euler Method	ls ODE Applications		
Opti	mization Using F	Karmarkar Function	on, ODE Ealer Method	is, ODL Applications,		
Course	Outcomes: On o	completion of the cou	rse, students will be able	to-		
Sr.		Course Outcon	nes	Bloom's Level		
No.						
CO1	Identify the	fundamental conce	epts of Scilab, its	1-Knowledge		
	significance, and its applications in chemical engineering					
	Explain how to	perform basic calcul	ations, vector & matrix			
CO2	operations, and	utilize Scilab func	tionalities for plotting,	2-Understand		
	file handling, ar	nd problem-solving				
CON	Implement Scila	ab for various tasks, 1	opE simulations and	2 4		
003	& non-linear ed	juations, integration,	ODE simulations, and	3-Apply		
	optimization us		Contents:			
	М	odule I		COs Manned: CO1		
Vector 1	Matrix Operation	s Conditional Branch	hing			
, , , , , , , , , , , , , , , , , , , ,	Main Operation	odule II	(L03)	COs Mapped: CO2		
Iteration.	Scripts and Fund	ctions, Plotting, File	Handling			
	Mo	dule III	(L03)	COs Mapped: CO3		
User defined Input and Output, Integration, Solving Non-linear Equations, Linear Equations						
Gaussian	Gaussian Methods, Linear equations					
Module IV(L03)COs Mapped: CO3						
Iterative	Methods, Interpo	olation, ODE Euler M	Iethods, ODE Application	ns, Optimization Using		
Karmarkar Function						
1 7 . 1	Text Books					
1.Introd publis 2.Advar Ltd (2	 1.Introduction to Scilab for Engineers and Scientists, Sandeep Nagar, First Edition, Apress publisher (2017). 2.Advanced Programming in Scilab, Chetan Jain, First Edition, Alpha Science International Ltd (2020). 					



Reference Books

1. Introduction to Scilab, Michael Baudin, First Edition, DigitE publisher

Guidelines for Laboratory Conduction

- 1. Teacher will brief the given problem statement to students, its objectives and outcome.
- 2. Students will solve the allotted problem in a group or individually using simulator.
- 3. After solving problem, students will check their simulated results from the teacher.
- 4. Students will then complete the write up.

Guidelines for Student's Lab Journal

Write-up should include title, Software used, Concept utilized, Course Usage and Problem Statement, conclusion. Simulation steps, simulated results if any.

Guidelines for Term work Assessment

- 1. Each experiment from lab journal is assessed for thirty marks based on three rubrics.
- 2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.



	Semester IV (SY - B. Tech.) Chemical Engineering 2307211: Process Calculations						
Teachir	ng Scheme:	Credit Scheme:	Examination sch	eme:			
Theory:	03 hrs/week	03	In Semester Exam: 20 marks				
			End Semesters Ex	am: 60 marks	5		
	Continuous Comprehensive Evaluation: 20 marks						
			Total: 100 Marks				
Prerequi	isite: Courses of	Engineering Mather	natics, Physics and	Chemistry.			
Course (Objectives:						
1. To le	earn the various	unit operations and u	init processes perfo	ormed in a che	emical industry.		
2. To 1	impart knowled	ge on concepts of	Material balance	for unit oper	ations and unit		
pro	cess.						
3. To e	enable students	to learn the applicat	ion of the general	energy balan	ce equation and		
pre	cisely to calcula	te the energy require	ments for unit oper	ations.			
4. To s	tudy basic conce	epts of Humidificatio	n operation.				
5. To s	tudy different ty	pes of fuels and under	erstand the combus	tion calculation	ons.		
Course	Outcomes: On	completion of the co	urse, students will	be able to-			
Sr.		Course Ou	tcomes		Bloom's		
INO.	Determine the	a composition of the	motorials and anni-	· 4h a	Level		
CO1	Determine the composition of the materials and apply the various laws governing solid, liquid and gas phases 3-Apply						
CO2	Calculate the amount of materials required to carry out the 3-Apply						
CO3	Determine the	Conversion and Yie	eld of the reactions		3-Apply		
	Evaluate the e	energy requirement for	or various unit oper	rations and	C 1 1 PP - J		
CO4	processes in c	chemical industries.		utions und	3-Apply		
CO5	Understand th Process.	ne basics of Humidifi	cation and Combus	stion	2-Understand		
	Γ	Course	e Contents:				
Unit 1	Units	s and Basic Chemical	Principle	(L07)	COs Mapped: CO1		
Introduc	ction to unit of	perations, Units and	l dimensions: fun	damental and	d derived units,		
convers	ions, ideal and r	eal gas laws. Mole fr	actions and partial	pressures, Av	verage molecular		
weight,	application of l	Dalton's, Amagat's, o	concept of vapor p	pressure, Rao	ult's law and its		
applicat	ions, gas & gase	eous mixture.					
Unit 2	Material Ba	llance without Chen	nical Reactions	(L08)	COs Mapped: CO2		
Basic C	oncepts and Intr	oduction to first law	of thermodynamics	s, material ba	lance calculations		
for Eva Recycliu	aporation, Disti	llation, Filtration, E	Extraction, Mixing	, crystallizat	ion. Bypass and		
Unit 3	Material	Balance with chemi	cal reactions	(L07)	COs Manned:		
				()	CO3		
Concept	t of limiting a	nd excess reactants,	percentage conve	ersion, yield	and selectivity.		



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Materia	Material balance of unsteady state processes involving chemical reaction.				
Unit 4	Energy Balance(L07)		COs Mapped:		
			CO4		
Basic C	oncept, Sensible Heat, latent heats of Phase change, ener	gy balances	s, heat capacity of		
pure su	bstances and mixtures, enthalpy of pure substances	and mixtu	res, Hess's law,		
Standard	d Heat of Formation and combustion, Heat of reaction, a	adiabatic re	actions, adiabatic		
flame te	mperature calculations.		-		
Unit 5	Humidification and Combustion	(L07)	COs Mapped:		
			CO5		
Humidit	y and saturation: Molal humidity, absolute molal h	umidity, r	elative humidity,		
saturatio	on humidity, psychrometric chart. Types of Fuel, Calor	rific values	, Orsat Analysis,		
combust	tion calculations.				
	Reference Books				
1. Stoich	iometry and Process Calculations, K. V. Narayanan. an	nd B. Laks	hmikutty, Prentice		
Hall Ir	ndia Pvt., Limited, 2 nd edition.				
2. Basic	Principles and Calculations in Chemical Engineering Da	wid M. Hir	nmelblau, james B		
Riggs,	, Prentice Hall India Pvt., Limited, 8 th edition.				
3. Stoich	iometry, B.I. Bhatt. And S .M Vora., Tata McGraw Hill.	4 th edition.			
4. Eleme	ntary Principles of Chemical Processes, Richar	d M. F	elder, Ronald W.		
Rouss	eau, Lisa G. Bullard, 4 th edition.				
Sr.	Components for Continuous Comprehensive Evalua	tion	Marks Allotted		
No.	-				
1	Three Assignments on unit-1, Unit-2, Unit-3 & 4		10		
2	Group Presentation on Unit-5		05		
3	LMS Test on Each Unit		05		
		Total	20		



