

#### Integral University, Lucknow Department of Chemistry

#### **Study and Evaluation Scheme**

#### Program: M.Sc. Chemistry

Period **Evaluation Scheme** Attributes Per hr/week/sem Sub Total Course S. No. **Course Title** Type of Paper CA Skill Environment Employ Entrepre Gender Human Professional Credit Credits code Ρ ESE Т Total Develop L & Tot. UE TA ability neurship Equality Value Ethics Sustainability ment THEORIES CH401 Physical Chemistry 03 00 20 40 100 3:1:0 ~ 1. **Foundation Course** 01 40 60 4 ~ 2. CH402 Inorganic Chemistry **Foundation Course** 03 01 00 40 20 60 40 100 3:1:0 4 ✓ ~ 3. CH403 Organic Chemistry **Foundation Course** 03 01 00 40 20 60 40 100 3:1:0 4 ~ ~ ~ ~ 4. CH404 Environmental Chemistry Core 03 01 00 40 20 60 40 100 3:1:0 4 √ √ ✓ ~ √ Modern Analytical 5. ✓ ✓ ✓ CH405 Core 03 01 00 40 20 60 40 100 3:1:0 4 Techniques CH419 Chemistry Lab Practicals-I 100 ✓ √ 6. Core 00 00 08 40 20 60 40 0:0:4 4 ~ ~  $\checkmark$ Total 15 05 08 240 120 360 240 600 24 24 Semester: Second Period Attributes **Evaluation Scheme** Per hr/week/sem Sub Total Course CA S. No. **Course Title** Type of Paper Skill Environment Gender Human Professional Credit Employ Entrepre . Credits code Ρ Total ESE Develop L т & Tot. ΤА UE ability neurship Value Ethics Equality ment Sustainability THEORIES

11120																		
1.	CH408	MIMA & Computational Techniques	Core	03	01	00	40	20	60	40	100	3:1:0	4	~	~	~	$\checkmark$	~
2.	CH409	Chemistry of Natural Products	Core	03	01	00	40	20	60	40	100	3:1:0	4	~	✓	~	$\checkmark$	
3.	CH411	Pharmaceutical Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4	✓	~	~	$\checkmark$	
4.	CH420	Surface Chemistry and Electrochemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4	~		~	$\checkmark$	
5.	CH421	Coordination and Organometallic Chemistry of Transition Elements	Core	03	01	00	40	20	60	40	100	3:1:0	4	~	~			
6.	CH422	Chemistry Lab Practicals-II	Core	00	00	08	40	20	60	40	100	0:0:4	4	~	$\checkmark$	~	$\checkmark$	$\checkmark$
		Total         15         05         08         240         120         360         240         600         24         24																

L= Lecture, T= Tutorial, P = Practical, CA= Continuous Assessment, UE= Unit Exam. TA= Teacher's Assessment, ESE= End Semester Examination;

Sessional=CT+TA; Subject Total= Sessional+ESE;

Semester: First

## Integral University, Lucknow Department of Chemistry

# Study and Evaluation Scheme

Program:	M.Sc.	Chem	istry
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**Semester: Third** 

S. No				Per	Period hr/week	/sem		Eval	uation So	heme	Sub						Attri	ibutes		
S. No.	Course code	Course Title	Type of Paper	L	т	Р	UE	са ТА	Total	ESE	Tot.	Credit	Total Credits	Employ ability	Entrepre neurship	Skill Develop	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics
THEC	DRIES								1						1	ment	1	Justamability		
1.	CH501	Polymer Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4	<b>√</b>	✓	✓			1	✓
2.	CH513	Organic reaction, Reagents & Heterocyclic Chemistry	Core	03	01	00	40	20	60	40	100	3:1:0	4	~		~		~		
3.	CH514	Chemical Kinetics and Chemical Equilibrium	Core	03	01	00	40	20	60	40	100	3:1:0	4	~		~		~		
4.	CH515	Inorganic Reaction Mechanism and catalysis	Core	03	01	00	40	20	60	40	100	3:1:0	4	~	~	~		~		
-	CH516	Quantum Chemistry and Molecular Spectroscopy	Electivo	02	01	00	40	20	60	40	100	2.1.0	4	~		~		~		
э.	CH506	Bioinorganic & Supra molecular Chemistry	Elective	03	01	00	40	20	60	40	100	3:1:0	4	~	~	~				
6.	CH517	Industrial Chemistry Practicals-3	Core	00	00	08	40	20	60	40	100	0:0:4	4	✓	✓	✓		$\checkmark$		
			Total	15	05	08	240	120	360	240	600	24	24							
Sem	ester: F	ourth																		
				Per	Period hr/week	/sem		Eval	uation So	heme	Sub						Attri	ibutes		
S. No.	Course code	Course Title	Type of Paper		т	р	(	CA	Total	FSF	· ·	Credit	Total Credits	Employ	Entrepre	Skill Develop	Gender	Environment	Human	Professional
				-			UE	TA	Total	LJL	Tot.			ability	neurship	ment	Equality	Sustainability	Value	Ethics
THEC	ORIES								-											
1.	CH518	Molecular Spectroscopy and Spectral Techniques	Core	03	01	00	40	20	60	40	100	3:1:0	4	~					~	~
2.	CH509	Green Chemistry												~	✓	~		~		
3.	CH519	Computational Methods in Chemistry	Elective	03	01	00	40 20 60 40 100	100	3:1:0	4	~		~		~	~				
4.	CH520	Seminar	Core	00	00	04	00	00	00	100	100	0:0:2	2			$\checkmark$				✓
5.	CH521	* Project Training & Evaluation	Core	00	00	00	00	00	00	300	300	10	10	✓	✓	✓	I	✓	✓	✓

02 80 120 480 600 Total 06 04 20 L= Lecture, T= Tutorial, P = Practical, CA= Continuous Assessment, UE= Unit Exam. TA= Teacher's Assessment, ESE= End Semester Examination;

40

Sessional=CT+TA; Subject Total= Sessional+ESE;

\*The Evaluation scheme for the Project Training:

20

Course Title	Course Code	Dissertation	Presentation	Viva/Discussion	Total
Project Training & Evaluation	CH521	200	50	50	300