	Semester IV (SY - B. Tech.) Chemical Engineering 2307212: Chemical Reactions and Synthesis II				
Teachir	ng Scheme:	Credit Scheme:	Examination sch	eme:	
Theory:	03 hrs/week	03	In Semester Exan	n: 20 marks	
			End Semesters Ex	am: 60 mark	S
			Continuous Comp	orehensive Eva	luation: 20 marks
			Total: 100 Marks		
Prerequi Engineer	isite: Knowledg	ge of fundamental	Chemistry up to	XII standard	l and first year
Course (Objectives:				
1. T	o impart the bas	ic concepts of organi	ic chemistry		
2. T	o develop under	standing about conce	epts of organic reac	tions for anal	ysis of unit
Р	rocesses				
3. T	o study the diffe	rent analytical instru	mentation techniqu	les	
Course	Outcomes: On	completion of the co	ourse, students will	be able to-	
Sr. No.		Course Ou	itcomes		Bloom's Level
CO1	Apply the cond	cept of naturally occu	urring polymer and	synthesize	2-Understand
	the new polym	ers			2 Onderstand
CO2	Apply the theo	ry of synthesis of co	mplex and evaluate	e their	3-Apply
	properties				
CO3	Analyze the given chemical substance by different 3-Apply			3-Apply	
	Instrumentation	n techniques.	ions and annihuit in	41e e	
CO4	synthesis of co	mpounds.	ism and apply it in	the	3-Apply
CO5	Understand con and their prope	ncept of isomerism a erties.	nd analyze differer	nt isomers	4-Analyze
		Course	e Contents:		
Unit 1		Green Chemistry	y	(L07)	COs Mapped:
		-			CO1
Definitio	n, goals of gree	en chemistry, efficie	ncy parameters, ne	eed of green	chemistry, Major
application	ons, traditional	and green path w	ay of adipic acid	l, polycarbor	nate, indigo dye,
ibuprofer	n, carbaryl Carbo	ohydrate: Cyclic stru	cture of glucose, c	ellulose, starc	ches. Starch based
products,	, Cellulose aceta	ate, nitrate, ether. ca	atalytic site of enzy	yme, factors	affecting enzyme
activity.					
Unit 2	Transition m	netals and Co-ordin	ation chemistry	(L07)	COs Mapped: CO2
Electroni	c configuration	of first series trans	sition metals shape	es of d- orbi	tal characteristics
(variable	oxidation states	s, magnetic property	, color of transitio	n metal comp	oounds). Ligands,
C.N. and geometry, nomenclature of complexes, chelates. Theories of co-ordination- i) Werner					
11) EAN	111) VBT for	tetrahedral and octa	ahedral complexes	1V) CFT (in	cluding crystal
field spli	itting in octable	aral field and tetral	hearal field, CFSE	for octab	earal complexes,
applications of CF1)					



Unit 3	Volumetric Analysis	(L07)	COs Mapped:
Ctau daud			CO3
Standard	tion types of titrations neutralization (with titration and	rins, sinali	scale units of
and preci	nition, types of inflations-neutralization (with inflation cull pitation with examples. Theory of indicators in above	titrations N	lumericals on all
and preci	pitation with examples. Theory of indicators in above	titrations. I	unici icais on an
Unit 4	Surface Chemistry	(L08)	COs Manned:
	Surface Chemistry	(100)	CO4
(a) Adsor	rption: Introduction to Freundlich and Langmuir theor	ies of adsor	ption, adsorption
from solu	tion, B.E.T. Theory of adsorption of gases, Application	n of adsorpti	on, numerical on
above.			
(b) Appl	cations characteristics, types, adsorption theory of ca	talysis, pror	noters, poisons,
industrial	applications of catalysts; Zeolites- structure, properties	, application	s as catalyst for
reactions	(amination of alcohol. NOX pollution control, alkylat	ion, cracking	g conversion of
methanol), Hydroformylation using catalyst, functionalized polym	ner,	
Unit 5	Stereochemistry and Unit processes in organic	(L07)	COs Mapped:
D .	synthesis	•	<u>CO5</u>
Basic co	ncepts, conformation isomerism of ethane, propane,	butane, cyc	lohexane, mono-
substitute	d cyclonexane, optical isomerism with 1 and 2	chiral cent	ers, Mechanism,
thermody	namics and kinetics of nitration, nalogenations, s	uipnonation,	preparation of
ntrobenz	ene, chiorai and vinyi chioride, dodecyloenzene sulpiiona	ate, lauryi ale	
1	I ext Books	-th _ 1:4:	
1. Conc $2 \wedge dw$	use Inorganic Chemistry J.D. Lee, wiley India Pvt Ltd. 5	D ^{an} edition	6th adition
2. Auva	inced morganic Chemistry Cotton, whichson Murino,	Bochmann,	o edition
3. Fliys 4 Dhys	ical Chemistry, F L Solli, Sultan Chand & Solls	ar Internatio	nal Flavanth
5 Stere	ochemistry of Organic Compounds Ernest I Eliel Sam	uel H Wiler	Wiley
6 Unit	Processes in Organic Synthesis P H Groggins Tata M	CGraw-Hill	5 th edition
0. 0111	Reference Books		5 cultion
1 Instr	mental Methods of Analysis H H Willard I I Merrit	t and IA De	ean & F A Settle
CBS	Publishers 7 th Edition		can & I .I Y bettle,
2. Voge	el's analytical chemistry, J. Mendham, Pearson Education	n, 6 th Edition	
Sr.	Components for Continuous Comprehensive Evalua	tion N	Aarks Allotted
No.			
1	Four Assignments on unit-1, Unit-2, Unit-3 & 4		10
2	Group Presentation on Unit-5		05
3	LMS Test on Each Unit		05
		Total	20



	Semester III (SY - B. Tech.) Chemical Engineering					
		2307213: TI	hermodynam	ics		
Teachir	ng Scheme:	Credit Scheme:	Examination s	scheme:		
Theory:	03 hrs/week	03	In Semester Ex	am: 20 marks		
			End Semesters	Exam: 60 mar	ks	
			Continuous Co	mprehensive Ev	aluation: 20 marks	
			Total: 100 Mar	`ks		
Prerequi	isite: Courses in	Engineering Mather	natics, Physics a	nd Chemistry.		
Course (Objectives:					
1. To i	ntroduce basic c	oncepts of thermody	namics, and thei	r applications.		
2. To f	ormulate and ap	ply the laws of therm	odynamics in o	rder to solve a	given problem	
usi	ng a particular th	hermodynamic proce	SS.			
3. To t	inderstand differ	ent methods for perf	orming phase ai	nd chemical rea	iction equilibrium	
Cal	Culations.					
Course	Outcomes: On	completion of the co	urse, students w	ill be able to-	Dia ann 's Lassal	
Sr. No		Course Out	comes		Bloom's Level	
110.	Understand h	asic concents of	thermodynamics	and their		
CO1	applications an	d limitations in Cher	nical Engineerir		2-Understand	
	Formulate the	relationship betwee	en different the	rmodvnamic		
~~	parameters f	for different pro	cesses and	apply the		
CO2	thermodynamic	c laws to the given j	process in order	to solve the	3-Apply	
	problem		-			
	Compare ideal	gas/solution model	s to reflect beha	avior of real		
CO3	mixtures based	l on the concepts of	chemical potent	ial, fugacity,	3-Apply	
	and excess free	e energy				
CO4	Evaluate the v	various methods and	assumptions for	or performing	3-Apply	
	phase equilibri	um calculations	. 1.1 .			
CO5	Determine the	equilibrium produc	ts and their con	icentration in	2 Understand	
05	reactions	men dealing with	systems moor	ing chemical	2-Onderstand	
	reactions	Course	Contents			
Unit 1	Introd	uction and Basic C	oncent	(L07)	COs Manned:	
c mt I		uction and Dusic C	oncept		CO1	
Introduc	tion and Funda	mentals of Thermod	ynamics, Syster	ms and variabl	es, state and path	
function	function, work, heat, reversible and irreversible processes, internal energy, Zeroth law of					
thermodynamics, First law of thermodynamics for non-flow process and flow process,						
equilibrium state, phase rule, heat capacity.						
Unit 2	P-V-T Behav	vior and law of ther	modynamics	(L07)	COs Mapped:	
		<u> </u>			<u>CO2</u>	
P.V.T.	behavior of put	re fluids, Equation	of state and c	oncept of idea	al gas, Processes	
involvin	ng ideal gas:	constant volume	process, consta	nt pressure p	process, constant	
tempera	ture process, ac	inabatic process and	polytropic pro	cess; Equation	of state for real	
gases, s	econd law of the	ermodynamics: Spon	naneous process	, neat reservon	, neat pump, neat	