# <u>SYLLABI</u> <u>SEMESTER – I</u>

1. Nam	ne of the Departmen	it: Chemistry		•						
2. Cou	rse Name	PHYSICAL CHEMISTRY		L		Т			Р	
3. Cou	rse Code	CH401		3		1			0	
4. Type	e of Course (use tick	mark)		Core	e ()	DE (	)		FC ( √	)
5. Pre-	requisite (if any)	B.Sc. with Chemistry	6. Frequency (use tick marks) Even ()	Odd	( <b>√</b> )	Either 9	Sem()	E	verv Se	em ( )
7. Tota	I Number of Lecture	es. Tutorials. Practicals			<u> </u>					( )
711000	lectu	ires = 30	Tutorials = 10			Practica	l = Nil			
0.001						· · · · · · · · ·				. 6
8. COU	a from Chomistry to	history information tachnology	course is to impart basic and fundamental knowled	uge of privs	ical chen	he course t	ppilea li	n almo	st all th	e neids
Startin	foundation to take u	biology, information technolo	by as well as the engineering. After the successit	iny complet		ne course, i	ne stud	ients a	re prov	lueu a
sound		p Ph.D. course in the luture.								
9. COUI	RSE OUTCOIVIES (CO)	): completion learners will develo	an fallowing attributory							
			op jonowing attributes.							
COOR										
	01	Students would analyze the id	ealized version of a gas, a perfect gas and shows ho	w its equat	ion of sta	ates may be	assemb	bled ex	perime	ntally.
	02	Students would able to develo	p the concept of conservation of energy; assess the	e energy cha	anges du	ring physica	i and cr	iemical	proces	ss.
	603	Students would differentiate b	petween spontaneous and non-spontaneous proces	s and unde	rstand h	ow Gibbs fre	e energ	gy is rel	ated to	)
		maximum non-expansion wor	K.							
	CO4	Students would explore the ra	te of chemical reactions and analyzed how rate of a	a chemical r	eaction i	s varying wi	th chan	ge of c	oncent	ration,
		pressure and temperature.			0 11					
	CO5	Students would develop the co	oncept of photochemistry and get inside of Lamber	t-Beer Law,	Grothus	– Drapper I	aw, Sta	rk – Eir	istein la	aw,
		quantum Efficiency and its det	ermination.							
10. Un	it wise detailed cont	tent								
Unit-1		Number of lectures = 08	Title of the unit: Properties of Gases							
The state	es of gases, gases lav	vs and deviation from ideal bel	navior, Vander Waals equation of state; Critical Phe	nomena: P\	V isother	ms of real g	ases, co	ontinuit	y of sta	ites,
the isoth	nerms of van der Wa	als equation, relationship betw	een critical constants and vander Waals constants,	the law of o	correspo	nding states	, reduce	ed equ	ation o	fstate.
Qualitat	ive discussion of the	Maxwell's distribution of mole	cular velocities, collision number, means free path	and collisio	n diamet	er.				
Unit-2		Number of lectures =08	Title of the unit: Classical Thermodynamics							
System a	& surroundings, inte	nsive and extensive properties	s, State and path functions and their differentials,	Thermodyn	iamic pro	ocesses, cor	ncept of	heat a	and wo	rk. First
Law of 1	Thermodynamics; St	atement, definition of interna	l energy and enthalpy, Heat capacity, heat capaci	ties at con	stant vo	lume and p	ressure,	, Joule'	s law -	- Joule-
Thomso	n coefficient and inv	ersion temperature. Second La	w of Thermodynamics: Entropy as a state function,	entropy as	a functi	on of V & T,	entrop	y as a f	unctior	۱ of P &
T, entro	py change in physica	l change, clausius inequality, er	ntropy as a criteria of spontaneity and equilibrium,	Equilibrium	change	in ideal gase	es and m	nixing c	of gases	i,
Maxwell	's relations.									
Unit-3		Number of lectures = 08	Title of the unit: Entropy and Free energy							
Gibbs fu	nction (G) and Helm	hotz function (A) as thermodyn	amic quantities, A & G as criteria for thermodynam	ic equilibriu	um and s	pontaneity,	their ac	dvantag	ge over	
entropy	change,VariationofG	and A with P, Vand T. Nerns the att	heorem, statement and concept of residual entropy. Ch	nemicalPote	entialand	partialm ola	rprope	rties:		
Gibbs-D	uhem equation, cond	cept of fugacity and its determi	nation.							
Unit-4		Number of lectures = 08	Title of the unit: Chemical Kinetics							
Rate of a	a reaction, factors inf	fluencing the rate of a reaction	; mathematical characteristics of simple chemical re	eactions – z	ero orde	r, first orde	r, secon	d orde	r, pseud	do
order,ha	lflifeandmeanlife,De	etermination of the order of reaction of the second s	on-differentialmethod, methodofintegration, me	odofhalflife	periodar	ndisolationm	nethod.		-	
Radioact	tive decayas a first o	rder phenomenon, Theories of	chemical kinetics: effect of temperature on rate of	reaction, A	rrhenius	equation, c	oncept	of activ	ation e	energy.
Unit-5		Number of lectures = 08	Title of the unit: Photochemistry							
Interacti	on of radiation with	matter, difference between t	hermal and photochemical processes. Laws of ph	otochemist	rv: Groth	nus – Drapp	er law.	Stark -	– Einste	ein law.
Jablonsk	i diagram depicting	various processes occurring i	the excited state. Lambert-Beer Law: quantum	Efficiency a	nd its d	eterminatio	n. Oual	itative	descrip	otion of
fluoresc	ence, phosphorescer	nce, non- radiative processes (i	nternal conversion, intersystem crossing), photoser	sitized read	ctions – e	energy trans	fer prod	cesses	simple	
example	s), Kinetics of Photo	chemical reaction. (Hydrogen-	Bromine, Hydrogen-Chlorine, Decomposition of Hydrogen-Chlorine, Decomposition of Hydrogen-Chlorine, Decomposition of Hydrogen (1997)	drogen Iodi	de and k	inetics of Di	merizat	ion of A	Anthrac	cene).
11. CO-F	PO mapping									
00		۸+	tributos	PO1	PO2		PO5	POG	PO7	POS
	Students would an	aluza the idealized version of a	and a perfect ass and shows how its equation of	101	102	105 104	105	100	107	100
CO1	statos may bo asso	mbled experimentally	gas, a perfect gas and shows now its equation of	3	2	2	1	3	3	3
	States may be asse	le te develor the concert of co	near stion of onergy process the energy changes				-			
CO2	during physical app	le to develop the concept of co	iservation of energy; assess the energy changes	3	2	2	1	2	2	2
	Ctudents would dif	forentiate between coestance	us and non-spontaneous process and understand				-			
CO3	bow Gibbs from one	rerentiate between spontaneo	as and non-spontaneous process and understand	3	2	3	1	3	2	3
					_	-	_	-		_
CO4	Students would exp	plore the rate of chemical react	cions and analyzed now rate of a chemical reaction	3	2	3	1	3	3	2
	is varying with that	nge of concentration, pressure			-	-	-	-	-	
CO5	Students would de	velop the concept of photoche	mistry and get inside of Lambert-Beer Law, Grothus	5- 3	2	1	1	3	2	1
	Drapper law, Stark	– Einstein law, quantum Eπicle	ncy and its determination.		-	-	-	•	-	
	3 S <sup>-</sup>	trong contribution, 2 Average	contribution , 1 Low contribution							
12. Bri	ef description of self	f-learning / E-learning compon	ent							
1. http:	://home.iitk.ac.in/~g	tm/thermodynamics/ui/TOC.h	tm							
2. http:	s://nptel.ac.in/cours	es/115103113/								
3. http:	s://nptel.ac.in/conte	nt/storage2/courses/1221010	01/downloads/lec-27.pdf							
4. http:	://www.cdeep.iitb.a	c.in/webpage_data/nptel/Core	%20Science/Engineering%20Chemistry%201/TOC-	mainM6.htr	n					
5.	https://www.you	tube.com/watch?v=SgTuWj9Tj	80							
13. Boo	ks recommended:									
1.	Physical Chemistr	y, P.W. Atkins,ELBS								
2.	Thermodynamics	<ul> <li>– J. Rajaram and J.C. Kuriacose</li> </ul>	<ul> <li>EducationalPublishers.</li> </ul>							
3.	Quantum Chemis	try – Eyring, Walter,Kinball								
4.	Statistical Physics	(Part I) (Course of Theoretical	Physics Vol. 5) – L.D. London. & E.M. Lefshitz Perga	nion Zpress,	London.					
5.	Principles of Phys	ical Chemistry by Puri, Sharma	andPathan.							

1. Name o	of the Departm	ent: Chemistry		-		-						
2. Course	Name			L		Т		Р				
3. Course	Code	CH402				3		1		0		
4. Type of	Course (use ti	ck mark)			(	Core ()	0	DE ( )		FC (√	)	
5. Pre-req	quisite (if any)	B.Sc. with Chemistry	6. Frequency (use tick marks)	Even ()	0	dd ( √ )	Eithe	r Sem ( )	E	very Se	m ( )	
7. Total N	umber of Lect	ures, Tutorials, Practicals										
Lectures =	= 30		Tutorials = 10		Practica	al = Nil						
8. COURSE	E OBJECTIVES:	The purpose of this course is	to develop the deep understanding of	general charact	teristic p	properties of	of transitio	n eleme	nts, nor	nenclat	ure and	
isomerism	in coordinatio	on compounds, organometallic	chemistry of transition elements, bioi	norganic chemi	stry and	d process in	human ai	nd to gair	i the kn	owledge	e of	
basics of ir	nstrumental sp	ectroscopic techniques.										
9. COURS	EOUTCOMES	(CO):										
After the su	ICCESSFUL COURS	e completion, learners will de	velop following attributes:									
		Students will be able to under	AI	inibules	fundam	ontal with (		AOT and	its wide	coroad		
c	01	applications.	stand the approaches to the developin		iunuam				its wide	spieau		
		Students will have a firm four	dation in the IUPAC nomenclatures of	the complexes	and und	derstand te	chnical lite	erature re	elated t	o the		
C	:02	discipline.		·								
		Students will be able to know	about the key concepts of inorganic ar	nd organometa	llic cher	nistry inclu	ding those	related t	o synth	iesis, rea	action	
cos chemistry, and structure and bonding.												
Students will be able to understand the metal component in protein structure and molecular modeling, including the use of the computer											er	
	program. Transport mechanisms across cell memoranes.											
c	Students will be able to understand the basic and advanced instrumental techniques used in inorganic synthesis including spectroscopic and											
10 Unit w	vise detailed co	ntent		icx molecules.								
Unit-1	ise detailed et	Number of lectures = 08	Title of the unit: Coordination Com	pounds								
General cha	racteristic pro	perties of transition elements.	Werner's theory. Effective atomic nun	ber. Shapes of	d orbit	als. Bondin	z in transi	tion meta	al comp	lexes: V	alence	
bond theory	y, Crystal field	theory; Octahedral complexes	, effects of crystal field splitting, tetrah	edral distortion	of octa	hedral com	plexes (Ja	hn-Teller		,		
Distortion),	Square planar	arrangements, tetrahedral co	mplexes, chelates, magnetism, Molecu	lar orbital theo	ry.							
Unit-2		Number of lectures =08	Title of the unit: Nomenclature And	Isomerism In (	Coordin	ation Comp	ounds					
Nomenclatu	ure of co-ordin	ation compounds, isomerism i	n coordination compounds; Polymeriza	ation, Ionizatior	n, Hydra	ite, Linkage	Coordina	tion, Coc	ordi nati	ion posi	tion	
isomerism.	Stereoisomeris	sm; Geometrical and optical is	omerism. Metal carbonyls, metal cluste	ers and sandwid	ch comp	ounds.						
Unit-3		Number of lectures = 08	Title of the unit: Organometallic Ch	emistry Of Trar	nsition E	lements						
Ligand hapt	icity, electron	count for different types of or	ganometallic compounds, 18 and 16 el	ectron rule exce	eptions,	synthesis,	structure	and bond	ling, org	ganome	tallic	
reagents in	organic synthe	sis and in homogeneous catal	ytic reactions (Hydrogenation, hydrofo	rmylation, isom	nerisatio	on and poly	merisation	1).				
Unit-4		Number of lectures = 08	If the of the unit: Bioinorganic Chem	istry	•:	:						
Biomorganic	c chemistry: pr	iotosystems, porphyrins, meta	incenzymes, oxygen transport, electro		uons; n	itrogen fixa	tion, meta	ii comple	xes in n	neuicine	:.	
Unit-5		Number of lectures = 08	Title of the unit: Characterization O	Inorganic Con	npound	s	· .	<u> </u>				
Characteriza	ation of inorga	nic compounds by IR, Raman,	NMR, EPR, Mossbauer, UV-Vis, NQR, N	IS, electron spe	ectrosco	py and mic	oscopic t	echnique	s			
11. CO-PO n	mapping											
COs			Attributes		PO1	PO2 PO	3 PO4	PO5	P06	P07	PO8	
CO1	Students will	be able to understand the app	proaches to the development of d block	< Comparison of the second sec	3	1 1		2	1			
	fundamental	with CFT/VBT/MOT and its wi	de spread applications.									
CO2	Students will	have a firm foundation in the	IUPAC nomenclatures of the complexe	s and	3	2 1		2	2			
			ne discipline.									
CO3	Students will	be able to know about the key	concepts of inorganic and organomet	allic	3	2 2		2	2			
	Chemistry inc	he able to understand the me	tal component in protoin structure a	na bonaing.								
604	modeling inc	Juding the use of the compute	ar program and transport mechanisms		3	2 2		2	2		1	
04	membranes.	adding the use of the compute				-   -		-	-			
	Students will	be able to understand the bas	ic and advanced instrumental techniqu	ies used in								
CO5	inorganic syn	thesis including spectroscopic	and analytical techniques for identification	ition and	3	2 1		2	2			
	characterizat	ion of complex molecules.										
		3 Stro	ng contribution, 2 Average contribution	on , 1 Low conti	ribution	1						
12. Brief d	lescription of s	self-learning / E-learning com	ponent									
1. https:/	//freevideolect	cures.com/course/3412/co-or	dination-chemistry									
2. http://	/www.chem.uw //potal.ac.in/or	vimona.edu.jm/courses/IC10K	iso.pdf									
<ol> <li>nttps://</li> <li>https:////integrationalized.com/linearized.com</li></ol>	//nptel.ac.in/co	Durses/104101091/										
5. http	s://nptel.ac.in/	/content/storage2/nptel data	3/html/mhrd/ict/text/104106074/lec2	4.pdf								
13. Books	recommended	l:										
1. F. Alb	oert Cotton, Ge	offery Wilkinson, Carlos A. Mu	urillo and Manfred Bochmann. Advance	d Inorganic che	emistry,	Sixth editio	n, Wiley	ndia Pvt.l	td.			
2. J. D. L	Lee, Concise In	organic Chemistry, Fifth editio	n, Wiley India Pvt.Ltd.									
3. JHHu	uheey, Inorgan	ic Chemisry - Principles, struct	ture and reactivity, Harper and Row Pu	blisher, Inc. Ne	w York(2	1972).						