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engine.	engine, Kelvin Plank statement, Clausius statement, entropy				
Unit 3	Thermodynamic Properties of Fluids	(L07)	COs Mapped:		
			CO3		
Fundam	ental property relations for closed systems, Ma	axwell relati	onships, Clausius-		
Clapeyr	on equation, Partial molar properties, chemical	potential, Id	leal and non-ideal		
mixture	s/Solutions, fugacity and fugacity coefficient for pure	e components	and for mixture of		
gases a	nd liquids. Lewis Randall rule, Henry's law, activ	vity co-effic	ient, Gibbs-Duhem		
equation	h, Excess properties of mixtures.	(T 07)	COc Mannadi		
UIIIt 4	r nase equilibrium	(L07)	COS Mapped: CO4		
Criteria	of equilibrium, phase equilibrium criteria, the phase	rule, Duhen	n's theorem, vapor-		
liquid e	quilibrium of ideal and non-ideal solution at low to m	noderate pres	sures, Raoult's Law		
and Mo	odified Raoult's Law, dew point and bubble poir	nt calculation	ns, thermodynamic		
consiste	ncy test.	(7.00)			
Unit 5	Chemical reaction equilibrium	(L08)	COs Mapped:		
The rea	The reaction coordinates Application of the criteria for equilibrium to chemical reactions				
the stan	dard Gibbs free energy change and the equilibrium co	uniorium to	t of temperature on		
equilibr	ium constant, evaluation of the equilibrium constant.	relation of e	quilibrium constant		
to comp	osition, calculation of equilibrium conversion for sin	gle reactions	the phase rule and		
Duhem'	s theorem for reacting systems	6			
	Text Books				
1. Cher	nical Engineering Thermodynamics, K. V. Narayar	nan, Prentice	Hall of India, 2 nd		
Editi	on.				
2. Cher	nical Engineering Thermo Dynamics, Y.V.C. Rao, U	niversity pres	ss (INDIA) Ltd.		
3. Intro	duction to Chemical Engineering Thermodynamics,	, J. M. Smit	h, H. C. Van Ness		
and	M. M. Abbott, McGraw Hill Education, /" Edition.				
1 An I	Keterence Books	Hill Dover	Dublications Inc.		
1. All I 2. Cher	nical Biochemical and Engineering Thermodynamic	$\frac{1}{2} = \frac{1}{2} = \frac{1}$	Her John Wiley &		
2. Cher	2. Chemical, Biochemical and Engineering Thermodynamics, S. I. Sandler, John Whey & Sons A th Edition				
Sr.	Components for Continuous Comprehensive Eva	luation	Marks Allotted		
No.			1,141 mb 1 moved		
1	Three Assignments on unit-1, Unit-2, Unit-3 & 4		10		
2	Group Presentation on Unit-5		05		
3	LMS Test on Each Unit		05		
		Total	20		



	Semest 230	er IV (SY - B. Tech.) 7214: Lab Work in F	Chemical Engineering Process Calculations	5
Teach	ning Scheme:	Credit Scheme:1	Examination scheme:	
Practi	ctical: 2Hrs. /Week TW: 25 marks			
			Practical: 25 marks	
Droro	auisita: Courses of	FEngingering Mathematic	I Otal: 50 Marks	
Course	Quisite. Courses of		s, Filysics and Chemistry	
1 To	b learn the various i	unit operations and unit p	rocesses performed in a cher	nical industry.
2. To	impart knowledge	e on concepts of Material	balance for unit operations a	nd unit process.
3. To	enable students t	to learn the application of	of the general energy balan	ce equation and
р	recisely to calculat	e the energy requirements	s for unit operations.	-
4. To	study basic conce	pts of Humidification ope	pration.	
5. To	study different typ	pes of fuels and understan	d the combustion calculation	18.
Cours	se Outcomes: On c	completion of the course,	students will be able to-	
		Course Outcome	es	Bloom's Level
CO1	To understand var	rious chemical Engineerin	ng Software	2-Understand
CO2	To calculate equivulate using MS-EXCE	valent weight, molecular L.	weight and mole fraction	2-Understand
CO3	To determine the	composition of the mater	ials by using MATLAB.	3-Apply
CO4	To apply the known composition of operations.	owledge of the software Binary Distillation/ Ab	like UNISIM to find out psorption/extraction/mixing	3-Apply
CO5	To apply the kn conversion for the	nowledge of the softwar e reaction.	e DWSIM to find the %	3-Apply
	List of La	boratory Experiments (Minimum seven experimen	nts)
Sr. No.		Laboratory Experin	nents	CO Mapped
1	To understand dif MATLAB, DWS	fferent software application IM and UNISIM in proce	on like MS-EXCEL, ss calculations.	CO1
2	To evaluate the end fraction using MS	quivalent weight, molecul S-EXCEL for various che	lar weight and mole mical compounds.	CO2
3	To determine the by using MATLA	composition of the input s	tream for mixing operation	CO3
4	To calculate the r MATLAB.	naterial and energy baland	ce for batch reactors using	CO3
5	To find the conde using UNISIM.	enser duty and re-boiler lo	ad for binary distillation	CO4
6	To find the comp	osition of absorption/mix	ing by using UNISIM.	CO4
7	To find the %Yie	ld and %Conversion for r	eaction by using DWSIM.	CO5



8 To simulate the extraction operation using DWSIM.	CO5				
Reference Books					
 Stoichiometry and Process Calculations, Narayanan. K. V. and Lakshmikut Publication. 	ty. B, PHI				
 Basic Principles and Calculations in Chemical Engineering, David M. Himp Publication 	2. Basic Principles and Calculations in Chemical Engineering, David M. Himmelblau Pearson Publication				
3. Stoichiometry, Bhatt B.I. and Vora S.M., Tata McGraw Hill.					
4. Elementary Principles of Chemical Processes, Richard M.Felder, Ronald W.Rousseau, John Wiley & Sons.					
Guidelines for Laboratory Conduction					
• Teacher will brief the given problem statement to students, its objectives and	d outcome.				
• Students will solve the allotted problem in a group or individually using sim	ulator.				
• After solving problem, students will check their simulated results from the t	eacher.				
• Students will then complete the write up.					
Guidelines for Student's Lab Journal					
Write-up should include title, Software used, Concept utilized, Course Usage a	and Problem				
Statement, conclusion. Simulation steps, simulated results if any.					
Guidelines for Termwork Assessment					
1. Each experiment from lab journal is assessed for 30 marks based on three 1	ubrics.				
2. Rubric R-1 is for timely completion, R-2 for understanding and R-3 for					
presentation/journal. Each rubric carries 10 marks.					