1. Name of	the Departme	nt: Chemistry											
2. Course Na	ame	ORGANIC CHEMISTRY		L			т		Р				
3. Course Co	ode	CH403			3			1		0			
4. Type of C	ourse (use tic	k mark)			Core (	)	DE	:()		FC (√	)		
5 Pre-requi	isite (if any)	B Sc with Chemistry	6 Frequency (use tick marks)	Even ()	bbO	<b>)</b>	Fithe	()	F	verv Se	, em ()		
7 Total Nur	where of least up	D.St. With Chemistry	o. Trequency (use tick marks)	LVen ()	Ouu	v)	Little	Jenn ()		very Je	()		
7. Total Nur	mber of Lectur	es, lutoriais, Practicais											
Lectures = 3	30		Tutorials = 10		Practical = N	11							
8. COURSE 0	OBJECTIVES: S shift and mini	tudents will be able to gain know mize environmental pollution th	rledge of Generation, stability and rough without use of solvents co	reactivity of in incepts of ster	termediates, eochemistry	Name r of acycl	eactions. ic & cycli	pericycli ic compo	c react ounds, s	ions, co stereo (	ncerted chemica		
properties a	and their applic	cations.											
9. COURSE	OUTCOMES (	CO):											
After the succ	cessful course	completion, learners will develop	o following attributes:										
COURSE OUT	COME (CO)		A	TTRIBUTES									
C	201	Analyze and compare reactivity	and stability of carbocations, carb	anions, free rac	licals, carben	es, nitre	nes and b	penzynes	and ac	dition			
0	:02	Comprehension of types of Orga	anic reaction mechanisms involving	g elimination ar	nd substitutio	on reacti	ons with	electropl	hilic,				
		nucleophilic or radical species.	- <b>C</b> N I	•									
C	.03	Able to evaluate different types	of Name reactions and its mechar	iism.									
C	:04	Know about Pericyclic reactions, rearrangement.	, types of Pericyclic reactions, ster	eochemistry, th	ermal and pl	notoche	nical cycl	lisation, (	Cope ar	nd Clais	en		
C	:05	Understand the Principles of ste stereogenicity, stereoselectivity,	reochemistry, Configurational and , enantioselectivity and diastereos	conformationa electivity.	al isomerism	in acycli	c and cyc	lic compo	ounds,				
10. Unit wis	se detailed cor	itent											
Unit-1		Number of lectures = 08	Title of the unit: Reactive inter	mediates									
Generation, s	eneration, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and benzynes. Organic reaction mechanisms involving addition reactions it electrophilic, nucleophilic or radical species												
Unit 2			Title of the unit. Depatien most	and and and Ma		_							
Unit-2		Number of lectures =08	Title of the unit: Reaction mech	anisms and Na	me reaction	S							
Organic react	ion mechanisn	ns; involving, elimination and sub	stitution reactions with electrophi	lic, nucleophilic	c or radical sp	ecies. N	eighbour	ing grou	p partic	ipation	,		
elimination: E	2 vs E1, elimir	ation vs substitution. Aldol conde	ensation, Cannizzaro reaction, Hof	mann, Beckma	nn and Fries	rearrang	ements,	Reimer-T	iemanı	n reactio	on.		
Unit-3		Number of lectures = 08	Title of the unit: Name reaction	S									
Reformatsky a Meerwein-Po	and Grignard r onndorf Verley	eactions, Michael addition, Fried reduction and birch reduction, hy	el-Crafts reaction, Witting reactior droboration-oxidation, oxymercu	, Oppenaur oxi ration and deo	dation, Clem symercuration	mensen n.	reductio	n, Wolff-	Kishnei	r reduct	ion,		
Unit-4		Number of lectures = 08	Title of the unit: Pericyclic. Elec	trocyclic. Cyclo	addition rea	ctions a	nd Sigma	tropic re	arrange	ements			
Pericyclic read	ctions: Introdu	ction, $\pi$ molecular orbital of ethy	lene and 1.3-butadiene. Electrocy	lic reactions: lu	ntroduction.	stereoch	emistry f	or the ri	ng oper	ning and	d ring		
closing oloctro	ocyclic roactio	ns, thermal and photochomical of	clication of $(4n)$ and $(4n+2)$ system	o Cycloadditio	n roactions: I	ntroduc	ion Thor	mal and	nhotocl	homical	1		
closing electro						ntiouuc	.1011, 11101	illai allu	μποτοτι	lienncai	·		
induced (2+2)	) and (4+2) cyc	loaddition reactions. Sigmatropic	rearrangements: Introduction, cla	ssification, Cop	e and Claise	n rearrai	igement.	•					
Unit-5		Number of lectures = 08	Title of the unit: Principles of st	ereochemistry									
Configuration	al and conforr	national isomerism in acyclic and	cyclic compounds; stereogenicity,	stereoselectivi	ty, enantiose	lectivity	and dias	tereosele	ectivity.				
11. CO-PO ma	apping												
0		Δttri	hutes		PO1 PO	PO3	PO4	PO5	POG	PO7	POS		
003				P I.	101 102	. 105	104	105	100	107	100		
CO1	Analyze and c carbenes, nit radicalspecies	compare reactivity and stability of renes and benzynes and additic 5.	r carbocations, carbanions, free rais on reactions with electrophilic, no	ucleophilic or	3 1	2	1		2	2	2		
	Comprehensi	on of types of Organic reaction m	echanisms involving elimination a	nd		-							
CO2	substitution r	eactions with electrophilic, nucle	ophilic or radicalspecies		3 1	2	1		2	2	2		
	Substitution		oprime of rudicuspecies.			_			-	-			
CO3	Able to evaluate	ate different types of Name react	ions and its mechanism.		3 1	2	1		2	2	2		
CO4	KnowaboutPe emical cyclisa	ricyclicreactions, types of Pericyclicre tion, Cope and Claisen rearranger	eactions, stere och em istry, thermalan ment.	dphotoch	3 1	2	1		3	3	2		
	Understand +	he Principles of storoochomistry	Configurational and conformation	al isomorism									
	in accelia and	avalia associate at a star a sta		di isoniensin					-	-			
CO5	in acyclic and	cyclic compounds, stereogenicity	, stereoselectivity, enantioselectiv	ity and	3 1	2	1		2	2	2		
	diastereosele	ctivity.											
		3 Strong o	contribution, 2 Average contribut	on , 1 Low con	tribution								
12. Brief de	scription of se	If-learning / E-learning compone	nt										
1 https://u	nntel ac in/cou	urses/104105104/											
2 https://i	nptel.ac.in/cou	rses/104101005/											
3. https://	notel ac in/cou	urses/104103023/											
4 https://u	nntel ac in/cou	rses/104106077/											
5. https://	//nptel.ac.in/c	content/storage2/courses/104102	3071/pdf/mod8.pdf										
13. Books rec	commended		71 7 FFF										
1 01						(iles 1st		Dublinet					
1. Advance	ed Organic Che	emistry (Reactions, Mechanisms a	the Structure): Michel B. Smith and	Jerry March, 4	full Edition, V	viley Inte	erscience	rublicati	on.				
2. A Guide	Charriet	Packart Thornton Manistry by Pe	eter sykes, six edition, Pearsonpub	hottochering C	ou on the sector	De De c	opentit	otica					
5. Organic	Chemistry by	Robert Inornton Morrison, Robe	nt ivelison Boyd, and Salbai Kanti B	nattacharjee, S	eventh ealtic	m, Pears	onpublic	ation.					
4. Organic	Chemistry by	Jonathan Clayden, Nick Greeves,	and Stuart warren, Second editio	n, OxfordPublic	ation.								
5. Organic	: Chemistry by III Sinar Volume 1 & 2. Sixth edition, PersonPublication												