Semester IV (SY - B. Tech.) Chemical Engineering				
	2307215: Lak	o Work in Chemical	Reactions and Synthe	sis II
Teaching	g Scheme:	Credit Scheme:2	Examination scheme:	
Practical	: 4Hrs. /Week		TW: 50 marks	
			Practical: 50 marks	
			Total: 100 Marks	
Prerequi	site: Knowledge	e of fundamental Cher	nistry up to XII standar	d and first year
Engineer	ing Chemistry.			
Course O	bjectives:			
1.10	impart the basic of	concepts of organic, inor	ganic and physical chemisti	ry analysis of unit
2. 10 Pro	cesses	tanding about concepts	of organic reactions for	analysis of unit
3 To	study the differen	nt analytical instrumentat	tion techniques and their an	nlications
Course (Dutcomes: On co	mpletion of the course, s	tudents will be able to	piloutions
		Course Outcom	les	Bloom's Level
001	Estimate the pur	rity and quantity of subst	ance present by	3-Apply
CO1	traditional meth	ods	1 5	11.7
CO1	Apply the theor	y of synthesis of complex	x and evaluate their	2 Apply
02	properties			5-Apply
CO3	Understand catalyst and its mechanism and apply it in adsorption			2-Understand
	of organic comp	oound.		2 Onderstand
CO4	Analyze the compounds purity and apply the purification			3-Apply
	techniques for it			11.5
- Cm		List of Laboratory	Experiments	CO Mannad
Sr. No		Laboratory Experin	ments	CO Mapped
110.	Adsorption of	acetic acid on charco	al to verify Freundlich	CO3
1	isotherm	dectie dela on charee	ar to verify rrealidition	005
2	Determination of	of purity of sod. Carbonat	te by titration method	CO1
3	Preparation of the	ris ethylene diammine ni	ckel (II) thiosulphate	CO2
4	Preparation of to	etramine copper (II) sulp	hate	CO2
5	Preparation of o	sazone derivative of glue	cose	CO2
6	Estimation of gl	ucose/acetone in solution	n	CO1
7	Purification of c	organic compounds by cr	ystallization	CO4
8	Purification of c	organic compounds by su	blimation	CO4
9	Determination of	of chloride content by Mo	ohr's method	CO4
10	To determine in	tegral and differential he	at of solution of a salt	CO1
11	Photo catalyst b	ased chemical reaction		CO1



Text Books
1. Laboratory manual on general and applied chemistry, Dr. S.K. Bhasin, Dhanpatrai
publication.
2. Laboratory manual on engineering chemistry, Dr. S.K. Bhasin, Dhanpatrai publication.
Reference Books
1. Instrumental Methods of Analysis, H.H. Willard, L.L. Merritt and J.A. Dean & F.A Settle,
CBS Publishers, 7 th Edition.
2. Vogel's analytical chemistry, J. Mendham, Pearson Education, 6 th Edition
Guidelines for Laboratory Conduction
• Teacher will brief the given experiment to students with its procedure, observations, calculation and outcome of the experiment
• Apparatus and equipments required for the allotted experiment will be provided by the lab
• Apparatus and equipments required for the anoted experiment will be provided by the lab assistants using SOP.
• Students will perform the allotted experiment in a group under the supervision of faculty and lab assistant.
• After performing the experiment, students will perform calculations based on the obtained readings and get it verified from the teacher
• Students will then complete the experimental write up
Cuidelines for Student's Lab Journal
Write-up should include title aim diagram working principle procedure observations graphs
calculations, results, conclusions, etc.
Cuidelines for Termwork Assessment
1 Each experiment from leb journal is assessed for 20 marks based on three subries
 Each experiment from fab journal is assessed for 50 marks based on three rubrics. Dubric D. 1 is for timely completion. D. 2 for understanding and D. 2 for
2. Rubbic K-1 is for timely completion, K-2 for understanding and K-5 for
presentation/journal. Each rubric carries 10 marks.





	Semester IV (SY - B. Tech.) Chemical Engineering				
Toochin	a Schomo.	230/210. F	Fyamination sch	ma	
Theory:	13 hrs/week	13	Lin Somester Even	· 20 mortes	
Theory.	55 III 5/ WCCK	05			
			End Semesters Ex	am: 60 marks	
			Continuous Comp	renensive Eval	uation: 20 marks
D	'		1 Iotal: 100 Marks	• • • • • •	
Chemistry	site: Courses (7.	of Engineering Mat	hematics, Engineer	ing Mechani	cs, Physics and
Course C)bjectives:				
1. To	o introduce basic	c concepts of fluid me	echanics, fluid prope	erties, types o	f fluids and
cla	assification of fl	ows.			
2. To	o understand flui	id statics, basic equat	ions of fluid flow a	nd application	s to determine
lo	sses occurring th	rough pipelines.			
3. To	o develop relatio	onships among proces	ss or system variabl	es using dime	ensional analysis
an	d fluidization ar	nd applications of diff	ferent valves and pu	mps.	
Course	Outcomes: On o	completion of the cou	urse, students will be	e able to–	Γ
Sr.		Course Ou	tcomes		Bloom's
No.					Level
CO1	Explain differe	nt fluid properties, ty	pes of fluids and flo	OWS.	1-Knowledge
CO2	Understand fluid statics and its applications related to pressure 2-Understand				
	Apply basis of	ices in chemical indu	stry.	d florr moto	
CO3	Apply basic eq	uations of fluid flow	and determine nul	d now rate	3-Apply
	Apply theorem	vices.	tical aquations on	d datarmina	
CO4	Apply theorem	or flow of fluid throu	alical equations and	u uetermine	3-Apply
	Understand or	on noopte of boundar	y lover and fluid	ization and	
CO5	onderstand co	f different velves or	y layer and find	nortation of	2 Apply
005	fluid through p	inelines	iu pumps for trans	portation of	5-Appiy
	nulu tillougil p	Course	Contents		
Unit 1		Introduction	. contento,	$(\mathbf{I}, 07)$	COs Mannad.
Omt I		mnouuction		$(\mathbf{L}07)$	COS Mapped.
Fluid b	ranches of fluid	mechanics propertie	s of fluid classific	ation of fluids	s different types
of visco	meters. Newton	's law of viscosity.	numericals. non-Ne	wtonian fluid	s, types of flow
lines to a	describe the flow	v			s, cypes of now,
Unit 2	Fluid	Pressure and Meas	urement	(L07)	COs Manned:
0	1 1414			(107)	CO2
Pascal's	law, Hydrostati	c law, concept of atr	nospheric, gauge, v	acuum and al	bsolute pressure.
manome	ters, and pressu	ire measurement by	simple and differe	ntial manome	eter, Numericals
based or	n manometers				
Unit 3	Basic Eq	uations of Fluid Flo	w and Flow	(L07)	COs Mapped:
	1	Measuring Device	25		CO3
Basic equ	ations of fluid	flow: continuity equa	ation and equation	of motion, flo	w measurement



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using ver	turimeter, orifice meter, pitot tube, rotameter, Mass fl	owmeters,	Numericals	based on
different	flow measuring devices			
Unit 4	Fluid flow through pipelines and dimensional	$(\mathbf{L}07)$	COs N	Japped :

Unit 4	Fluid flow through pipelines and dimensional	(L07)	COs Mapped:			
	analysis		CO4			
Laminar flow through circular pipe: Hagen Poiseuille equation, major and minor losses, Darcy-						
Weisbach	Weisbach equation, Numericals, dimensionless numbers in fluid mechanics, dimensional					
homogeneity, types of similarities, model and prototype, dimensional analysis by Rayleigh's						
method a	nd Buckingham's method					
T T • / =						

Unit 5	Boundary Layer and fluid transportation	(L08)	COs Mapped: CO5

Concept of hydrodynamic boundary layer, growth over a flat plate, different thickness of boundary layer, numerical based on boundary layer, types of fluidization, different types of valves and pumps, centrifugal pump working and characteristics, numericals based on centrifugal pump

Text Books

- 1. Hydraulics and Fluid Mechanics, Modi, L.P., Seth, S.M., Standard Book House, New Delhi.
- 2. A Textbook of Fluid Mechanics and Hydraulic Machines, Bansal R. K., Laxmi Publications. Reference Books
- 1. Unit Operations of Chemical Engineering, W. L. McCabe, J. C. Smith, P. Harriot, McGraw-Hill International, 7th Edition.
- 2. Fluid Mechanics for Chemical Engineers, Noel de Nevers; McGraw Hill, 3rd Edition. Chemical Engineering, Volume-1, J R Backhurst, J H Harker, J.F. Richardson, J.M. Coulson, Butterworth-Heinemann, 6th Edition.

Sr.	Components for Continuous Comprehensive Evaluation	Marks Allotted
No.		
1	Three Assignments on unit-1, Unit-2, Unit-3 & 4	10
2	Group Presentation on Unit-5	05
3	LMS Test on Each Unit	05
	Total	20



Semester IV (SY - B. Tech.) Chemical Engineering					
Turk	23	U/21/: Lab Work in F	Iuid Mechanics		
l eachi	Teaching Scheme: Credit Scheme:1 Examination sch				
Practica	al: 2Hrs. / Week		TW: 25 marks		
			Practical 25 marks		
D			Total: 50 Marks	M. L.	
Dhusios	uisite Courses, II	any: - Courses of Engineering	ig Mathematics, Engineeri	ng Mechanics,	
Course	Objectives:				
	get knowledge of y	viscosity measuring device			
2 To	get knowledge of t	pressure measuring devices			
3. To	apply basic equation	ons of fluid flow to determine	ne fluid flow rate by diffe	rent devices.	
Course	e Outcomes: On co	ompletion of the course, stu	dents will be able to-		
Sr.		Course Outcomes		Bloom's	
No.				Level	
CO1	Determine visco variation.	osity of fluid using visco	meter and predict its	2-Understand	
CO2	Identify type of f	1-Knowledge			
CO3	Describe differen	1-Knowledge			
CO4	Apply basic equations of fluid flow to determine fluid flow rate using different devices and energy losses. 3-Apply				
CO5	Explain different	1-Knowledge			
		List of Laboratory E	xperiments		
	(Minimum 8 ex	xperiments out of the follo	wing list should be perfo	ormed)	
Sr.		Laboratory Experime	nts	CO Mapped	
NO.		<u> </u>		001	
	Determination of	of viscosity of fluid using vi	scometer		
2	Determination of	of type of flow using Reyno	lds Apparatus		
3	Verification of	Bernoulli's theorem	f	CO3, CO4	
4	Determination	of coefficient of discharge o	f venturimeter	CO4	
5	Determination	of coefficient of discharge o	f orifice meter	CO4	
0	Determination	of friction factor (Maior loss		CO4	
/ 0	Determination	of minor losses	ses)	CO4	
0	Determination	of contrifugal nump charact	ristics	C04	
9	9 Determination of centrifugal pump characteristics. CO5				
Text Books					
1. Hydraulics and Fluid Mechanics, Modi, L.P., Seth, S.M., Standard Book House, New Delhi.					
2. A Textbook of Fluid Mechanics and Hydraulic Machines, Bansal K. K., Laxmi Publications. Reference Books					
1 Unit	Kelefelice DOOKS				
Hill	International 7 th I	Edition	месан, э. с. оннин, г.	mannor, meonaw-	
2. Flui	d Mechanics for C	hemical Engineers, Noel de	Nevers; McGraw Hill, 3	rd Edition.	



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3. Chemical Engineering, Volume-1, J R Backhurst, J H Harker, J.F. Richardson, J.M. Coulson, Butterworth-Heinemann, 6th Edition.

Guidelines for Laboratory Conduction

- Teacher will brief the given experiment to students with its procedure, observations, calculation, and outcome of the experiment.
- Apparatus and equipments required for the allotted experiment will be provided by the lab assistants using SOP.
- Students will perform the allotted experiment in a group under the supervision of faculty and lab assistant.
- After performing the experiment, students will perform calculations based on the obtained readings and get it verified from the teacher.
- Students will then complete the experimental write up.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, results, conclusions, etc.

Guidelines for Termwork Assessment

1. Each experiment from lab journal is assessed for 30 marks based on three rubrics.

2. Rubric R-1 is for timely completion, R-2 for understanding and R-3 for presentation/journal. Each rubric carries 10 marks.



Semester IV (SY - B. Tech.) Chemical Engineering 2307218: Environmental Economics					
Teachin	g Scheme:	Credit Scheme:	Examination sch	eme:	
Theory:	Theory:02 hrs/week 02 Continuous Comprehensive Evaluation				uation: 50 marks
Prereaui	site Courses, if	any: - Economics for	Sustainability		
Course	bioctivos:		2 000000000		
1. To e	xpose the studen	nts to environmental r	problems and conce	pt of sustainal	ole development
2. To e	xplain the conce	pts of carbon footprin	nt and its calculation	ns.	
3. To ta	rain the students	to analyze environme	ental damage		
4. To h	elp students inte	rnalize the tools need	led for the evaluation	on of projects	such as cost-
ben	efit analysis, and	d environmental impa	nct		
Course	Outcomes: On o	completion of the cou	urse, students will b	e able to–	1
Sr.		Course Ou	tcomes		Bloom's
No.	<u> </u>				Level
CO1	Study of local applying econo	and global environme omic principles to the	ental issues and limi	tations of	2-Understand
coa	Demonstrate ca	arbon footprint and de	evelop broader unde	erstanding	2 4 1
CO2	of economics o	f climate change.	1	e	3-Apply
CO3	Illustrate the en	vironment policy iss	ues like environmer	ntal damage.	4- Analyze
	Analyze enviro	onmental policy for	local environment	al problems	
CO4	and understan	nd and the imp	lementation of	international	4- Analyze
	environment po	Course	Contents		
Unit 1	Introducti	on to Sustainable de	velonment	(1.08)	COs Manned
		Environmental Issu	es	(100)	CO1
Introduct	ion to Sustainabl	le development, conc	epts, sustainable de	velopment go	als, Overview of
environm	ental problems	in the world. Climate	e change, Internatio	onal agreemen	nts, Overview of
environm	ental problems o	of India, Carbon foot	print	1	1
Unit 2	Externa	alities, Environment	tal policies	(L08)	COs Mapped: CO2
The the	eory of externa	lities: Pareto optim	ality and market	failure in t	he presence of
external	ities; property 1	rights and the Coas	e theorem, The de	esign and im	plementation of
environmental policy: overview; Pigouvian taxes and effluent fees; tradable permits; choice					
between taxes and quotas under uncertainty; implementation of environmental policy					
Unit 3	Measu	iring Environmenta	l Impacts	(L08)	COs Mapped:
International environmental problems: trans-boundary environmental problems: economics of					
climate change: trade and environment. Measuring the benefits of environmental improvements:					
non-market values and measurement methods; risk assessment and perception					
		Tex	t Books	<u> </u>	
1. Kols	tad, C. (2010). In	ntermediate environm	nental economics, 2	nd ed. Oxford	University Press.
2. Stepl	2. Stephen Smith (2011) Environmental Economics: A Very Short Introduction, Oxford				



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University Press

Reference Books

- 1. This Changes Everything: Capitalism vs. the Climate by Naomi Klein
- 2. Cropper, M., Oates, W. (1992). Environmental economics: A survey, Journal of Economic Literature, 30, 675-740.
- 3. Heal, G. (2012). Reflections defining and measuring sustainability. Review of Environmental Economics and Policy, 6, 147-163.
- 4. Newell, R., Pizer, W., Raimi, D. (2013). Carbon markets 15 years after Kyoto: Lessons learned, new challenges. Journal of Economic Perspectives, 27, 123-46.
- 5. Perman, R., Ma, Y., McGilvray, J., Common, M. (2011). Natural resource and environmental economics, 3rd ed. Pearson Education/Addison Wesley.
- 6. Stavins, R. (ed.) (2012). Economics of the environment: Selected readings, 5th ed. W. W. Norton.