1. Name of the	e Department: C	hemistry											
2. Course Nam	e	ENVIRONMENTAL CHEN	MISTRY		L		Т			Р			
3. Course Code	9	CH404			3			1		0			
4. Type of Cou	rse (use tick ma	rk)		C	ore ( √ )	)	DE	=()		FC ( )			
5. Pre-requisit	e (if any)	B.Sc. with Chemistry	6. Frequency (use tick marks) Even ()	C	Odd ( √ )		Either	Sem ( )	Ev	very Ser	n()		
7. Total Numb	er of Lectures, T	utorials, Practicals											
Lectures = 30			Tutorials = 10	Practic	cal = Nil								
8. COURSE OB	JECTIVES: The m	ain objectives of this course	e is to study various types of pollutants, their sou	irces, eff	fects on	living	and non	living s	pecies	and rela	ated		
control measu	res.												
9. COURSE OU	TCOMES (CO):		<b>. .</b>										
After the succes	sful course com	pletion, learners will develo	p following attributes:										
COURSE OUTCO	ME (CO)		ATTRIBUTES										
co:	L Ev	valuate different types of air arming, Green House Effect	pollutants, their harmful effects on living and n and Ozone Layer Depletion.	on living	species	s, their	control	measur	es; Stu	dy of Gl	obal		
coa	2 Ar	nalyze the various factors of ater treatment processes.	water quality assessment parameters, water po	ollutants	and the	eir sour	ces and	differe	nt type:	s of was	te		
CO	<b>3</b> Ui	nderstand the importance o	f soil composition; Analyze various types of soil	pollutan	ts, their	r contro	ol and re	elated st	tandard	s.			
CO4	1 Ev	valuate the various types of	waste and their toxicity aspects and manageme	nt.									
CO	5 Ui	nderstand the sources of he	avy metals and their health hazards										
10. Unit wise o	10. Unit wise detailed content												
Unit-1	Init-1         Number of lectures = 08         Title of the unit: Air pollutants												
CO, CO2, ozone, pollutants, inter	, CO2, ozone, CFC, & NOx, ozone depletion, global warming, Harmful effects of pollutants on living and non-living species, Analytical methods for monitoring air Ilutants, international and national standards.												
Unit-2	n	lumber of lectures =08	Title of the unit: Physical, chemical and biolo	gical wa	ter qua	lity pa	rameter	rs					
Physical, chemic	Init-2         Number of lectures =08         Title of the unit: Physical, chemical and biological water quality parameters           ysical, chemical and biological water quality parameters; their assessment; Water pollution; water pollutants; toxicity aspects; international and national standards;												
control; Water s	ampling techniq	ues; Water treatment proce	esses: aeration, solid purification, nanofiltration,	chemica	al treatr	nents,	reverses	s osmos	is, desa	linatior	า.		
Waste water tre	atment processe	es. Water table maintenance	e & harvesting methods.										
Unit-3	1	lumber of lectures = 08	Title of the unit: Composition of soil										
Inorganic and or aspects; interna	ganic componer tional and natior	nts, micro and macronutrien nal standards; control.	ts; Soil pollution; Fertilizers, insecticides, pestici	des, plas	stics, to	xic met	als, dye:	s, surfa	ctants;	toxicity			
Unit-4	Γ	lumber of lectures = 08	Title of the unit: Industrial waste										
Toxic aspects, m	anagement and	disposal; Radioactive, muni	cipal, agricultural and biomedical waste – toxici	y hazaro	ds. Bhop	oal gas	tragedy	, Cherno	obyl dis	aster.			
Unit-5		Number of lectures = 08	Title of the unit: Heavy metal in the environr	nent									
Sources of heav	y metals; Poison	ing of heavy metals in every	bite; Mercury, Copper, Chromium, Cadmium, C	obalt, Le	ead, Ars	enic.							
11. CO-PO map	oing												
COs		Attribut	tes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8		
C01	Evaluate different species, their co	ent types of air pollutants, ontrol measures; Study of G	their harmful effects on living and non living Global Warming, Green House Effect and Ozone	3	2	3	3	3	3	3	2		
CO2	LayerDepletion Analyze the var	ious factors of water quality	y assessment parameters, water pollutants and	3	2	3	3	3	3	3	2		
СОЗ	their sources ar Understand the	importance of soil composi	water treatmentprocesses. ition; Analyze various types of soil pollutants	3	1	3	3	3	3	3	3		
<u> </u>	their control an	d relatedstandards.	air toxicity aspects and management	2	2	2	2	2	2	2	2		
C04	Understand the	sources of heavy metals an	ind their health hazards.	3	2	3	3	2	3	3	2		
	3 Strong	contribution 2 Average co	ontribution 1 low contribution	- 1		-	1	-	-				
12. Brief descr	intion of self-lea	arning / F-learning compone	ent										
1 https://ppte	Lac in/content/s	storage2/courses/10510208	89/air%20pollution%20(Civil)/Module-1/2 htm								_		
2. https://www	v.youtube.com/v	watch?v=xw9FPlq0sJ8											
3. https://wwv	v.youtube.com/v	watch?v=7kizaNBowrw											
4. https://www	v.youtube.com/v	watch?v=dnQjYXXX17A											
5. https	://www.ukessay	vs.com/essays/environment	al-sciences/the-issue-of-heavy-metals-contamin	ation-er	nvironm	iental-s	ciences	-essay.p	hp				
13. BOOKS reco	ommended:	inter Manahar Charles 5 00											
1. Envir	Concepts of En	vironmental Chemistry Deel	JU4, Taylor & Francislia.										
3. Envir	onmental Chem	istry: A Global Perspective.	Gary W. Vanloon Stephen J. Duffy . Oxford Univ	Pr(Sd).									
4. Intro	duction To Envir	onmental Chemistry, Reid, E	Brian J. Blackwell ScienceLtd.	(									
5. Chen	nistry of the Envi	ronment, Thomas G. Spiro,	William M. Stigliani, 2nd Edition, Prentice Hallpu	blication	n.								