Sr.	Components for Continuous Comprehensive Evaluation	Marks Allotted
No.		
1	Three Assignments on Unit-1, Unit-2, Unit-3	30
2	Group Presentation on any two units (Unit-1, Unit-2, Unit-3)	20
	Total	50



Semester III (SY - B. Tech.) Chemical Engineering 2307219: Democracy, Election and Governance					
Teachir Tutoria	Credit Scheme: Credit Scheme: Examination Scheme: 'utorial: 02hrs/week 02 Tutorial: 50 Marks Total: 50 Marks Total: 50 Marks				
Prerequ	iisite Courses, i	f any: NA	I		
Course 1. To 2. To	Objectives: introduce the stu help them unders	dents meaning of democ stand the various approa	cracy and the role of the g ches to the study of demo	governance ocracy and governance	
Course	Outcomes: On	completion of the course	e, students will be able to)—	
		Course Outcom	es	Bloom's Level	
CO1	Understand th	e and inculcate key prin	ciples of Democracy	2-Understand	
CO2	Identify how systems	different rights are pro	otected in Democratic	2-Understand	
CO3	Understand va	arious approaches for Go	overnance	2-Understand	
CO4	Reflect on the	various threats and chal	llenges to Democracy	3-Apply	
		COURSE	CONTENTS	I	
Unit I	Democracy- Dimensions	Foundation and	(L08)	COs Mapped – CO1, CO2,CO4	
Constit Social,	ution of India, E Economic, and l	volution of Democracy- Political	Different Models, Dime	ensions of Democracy-	
Unit II	Dece	entralization	(L08)	COs Mapped – CO1, CO2, CO3, CO4	
Indian to period '	tradition of dece 73 rd and 74 th ame	ntralization, History of F endments, Challenges of	Panchayat Raj institution caste, gender, class, dem	in the lost independence nocracy and ethnicity	
Unit III	Go	overnance	(L08)	COs Mapped – CO2, CO3, CO4	
Meaning and concepts, Government and governance, Inclusion and exclusion					
Text Books					
 Basu, D. D. (1982), "Introduction to the Constitution of India", Prentice Hall of India. Chandra, B. (1999), "Essays on contemporary India", Har-Anand Publications. 					
Sr. No.	Components f	or Tutorial Evaluation		Marks Allotted	
1	Three Assignm	ents on Unit-1, Unit-2, U	Unit-3	30	
2	Group Presenta	ation on any two units Un	nit-1, Unit-2, Unit-3	20	
			Total	50	



Semester IV (SY - B. Tech.) Chemical Engineering 2307220: Technical Writing					
Teaching	Teaching Scheme: Credit Scheme: Examination scheme:				
Tutorial: 0	1 hrs/week	TUT: 1	Tutorial:	25 Marks	
Practical:	02 hrs/week	TW: 1	TermWo	rk: 25 Marks	
			Total:50	marks	
Prerequisit	te Courses, if any	y: - English with Gram	mar		
Course Ob	jectives:				
To ma	ke the student a	ware of the importan	ce of writ	ing skills and th	e significance of
docum	entation related to	the works carried by a	any engine	ering professional	
Course O	utcomes: On con	npletion of the course,	students w	ill be able to-	1
Sr. No.		Course Outco	mes		Bloom's
					Level
COI	Discuss the va	rious components of th	nesis		2-Understand
CO2	Describe signi	ficance of word proces	ssors in tec	hnical writing	2-Understand
CO3	Use word proc	cessors for academic an	nd research	writing	3- Apply
		Course Con	ntents:		
Unit 1	A	cademic writing		(L06)	COs Mapped: CO1. CO2
Different ty presentation computation	ypes of reports / ns. Structure of nal details; Prel	presentations; Charac a thesis; Scope of th iminary studies; Result future works; Bibliog	teristics of teristics of the work; I the work; Applied to the teristic of the teristic of the teristic teristic of the teristic of the teristic teristics of the teristic of the teristic of the teristic teristics of the teristic of the teristic of the teristic teristics of teristic of teristic of teristic of teristic teristics of teristic of teristic of teristic of teristic teristics of teristics of teristic of teristic of teristic of teristic teristics of teristic of teristic of teristic of teristic of teristic of teristic teristics of teristic of ter	academic and re iterature review; Discussions; Figu	esearch reports / Experimental / res and Tables
Junit 2	Tools and took	niques for research y	rapity, App writing		COs Mannad
Unit 2	Tools and tech	inques for research v	vriting	(L00)	CO2, CO3
Types of r writing; Mo communica effective po	Types of research papers; Structure of research papers; Research paper formats; Abstract writing; Methodology; Results and discussions; Different formats for referencing; Ways of communicating a research paper, Handling MS Word and Latex processors; Developing effective power point presentation; Plagiarism; its handing through plagiarism detection tools				
		Text Bo	oks		
 C P Ravikumar, "On Writing a Thesis", IETE Journal of Education, 2000. K. V. Laan, J. T. Hackos, "The Insider's Guide to Technical Writing", 2nd Edition, 2022. J. Cox, J. Lambert, "Microsoft Word 2010 Step by Step", Microsoft Press, 1st Edition, 2010. Available (online) H. Kopka, P. W. Daly, "A guide to LATEX: and Electronic Publishing", Addison-Wesley Longman Limited 2004, 4th Edition, 2004. Available (online). 					
	No. 1 1 1 1	Reference	Books		
1. M. D. L 2. SWAY Kolkat	Desai, "Technical AM course on "A a.	communication". Avail cademic & Research F	liable (onlin Report Writ	ne). ting" by Dr. Samin	r Roy, NITTTR



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3. S. K. Singh, "Technical Writing ", Vayu Education of India.

Guidelines for Laboratory conduction/assignment

- Teacher will brief about various types of academic and research activities.
- Teacher will brief the types of research thesis/ papers, content of the thesis/ research papers and structure of the research thesis/ papers.
- Students will study the case study of research thesis/paper and prepare power point presentation for scope of the work.
- Groups of students will study review paper and based on it, students will prepare Literature review.
- Students will check the case studies, literature review and power of point presentation from the teacher.

Guidelines for Student's Lab Journal

Write-up should include the guidelines for writing the research paper / thesis. Importance of Literature review and Bibliography. Write-up should include type of research paper, topic of research paper/ thesis, concept utilized, Developing effective power point presentation, conclusion, etc.

Guidelines for Term work Assessment

- 1. Each assignment carries 30 marks,
- 2. Evaluation is based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.



S. Y. B. Tech Chemical Engineering					
Department Specific Exit Courses (To award Diploma)					
		2307221: Internshi	i p		
Teaching Sc	Teaching Scheme:Credit Scheme:Examination Scheme:				
Theory: NA		02	Term work: 100 Mar	rks	
Course Obje	ectives: The objectives	s of the course are to			
1. Encourag	e and provide oppor	rtunities for the stude	nts to acquire profe	ssional learning	
experience	es.				
2. Provide	exposure to handlin	g and using various	tools, measuring in	nstruments, and	
technolog	tes used in industries.	professional and am	nlovahility alvilla an	d arrand thair	
5. Ellable s	al network	professional and em	pioyability skills all	u expanu men	
Course Outo	comes: On completion	of the course, students	will be able to-		
		Course Outcomes		Ploom's	
		Course Outcomes		Diooiii s Level	
CO1	Operate various me	asuring instruments, and	d tools used in	1-Remember	
001	industry efficiently	and develop technical c	ompetence.	2-Understand	
CO2 Understand the wor		rking culture and environment of the		4-Analyze	
	Industry and get fan	niliar with various depa	rtments and practices	5-Evaluate	
	in the industry.				
CO3	Apply internship lea	arning in engineering project work, i.e. topic		3-Apply	
	finalization, project	planning, prototype de	velopment, result		
~~~	interpretations, repo	rt writing, etc.			
CO4	Create a professiona	I network and learn abo	out ethical, safety	1-Remember	
	measures, and legal	practices.	C4	2-Understand	
	Interns	nip Guidelines for the	Students		
A. Before Join	ning the Internship				
1. Search	for internships in the	industries provided by	the department.		
2. The int	ernship duration shou	ld be of 4 weeks.			
3. Ask fo	r the internship reque	est letter from the respe	ective class / Internsh	ip coordinator.	
Concer	rned coordinator will a	appoint a guide for you.		· 1 /T / 1·	
4. Mentoring of the internship activity will be done through your Guide/Internship					
5 You are informed to report to concerned from time to time					
5. For all morned to report to concerned from time to time.					
B. During Int	ernship				
1. Keep t	he internship record b	ook with you.			
2. Note d	own all the details da	te-wise in the internsh	ip record book. Take	the signature of	
your in	dustry mentor daily.		-	-	
3. The in	ternship record boo	k will help you to	write your final in	ternship report.	



Simultaneously you can start writing internship reports.

4. Maintain an institutional culture while working in the industry.

# C. After Internship

- 1. Submit the Internship Record book and Internship report. Both are in hard copy.
- 2. Submit all your details within 15 days of completion of the Internship.
- 3. After the internship, the presentation schedule will be displayed.
- 4. The internship course will be assumed to be completed only after the final presentation. The date of presentation will be declared at least 10-15 days before the actual date.

	Evaluation and Assessment of Internship			
Sr.	Evaluation	Marks	Remarks	
No.	Parameter			
1	Internship	25	Maintain all the records. This should be handwritten and	
	Record Book		submitted in hard copy. It will be evaluated based on	
			1. Proper and timely documented entries	
			2. Adequacy and quality of information	
			3. Data, observations, and discussions recorded	
			4. Thought process and recording techniques used	
			5. Organization of the information	
2	Internship	25	Submit your report as per the guidelines. It should have	
	Report		<b>1. Starting pages:</b> Certificates, declaration, abstract, table of	
			contents, figures, tables, etc.	
			<b>2. Chapter 1:</b> Introduction: Brief about the company, industry	
			or organization, objectives, motivation, and organization of the	
			report	
			3. Chapter 2: Problem Identification/Problem	
			statement/objectives and scope/expected outcomes	
			4. Chapter 3: Methodological details	
			5. Chapter 4: Results / Analysis /inferences and conclusion	
			6. Chapter 5: Suggestions/Recommendations for improvement	
			to the industry, if any	
			7. End Pages: Acknowledgement and references	
3	Post-	50	Evaluation will be done by both industry and department	
	Internship		mentors, based on the presentation criteria given below	
	Evaluation		1. Internship Identification and Selection	
			2. The Problem Studied with objectives and expected outcomes	
			3. Consideration of environmental/ Social /Ethical/ Safety	
			measures/Legal aspects.	
			4. Methodology/System/Procedure Q&A	
			5. Block diagram, flow-chart, algorithm, system description	
			6. Final results, discussions, suggestions, comments, etc. Q&A	
			7. Presentation and Communication	
Т	otal Marks	100	Timely completion of activities is essential for all above	



S. Y. B. Tech Chemical Engineering				
	Departme	ent Specific Exit Courses (Te	o award Dip	oloma)
	2	307222: Chemical Process I	ndustries	
Teachi	ng Scheme:	Credit Scheme: 03	Examination	n scheme:
Theory	:02 hrs/week	Theory: 02	In SemExam	: 20Marks
Practica	al:02 hrs/week	TW: 01	End SemExa	m: 30Marks
			Term work:	50 Marks
			Total:100 ma	urks
Prerequ	isites: Basic Kno	wledge of Chemical compound, I	ntroduction of	unit processes and
unit oper	rations			
Course	Objectives:			
1. To	study introductio	n of chemical engineering and st	udy of glass,	coal and chlor-alkali
indu	istries			
2. To s	study Natural che	mical industry.		
3. To s	study nitro-phosp	horus, sulfur industry.		
4. To	study Petroleum	and Polymer industry.		
5. To s	study Petrochemi	cal Industry.		
Course	e Outcomes: On	completion of the course, students	will be able to	)—
CO		<b>Course Outcomes</b>		<b>Bloom's Level</b>
CO1	Understand bas	ic concepts and explain glass, co	al and chlor-	2-Understand
	aikan mustry.			2. Understend
	Understand and	describe about natural chemical in	idustry.	2- Understand
<u>C03</u>	Understand and	explain about nitro-phosphorus, s	ulfur industry	2- Understand
CO4	Understand an	d describe about Petroleum a	and Polymer	2- Understand
CO5	Illuusuy.	describe about natrochamical indu	atex	2 Understand
	Understand and	Course Contents:	istiy	2- Understand
Unit 1	Basic Conc	ents (I 05)		COs Manned ·CO1
Introdu	etion: Chemical	industries facts and figures MSD	S Unit opera	tion and unit process
concents	Chemical proc	essing and role of chemical engli	ineers process	s flow diagrams the
anatomy	of a chemical m	anufacturing process major engine	pering problem	s now diagrams, the
Class In	dustries. Metho	d of manufacture, manufacture of	special glasses	15
Coal C	homicals. Destr	uctive distillation of coal Type	special glasses	zation Coke oven
construc	tion working and	applications		
Chlor-A	Ikali Industry	Production of Soda ash Production	n of Chlorine a	and caustic soda
Unit 2 Notural Chamical Industry (L05)				COs Manned ·CO2
i s	Sugar and starch i	ndustry		
i. Sugar and starch industry ii. Oil Fat and wayes				
iii Pulp and Paper industry				
iv Food and food- by product processing				
Unit 3 Nitrogen, Phosphorus and sulfur Industry (L05) COs Manned :CO3				
i N	Jitrogen Industry	· Production of Ammonia Nitric a	cid Uree Am	monium Nitrate
i. Phosphorous Industry: Production of Phosphoric acid, orea, Ammonium Nitrate.				
F	Phosphate. Ammo	onium Phosphate		
	1 - 7	1		



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iii.	Sulphur Industry: Production of Sulphur, Sulphuric acid, Ammoni	um sulphate.
Unit 4	Petroleum and Polymer Industry (L05)	COs Mapped :CO4
i.	Petroleum Industry: History of production of crude petroleu	m, characteristics of
	refineries-refinery operations,	
ii.	Introduction to Polymer, Classification of Polymerization, Pr	oduction:polyolefins:
	polyethylene, poly propylene and polystyrene, styrene co	polymers, polyvinyl
	chloride, polycarbonate, nylon 6,nylon 66,urea formaldehydd	e, styrene butadiene
	rubber (SBR) etc	-
Unit 5	Petrochemical Industry (L05)	COs Mapped :CO5
i.	C1 Compounds: Production of Methanol, Formaldehyde,	and Halogenated
	Hydrocarbons.	_
ii.	C2 Compounds: Production of Ethylene and Acetylene-	Steam Cracking of
	Hydrocarbons, Ethylene Dichloride, Vinyl Chloride.	-
iii.	C3 Compounds: Production of Propylene by Indirect Hydration, A	cetone, Cumene
iv.	Aromatic Compounds: Production of Phenol, Phthalic Anhydride	and Styrene.
	<b>REFERENCE BOOKS:</b>	
1. Di	ryden's Outlines of Chemical Technology, M Gopal Rao, Marshal S	Sittig, East-west press
$3^{rc}$	¹ Edition.	<i>U</i> , I
2. Sh	rreve's Chemical Process Industries, George T Austin, Tata McGRA	AW Hill, 5 th Edition.
3. Ui	nit Processes in Organic Synthesis, P. H. Groggins., Tata McGRAV	V-Hill, 5 th Edition.