1.Name	Name of the Department: Chemistry													
2.Cours	e Name	MODERN ANALYTICAL 1	ECHNIQUES			L			Г		Р			
3.Cours	e Code	CH405				3			1		0			
4.Type of	of Course (use tick n	nark)			Co	ore( √ )		DE	()		FC( )	)		
5.Pre	-requisite(if any)	B.Sc. with Chemistry	6.Frequency (use tick marks)	Even ( )	0	dd (√ )	E	Either S	iem ( )	E١	/erySe	m( )		
7.Total	Number of Lectures	, Tutorials, Practicals												
Lectures	s=30		Tutorials=10		Prac	tical=N	il							
8. COUF spectror	RSE OBJECTIVES: The metry. Make the stu	e course aims at providing dents able to interpret an	knowledge of principles and instru d assign spectroscopic data as a too	mentations of UV, IR, NMR, A I for structural elucidation.	tomic	absorp	otion sp	pectros	copy an	d Mas	SS			
9. COUR	SE OUTCOMES (CO)	:												
After the	successful course co	ompletion, learners will de	evelop following attributes:											
COURS	E OUTCOME (CO)			ATTRIBUTES										
	CO1	Explain the effect of conju spectroscopy as a qualitat absorption of organic com	gation, solvent polarity and non-bc ive and quantitative method. Appli apounds.	nding electrons on a UV/Vis cation of correct Woodward-	absorı Fieser	otion sp rules t	oectrur o calcu	n. Eval Ilate w	uate the aveleng	e utilit th of r	y of U\ naximi	J/Vis um		
	CO2	Comprehension of factors acids, anhydrides, interpre	affecting vibrational, frequencies, set and assign IR spectroscopic data	vibrational frequencies of car as a tool for structural elucid	bonyl ation.	compo	ounds (	ketone	es, aldeh	ydes,	esters	,		
	CO3	Argue how nuclear spins Identify the number of pr spectrum of a compound spectrum to specific proto	are affected by a magnetic field, and oton and carbon NMR signals expo- given its structure, to assign peaks work and carbons in a compound.	nd be able to explain what h ected from a compound give with the aid of a chart of che	appen en its s mical s	is wher structur shifts fr	n radio re, spli om 1H	freque tting p and 13	ncy radi attern ir 3C NMR	ation n the in an	is abso proton NMR	orbed. 1 NMR		
	CO4	Become familiar with the spectrometer and functio mass spectra	mass spectrometric technique, diffens of each. Application of a mass sp	erent types of ionization tech ectrometric technique, distir	nique: Iguish	s and sl fragme	ketch c entatio	compor n meth	nents of Iods. Int	a mas erpret	ss tation	of		
	CO5 Comprehension of principle, instrumentation, interferences and Sample preparation, Applications of AAS													
10.Unit	wisedetailedconten	t												
Unit-1		Number of lectures=08	Title of the unit: UV Spectros	сору										
Wave-like	e propagation of ligh	t, absorption of electroma	ignetic radiation by organic molecu	les allowed and forbidden tra	insitio	ns, inst	rumen	itation,	effect c	of solv	ents o	n		
electronic	c transitions, formati	ion and designation of abs	orption bands, conjugated systems	and transition energies, uns	aturat	ed carb	onyl c	ompou	nds, die	nes ar	nd			
Linit-2	eu polyenes, woodw	Number of lectures= 08	Title of the unit: IR Spectrosc	onv										
Introducti	ion, absorption in t	the infrared region, theor	y of infrared spectroscopy, instru	mentation, molecular vibrat	ions. (	alculat	tion of	vibrat	ional fr	equer	icies, f	factors		
affecting	vibrational frequence	cies, characteristic absorpt	ions in common classes of compou	nds, fingerprint region, chara	acteris	tic vibr	ationa	l frequ	encies o	f alka	nes, al	kenes,		
alkynes, a	aromatic compounds	s, alcohols, ether, phenols	and amines. Detailed study of vibra	tional frequencies of carbon	yl com	pound	s (keto	nes, al	dehydes	s, este	rs, acio	ds,		
anhydride	es), applications of ir	nfrared spectroscopy.												
Unit-3		Number of lectures=08	Title of the unit: NMR Spectro	oscopy										
Introducti	ion, theory of NMR	spectroscopy, Instrumenta	ition, chemical shift, equivalent and	nonequivalent protons, s pi	n-spin	splittin	ig, vicir	nal cou	pling an	d ster	eostru	cture,		
proton ex	change reactions, n	uclear overhauser effect (I	NOE), shift reagents, principle of C-2	13 NMR spectroscopy, Relaxa	ation a	nd dyn	amic p	rocess	es - Spin	lattic	e relax	ation		
(11) and 3	spin - spin relaxation	Number of loctures-08	Title of the unit: Mass Spectra	metry										
Introducti	ion basic theory ins	strumentation important	useful terms in mass spectrometry	various modes of ionization		ED and	I FAR)	and th	eir annli	cation	16			
fragment	ation patterns of var	rious functional groups (al	kanes. alkenes. alkvnes. alcohols. et	her, phenols, amines, ketone	es. ald	ehvdes	. esters	s. acids	and anl	hvdrid	les).			
molecular	r ion peak, metastab	ole peak, Mclafferty rearra	ngements, Nitrogen rule.	· · · · · · · · · · · · · · · · · · ·				,			//			
Unit-5		Number of lectures=08	Title of the unit: Atomic Abso	rption										
Spectroph	hotometry: Introduc	tion, Principle, Instrument	ation, Interferences- Spectral, Ioniz	ation, Physical and Refractor	y com	pound	format	tion, Sa	mple pr	repara	ition,			
Internal s	tandard and standar	rd addition calibration and	applications of AAS.											
11. CO-PC	D mapping		Attuibut on		<b>DO1</b>	<b>DO</b> 2	<b>DO</b> 2	<b>DO</b> 4	DOL	DOC	007	000		
COS	Explain the effect of	f conjugation solvent not	Attributes	a LIV/Vis absorption	104	PUZ	PU3	P04	P05	PU6	PU/	PUS		
CO1	spectrum. Evaluate of correct Woodwa	the utility of UV/Vis spect rd-Fieser rules to calculate	roscopy as a qualitative and quantit wavelength of maximum absorptic	a covy vis absorption tative method. Application on of organic compounds.	3	2	1	1		3	2	2		
CO2	Comprehension of f (ketones, aldehydes structural elucidation	factors affecting vibration s, esters, acids, anhydrides on.	al, frequencies, vibrational frequences, interpret and assign IR spectrosco	cies of carbonyl compounds pic data as a tool for	3	2	1	1		3	2	2		
	Argue how nuclear radiofrequency rad	r spins are affected by a iation is absorbed. Identify	magnetic field, and be able to e the number of proton and carbon	xplain what happens when NMR signals expected from										
CO3	a compound given	its structure, splitting pa	ttern in the proton NMR spectru	m of a compound given its	3	2	1	1		3	2	2		
	structure, to assign	peaks with the aid of a ch	art of chemical shifts from 1H and 1	.3C NMR in an NMR										
	spectrum to specific	c protons and carbons in a	compound.											
CO4	components of a m distinguish fragmen	ass spectrometer and fund ntation methods. Interpret	ctions of each. Application of a mass ation of mass spectra	s spectrometric technique,	3	2	1	1		3	2	2		
CO5	Comprehension of	principle, instrumentation	, interferences and Sample prepara	tion, Applications of AAS	3	2	2	2	1	3	2	2		
		3 S	trong contribution, 2 Average cont	ribution , 1 Low contributior	1									
12.Brief	description of self-	learning /E-learning comp	oonent											
1. http	s://www.youtube.c	om/watch?v=tbUx-RaZS7I	M											
2. http 3 http	s://nptel.ac.in/cours	ses/103108139/ ses/104108078/												
4. http	s://nptel.ac.in/cour	ses/102101050/												
5. http	s://www.youtube.c	om/watch?v=xOKoVOMKI	HN8											
13. Boo	ks recommended:													
1. Intro	oduction to spectros	scopy: Pavia, Lampman &	Kriz, 3rd Ed, Books/cole.											
2. Spec	ctroscopic methods	in organic chemistry: H. W	/illiams and Ian fleminig, V EditionTa	ata Mc Grawhills										
4. Fun	damentals of Analyt	ical chemistry, Douglas A.	Faigrave publications. Skoog, Donald M. West, F. James Ho	oller, 7th edition, Harcourt co	ollege	publica	tions.							

4. Fundamentals of Analytical chemistry, Douglas A. Skoog, Donald M. West, F. James Holler, 7th edition, Harcourt college publications.

1. Name of the De	partment: Cher	mistry									
2. Course Name		CHEMISTRY LAB PRACTICAL	-1		L			т		Р	
3. Course Code		CH419			0			0		8	
4. Type of Course	(use tick mark)				Core (	√)	[	DE ( )		FC (	)
5. Pre-requisite (if	fany)	B.Sc. with Chemistry	6. Frequency (use tick marks) Even	()	Odd (	√)	Eith	er Sem (	)	Every S	iem ( )
7. Total Number o	f Lectures, Tuto	orials, Practicals									
Lectures = 00			Tutorials = 00	Practi	cal = 08						
8. COURSE OBJECT	IVES: To develo	op practical and technical skill	s for better understanding of theory. To dev	elop tran	sferrabl	e skills a	ind enha	ancing co	ommuni	ication s	skills of
students.											
9. COURSE OUTCO	MES (CO):	tion learners will develop fol	llowing attributes:								
COURSE OUTCOME	(CO)	ion, learners will develop joi	ATTRIBUT	FS							
CO1	(00)	Perform accurate and precise	e analysis in the field of industrial chemistry								
(02		Able to examine water qualit	ty parameters (DO, COD, BOD and TDS) and	arguo ah		ar qualit					
C02		Explain the principles of chro	matographic techniques LIV spectroscopy a	angue abo	ity mea	suromo	y. ntc				
CO4		Organize the records of all n	erformed experiments in the manner which		d in lab	oratory	11.5.				
CO4		Analyze the importance of p	erronal safety and care of equipments and c	homicals		oratory.					
10 List of ovnorimo	ntc			Tiernicais							
10. List of experime	ints	ful a state of the									
1. To determine the	percentage con	nposition of the given mixture	e consisting of two liquids A and B by viscosi	tymethod	1.						
2. To determine the	relative surface	tension of a liquid bystalagn	ometer.								
4. Soloctivo oxtractic	n of iron motal	ation from mixture of iron a	copically using water assorvent.	sportivor	oncontr	ration					
5 Paper chromatog	ranhy senaratio	n of metalion	and magnesium for determination of their re	spectived	Juncenti	ation.					
6 Determination of	conner and nick	kel in the givensamnle									
7 Separation of ami	no acid by thinl	averchromatography									
8. Separation of mix	ture of carbohy	drate by thin laverchromatog	rraphy.								
9. Separation of mi	xture of dyes by	y columnchromatography.	, - P								
10. Oxime and 2, 4 c	linitrophenylhy	drazone ofaldehyde/ketone.									
11. Determination o	f Dissolved Oxy	gen (D.O.) in the given waters	sample.								
12. Determination o	f Conductivity o	of the watersample.									
13. Determination o	f Total Dissolve	d Solid (T.D.S.) in the given wa	atersample.								
14. Determination o	f concentration	of KMnO4 by UV-VisibleSpec	ctrophotometer.								
15. Determination o	f iron content ir	n the given water sample by L	JV-VisibleSpectrophotometer.								
16. Determination o	f Chlorophyll in	olive oil by UV-Visible Spectre	oscopy.								
17. Separation of pla	ant pigment fro	m green leaves by columnchr	omatography.								
11. CO-PO mapping											
COs		Attri	ibutes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Perform accura	ate and precise analysis in the	e field of industrial chemistry.	3	2	2	1	3	3	3	2
CO2	Able to examir water quality	ne water quality parameters (	DO, COD, BOD and TDS) and argue about	3	2	3	3	3	3	3	2
CO3	Explain the prin measurements	nciples of chromatographic te 3.	echniques, UV spectroscopy and viscosity	3	2	2	2	3	3	3	2
CO4	Organize the re laboratory.	ecords of all performed exper	riments in the manner which is required in	3	3	2	2	3	1	3	2
CO5	Analyze the im	portance of personal safety a	and care of equipments and chemicals.	3	1	2	2	3	3	3	2
	3 Strong	contribution, 2 Average cont	ribution , 1 Low contribution								
12. Brief description	of self-learnin	ig / E-learning component							. ,		
1. https://w	/ww.fondriest.c	om/environmental-measurer	nents/measurements/measuring-water-qua	lity/disso	lved-ox	ygen-sei	nsors-an	d-metho	ods/		
3. https://w	/ww.voutube.co	om/watch?v=8wmQ_xWqZbo									
4. https://w	/ww.youtube.co	om/watch?v=kXI_Om-2XYk									
5. https://w	/ww.youtube.co	om/watch?v=YBeZZwNSeb8									
7. https://w	/ww.youtube.cc /ww.voutube.cc	om/watch?v=V16USbiKZXw									
13. Books recomme	nded:	,									
1. Advance Practic	al Chemistry: Ja	gdamba Singh, L.D.S Yadav, Ja	aya Singh, I.R. Siddiqui, PragatiEdition.								
2. Practical Organic	c ChemistryA.I.V	/ogel.									
3. Practical Physica	l Chemistry : B.	Viswanathan and P.S.Raghav	van.								
4. Experimental Ind	organic Chemist	try –W.G.Palmer.									