4. Cł	nemical Process Technology Jacob A. Moulijn, Michiel Makkee, A	nnelies E. van Diepe,
W	iley	1
5. In	dustrial Chemicals, Feith – Keys and Clerk	
6. Cł	nemical Technology- Venkateshwaralu, Vol. I, II, III, IV Chemical	Engg. IIT Madras

6. Chemical Technology- Venkateshwaralu, Vol. I, II, III, IV Chemical Engg. IIT Madras

Suggested List of Laboratory Assignments:				
Any eight practical's to be performed out of the following:				
Sr.	Laboratory Experiments	СО		
No.		Mapped		
1.	Lab scale product synthesis.	CO1		
2.	Mass balance calculations of any two processes using process	CO1,CO2		
	calculation approach.			
3.	Heat balance calculations of any two processes using process	CO1, CO2		
	calculation approach.			
4.	Calculations based on recycle operations.	CO1, CO2		
5.	Process flow sheets drawing of any two processes using CAD.	CO1, CO3		
6.	Simple mass & energy balance using process simulators	CO1, CO3		
7.	Process flow sheets drawing of any two processes using Simulation	CO1, CO3		
	Software			
8.	Mass Balance using Simulation approach	CO1, CO3		
9.	Energy Balance using simulation approach	CO1, CO3		
Guidelines for Laboratory Conduction				
• Teacher will brief the given experiment to students with its procedure, observations,				



calculation, and outcome of the experiment.

- Apparatus and equipment's required for the allotted experiment will be provided by the lab assistants using SOP.
- Students will perform the allotted experiment in a group under the supervision of faculty and lab assistant.
- After performing the experiment, students will perform calculations based on the obtained readings and get it verified from the teacher.
- Students will then complete the experimental write up.

# **Guidelines for Student's Lab Journal**

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, results, conclusions, etc.

# **Guidelines for Termwork Assessment**

- 1. Each experiment from lab journal is assessed for 30 marks based on three rubrics.
- 2. Rubric R-1 is for timely completion, R-2 for understanding and R-3 for presentation/journal. Each rubric carries 10 marks.



S. Y. B. Tech Chemical Engineering							
Department Specific Exit Courses (To award Diploma)							
2307223: Chemical Process Safety							
Teaching Scheme:Credit Scheme:Examination scheme:							
Theory:(	02 hrs/week	Theory: 02	In Sem Exam: 20Marks				
Practical	:02 hrs/week	TW: 01	End Sem Exam: 30Man	rks			
			Term work: 50 Marks				
			Total Marks: 100 Mark	S			
Prerequi	site Courses, if any	y: - Basic Chemical Enginee	ring courses				
Course C	bjectives:		1 (1 ) 1 (1	· (1 · 1			
1. 10 1 Encir	ntroduce basic co	oncepts of Industrial safe	ty and their application	ons in Chemical			
	heering.	ated to Industrial Sofety					
$\begin{array}{c} 2. & 10 \text{ Cl} \\ 2 & \text{To d} \end{array}$	eate manpower rea	aled to industrial Safety.	away to avoid the posidor	<b>a</b> ta			
5. 10 de	Outcomes: On con	relation of the course, stude	te will be able to	115.			
Sr No		Course Outcomes	its will be able to-	Ploom's			
51. 110.		Course Outcomes		Βισση δ Γονοί			
CO1	Recognize and a	nalyses safety program and	Create safety culture	3-Apply			
	Recognize and analyses safety program and Create safety culture.						
002	Get acquainted	and interpret the exact ca	uses benind different	2- Interpret			
	accidents in cher	the sum and apply the s	nowledge of industrial				
CO3	Evaluate cause of	ty purpose.	e types and also create	3 Apply			
005	the prevention st	rategy.	s types and also create	З-Аррту			
CO4	Create different	t designs for preventing	incidents and hazard	3-Apply			
	management.						
CO5	Evaluate HAZO	P and risk assessment and pl	an for emergency.	3-Apply			
		Course Content	S:				
Unit 1	Introdu	ction to Process Safety	(L05)	COs Mapped:			
Inter out on a	a of muchana cofeter -	ith moments of maior assider	to, micht ooren alta				
notroloum	e of process safety w	Safety culture storage of	dangerous materials n	lant layout safety			
systems	OSHA incidence	rate EAP EP The accide	ualigerous materials, p.	propagation and			
terminatio	ostra incluence	estion inhalation injection	dermal absorption dos	e versus response			
curves, re	lative toxicity. thre	shold limit values.	dermai absorption, dos	e versus response			
Unit 2	In In	dustrial hygiene	(L05)	COs Manned -			
0		auguran ng Brono		CO2			
Government regulations, identification, evaluation: evaluating exposures to volatile toxicants by							
monitoring, evaluating worker exposures to dusts, evaluating worker exposures to noise,							
estimating worker exposures to toxic vapors.							
Control of toxic chemicals, Storage and handling of flammable and toxic chemical, Runway							
reactions,	Relief system risk	and hazards management.					



Unit 3	Fire, Explosion and Prevention	(L05)	COs Mapped –		
			CO3		
Technolo	gy and process selection, scale of disaster, fire tria	ngle, distinction b	between fires and		
explosion	, definitions of ignition, auto-ignition temperatur	e, fire point, fla	mmability limits,		
mechanic	al explosion deflagration and detonation, confined	explosion, uncon	nfined explosion,		
vapour cl	oud explosions, boiling liquid expanding vapour ex	xplosion (BLEVE)	), dust explosion,		
shock wa	ve, flammability characteristics of liquids and vapou	irs, minimum oxy	gen concentration		
(MOC).	Design to prevent Fires and Explosions: Inerting,	static Electricity,	Explosion proof		
equipmen	Eine and Employer, Ventilation, sprinkler systems	s and Miscellane	eous Design for		
preventing	g Fires and Explosion.				
Unit 4	Hazard Analysis	(L05)	COs Mapped –		
Idontifica	tion process checklists bezord surveys UAZC	D studios sofat	CO4		
Identification process, checklists, hazard surveys, HAZOP studies, salety reviews. Kisk					
unreveale	d failure probability of coincidence event trees and f	ault trees	is, revealed and		
Unit 5	Emergency Preparedness and Planning	( <b>L 05</b> )	COs Manned -		
One 5	Emergency rrepareuless and rianning	(105)	CO5		
Typical e	mergency Plan, On-Site and Off Site Plans, Emergen	cy Control Progra	mme, Emergency		
shutdown	systems, Individual responsibility during emergency.				
Role of computers in safety, Tackling of disasters, Technology and process selection for					
emergenc	y. Prevention of hazard human element				
Reference Books					
1. Daniel	A. Crowl and Joseph F. Louvar, Chemical Process Sa	afety: Fundamenta	ls with		
applications, Prentice Hall, Inc, 1990. 33					
2. P. P. Leos, Loss prevention in process Industries, Vol 1 and 2 Butterworth, 1983					
3. R. W. King and J. Magid, Industrial Hazards and Safety Handbook, Butterworth, 1982					
4. Khulman, Introduction of Safety Science, TUV Rheinland, 1986					
5. W. E. Baker, Explosion, hazards and Evaluation, Elsevier, Amsterdam, 1983					
6. O. P. Kharbanda and E. A. Stallworthy, Management of Disasters and How to Prevent Them.					
Grower 1980					
Suggested List of Laboratory Assignments/ case study:					
Sr.	Assignments/ case study		СО		
No			Manned		

Sr.	Assignments/ case study	CO
No.		Mapped
1.	Case study on most significance accidents.	CO1
2.	Study of MSDS of the chemicals used in the practical's.	CO1, CO2
3.	Study of different types of Fire extinguishers.	CO1, CO2
4.	Determination of Threshold limit value for chemicals by dose response	CO1, CO2
	curve	
5.	Evaluation techniques used to find workers exposure to toxicants.	CO1, CO3
6.	Study of different types of ventilation systems.	CO1, CO3
7.	Study of different types of sprinkler systems.	CO1, CO3
8.	Case study on HAZOP study on one of the unit operations	CO1, CO3



## **Guidelines for Laboratory Conduction**

- Teacher will brief the given experiment to students with its procedure, observations, calculation, and outcome of the experiment.
- Apparatus, software and equipment's required for the allotted experiment will be provided by the lab assistants using SOP.
- In study practical students will collect suitable material from various sources such reference books, journals and will arrange in proper format.
- Students will perform the allotted experiment in a group under the supervision of faculty and lab assistant.
- After performing the experiment, students will perform calculations based on the obtained readings and get it verified from the teacher.
- Students will then complete the experimental write up.

#### **Guidelines for Student's Lab Journal**

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, results, conclusions, etc.

## **Guidelines for Termwork Assessment**

1. Each experiment from lab journal is assessed for 30 marks based on three rubrics.

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