## **SEMESTER-II**

1.Name of	the Departmo	ent: Chemistry		1									
2.Course Na	ame	MODERN INSTRUMENTAL METHODS OF A TECHNIQUES	ANALYSIS AND COMPUTATIONAL		L		т		Р				
3.Course Co	ode	CH408			3		1		0				
4.Type of C	Course (use tio	k mark)		(	Core(√)		DE( )		FC(	)			
5.Pre-requi	isite (if any)	B.Sc. with Chemistry 6.Frequency (us	se tick marks) Even ( v )		Odd ()	Eithe	er Sem (	)	EveryS	em()			
7.Total Nun	mber of Lectu	res, Tutorials, Practicals											
Lectures=30	0		Tutorials=10	Pract	ical=Nil								
8. COURSE	OBJECTIVES:	This course is designed for postgraduate stude	ents of chemistry and industrial chemistry as a	broad	base introdu	iction to	analytic	cal inst	rument	tation			
techniques	for the meas	urement of different chemical and physical pr	roperties of compounds and materials (compo	sition,	structure, e	.c.). After	succes	sfully	comple	tion of			
course, the		ble understand the working principal and app	dications of various modern analytical techniq	ues as v	well as their	operatio	n.						
After the suc	cessful course	completion. learners will develop following	attributes:										
COURSE OU	TCOME (CO)		ATTRIBUTES							_			
cc	01	Students would able to analyze the data by ap	pplying different type of statistical methods ar	id woul	d also undei	stand th	e differ	ent bet	tween				
		systematic and random errors.	emietry and recognize the electrophemical are		Thou got co	und incia	lo of dif	foront	turne of	c			
CC	02	polarographic and voltammetric methods and	their applications.	cesses.	They got so	una insia	e or ain	rerent	type of				
		Students would develop the concept of therm	nogravimetric analysis, differential analysis and	d differe	ential scanni	ng calori	metry n	nethod	ds and t	heir			
u	03	applications.	2 , ,			5							
	04	Students would restate difference between d	ifferent modes of chromatographic separation	i; apply	knowledge	of qualita	ative an	d quar	ntitative	Ş			
		analysis in various fields of chemical, pharmac	ceutical industry etc.	<u> </u>			<u> </u>						
CO5       Students would able to illustrate how the computer and software are used in analytical laboratory and got springboard for further study.         10.Unit wise detailed content													
10.Unit wise detailed content       Unit-1       Number of lectures=08       Title of the unit: Errors and Evaluation													
Definition of	torms moon a	nd median, presidian, standard deviation, rela	ative standard deviation, accuracy, absolute or	ror rol	ativo orror	tupos of	orror in	ovnori	imontal	Idata			
determinate interval estim	efinition of terms mean and median, precision, standard deviation, relative standard deviation, accuracy, absolute error, relative error, types of error in experimental data, eterminate (systematic), indeterminate (random) and gross, sources of errors and their effects upon the analytical results, statistical evaluation of data-normal distribution, terval estimation, methods of least squares.												
Unit-2	,	Number of lectures= 08 T	itle of the unit: Polarographic Techniques an	d Volta	mmetry								
Polarography	; Theory, Inst	rumentation and its working; Advantages of us	sing dropping mercury electrode, Derivation o	f Ilkovic	equation, F	actors af	fecting	the lim	niting cu	urrent,			
The half wave	e potential, C	iterion of reversibility, Applications of polarog	graphy, Square-wave polarography, Differentia	al pulse	polarograp	ny and cy	clic volt	amme	etry sho	wing			
cyclic voltami	metric excitat	ion.											
Unit-3		Number of lectures=08	Title of the unit: Thermal Methods										
Differential s	metric analysi	s, instrumentation and Applications, Different	liai thermai analysis, General principles and ap	mnens	ated DSC in	strumen	ence to r Heat i	polym flux DS	iers; C instru	ument			
and modulate	ed DSC instru	ment, DSC data analysis and applications.	i searning calorineery, instrantenes, rower ee	mpens		, and a second	, near i		e motre	ament			
Unit-4		Number of lectures=08 T	Title of the unit: Chromatography										
Chromatogra	aphic mechani	sm, Classification of chromatography, principl	les, types, techniques of column chromatogra	ohy and	l techniques	of elutio	n, thin '	layer					
chromatogra	phy, Gas chro	matography, Applications of gel permeation a	and ion exchange chromatography. Introduction	on of HP	PLC, instrum	entation,	reverse	e phase	e HPLC,				
industrial app	plications of H	PLC.											
Unit-5	computor au	Number of lectures=08	Itie of the unit: Computer application		norconnol o	omputor		fturar	o nacka				
introduction	disk operat	ng system and windows text processing s	software introduction to a spreadsheet soft	tware	creation of	snreads	s, PC-sc sheet so	oftwar	e crea	tion of			
spreadsheet	applications,	range, formulas, function, data base function	ns in spreadsheets, graphics on spreadsheet,	present	tation graph	ics, creat	ting a p	resent	ation o	n a PC			
data commu	inications, ne	working: Lan & Wans, software system, sof	ftw are development process, file design &	report d	design, Data	files: ty	pes/org	ganizat	ion, m	aster 8			
transaction fi	ile, relevance	of database management systems and integra	ation of applications, basic of data processing,	flow ch	arting, inpu	t-process	- outpu	it analy	/sis, rep	ort			
generation ar	nd label gene	ration.											
11. CO-PO m	lapping	Attributos		DO1			POF	POG	DO7	DOS			
	Students wo	Id able to analyze the data by applying different	ent type of statistical methods and would also	101	102 10.	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	105	100	10/	100			
CO1	understand t	he different between systematic and random	errors.	3	1 1		2	3	2	3			
CO2	Students eva	luate fundamentals of electrochemistry and re-	ecognize the electrochemical processes. They	3	1 1		1	3	2	3			
	Students we	Id develop the concent of thermogravimetric	analysis differential analysis and differential			+			-				
CO3	scanning cal	primetry methods and their applications.	analysis, unterential analysis and unterential	3	1 1		1	3	2	2			
	Students wo	uld restate difference between different mode	es of chromatographic separation; apply										
CO4	knowledge o	f qualitative and quantitative analysis in vario	us fields of chemical, pharmaceutical industry	3	2 1		2	3	1	2			
	etc.												
CO5	Students wo	uld able to illustrate how the computer and so ard for further study.	offware are used in analytical laboratory and	3	2 1		3	3	1	2			
	8p8	3 Strong contributi	ion, 2 Average contribution , 1 Low contribut	ion		_	- 1						
12.Brief des	scription of s	elf-learning /E-learning component											
1. https://	/www.youtub	e.com/watch?v=HEgl0JyX80U											
2. https://	/www.youtub	e.com/watch?v=d1vv7ww8xtA											
3. https://	/www.youtub /pptol.ac.in/	e.com/watch?v=NzbDEjl8lKE	dE odf										
5. https://	https://mptel.ac.in/content/storage2/courses/102103044/pdi/mod3.pdi https://www.youtube.com/watch?v=Cu_WeVyOaHI												
13. Books r	Books recommended:												
1. Fundam	nentals of Ana	lytical chemistry, Douglas A. Skoog, Donald M	1. West, F. James Holler, 7th edition, Harcourt	college	publications								
2. Principle	les and praction	e of analytical chemistry, F. W. Fifield, D. Keal	ley, 5th edition, Blackwell publication.										
3. Analytic	cal chemistry,	Gary D. Christian, 6th edition, Wiley and sons	publication.										

4. Basic concepts of analytical chemistry, S. M. Kopper, New Age International Publishers.

1. Name o	of the Departme	ent: Cher	nistry										
2. Course	Name	CHEM	ISTRY OF NATURAL PROD	UCTS			L			т		Р	
3. Course	Code	CH4	09				3			1		0	
4. Type of	Course (use tic	k mark)					Core (	/)	C	DE ( )		FC (	)
5. Pre-req	uisite (if any)		B.Sc. with Chemistry	6. Frequency (use tick marks)	Even (√)		Odd (	)	Eithe	r Sem ( )	1	Every Se	em ( )
7. Total N	umber of Lectur	res. Tuto	rials. Practicals					·				,	
Lectures =	= 30		,	Tutorials = 10		Prac	tical = N	il					
		Students	gain the knowledge of sec	ondary plant metabolites such as te	rnenoids alka	loids (	arhohvo	Irates A		rid Pent	ides &	Proteins	
steroids. S	Synthesis and me	edicinal	uses of: caffeine, theophyl	line, theobromine and Phytopharma	aceuticals.	10103, 0	unborryc	nuces, r		ciu, i cpi	iucs a	roteins	' <i>'</i>
9. COURSE	FOUTCOMES (C	<u>:0):</u>											
After the su	ccessful course	complet	tion, learners will develop	following attributes:									
COURSE OU	JTCOME (CO)			AT	TRIBUTES								
C01		Create t Stereoch	he concept of secondary p nemistry, constitution and	lant metabolites; terpenoids and its synthesis of Citral and Menthol.	general meth	ods of	structur	e deteri	minatior	n, isoprei	ne rule;		
CO2		Evaluate exhausti	the general method of iso we methylation, Emde's de	plation, structure elucidation of alka	lloid, specially I).	based	on nitro	gen het	erocyclic	c ring (H	ofmann	's	
CO3		Analyze nucleus	general reactions, constitution of steroids.	ition of glucose & fructose; Conform	nations of mor	nosaccl	naride's.	Stereo	chemistr	y and co	onfigura	tion of t	the
CO4		Know at determi	pout, classification, general nation of structure of poly	method of preparation, properties	and reactions	of ami rv stru	ino acids cture of	, genera proteins	al metho	od of syn	thesis &	§.	
-		Underst	and the Synthesis and med	licinal uses of: caffeine, theophyllin	e. theobromin	e.							
CO5		Phytoph	armaceuticals: Recent dev	elopment and commercialization of	f plant derived	natura	al produ	cts. Stra	tegies fo	or rapid i	denti fi	cation o	of novel
		therape	utic leads from natural pro	ducts.									
Interpreting and a colopination of point and a colopination of point a college of the point and a college of the point and a college of the point a colleg													
CO5       Phytopharmaceuticals: Recent development and commercialization of plant derived natural products. Strategies for rapid identi fication of novel therapeutic leads from natural products.         10. Unit wise detailed content       Number of lectures = 08       Title of the unit: Terpenoids         Introduction, nomenclature, occurrence, general properties, classification, isolation and general methods of structure determination of terpenoids, isoprene rule;         Stereochemistry,constitutionandsynthesisofCitralandMenthol.Carotenoids;Introduction,classification,isolationandgeneralmethodofstructuredeterminationof carotenoids.													
Unit-1         Number of lectures = 08         Title of the unit: Terpenoids           Introduction, nomenclature, occurrence, general properties, classification, isolation and general methods of structure determination of terpenoids, isoprene rule;           Stereochemistry,constitutionandsynthesisofCitralandMenthol.Carotenoids;Introduction,classification,isolationandgeneralmethodofstructuredeterminationof carotenoids.													
carotenoids	S												
Unit-2			Number of lectures =08										
Introduction	n,nomenclature,c	classificat	ion, isolation, physiological ac	ofstructureeluci	dation	ofalkaloi	d,specia	llybased	onnitrog	en			
neterocyclic	c ring (Hotmann	rs exhau	stive methylation, Emde s	od).									
Unit-3			Number of lectures = 08	& Steroids				<u> </u>					
Introduction	i, classification, ge	eneralrea	ctions, constitution of glucose	&fructoseConformationsofmonosac	charide's.Stero	ids;Intr	oduc tio	n,Diel'sh	ydrocarl	oon,			
nomenciatu	ire, stereochem	istry and	Number of lostures - 09	Title of the unit: Amine Acid De	atidos 8 Duoto								
Unit-4	n nomonolaturo	classifia	number of lectures - oo	nite of the unit. Annito Acid, Pe	prices & Proce	roduct	ion occu				onoral		
Introduction	n,nomenciature,	,classific	ation,generalmethodorpre	paration, properties and reactions of	aminoacids.int	roduct	ion,occu	irrenc e	,nomeno	clature,g	eneral		
method of s	synthesis & dete	erminatio	on of structure of polypept	Ides. Primary, secondary, tertiary &	quaternary st	ructure	e or prot	eins.					
Unit-5			Number of lectures = 08	Title of the unit: Phytopharmac	euticals								
Synthesis ar	nd medicinal use	es of; cat	feine, theophylline, theob	romine. Phytopharmaceuticals: Rec	ent developm	ent and	d comme	ercializa	tion of p	olant der	ived na	tural pro	oducts.
			nover therapeutic leaus h										
11.00-P01			A+++-ih			<b>DO1</b>	002	002	<b>DO</b> 4	DOL	DOC	007	<b>DO</b> 2
COS	Constantly a series		Attrib	utes	ala af	PUI	PUZ	PU3	P04	PU5	PU6	P07	PU8
CO1	Structure deter Menthol.	rminatio	econdary plant metabolite n, isoprene rule; Stereoch	es; terpenoids and its general metho emistry, constitution and synthesis	ods of of Citral and	3	1	2	1		2	2	2
CO2	Evaluate the genitrogen heter	eneral m ocyclic ri	ethod of isolation, structur ng (Hofmann's exhaustive	re elucidation of alkaloid, specially b methylation, Emde's degradation a	based on nd Von	3	1	2	1		2	2	2
	Braun'smethod Analyze genera	d). al reactio	ns, constitution of glucose	& fructose; Conformations of				-			-	_	
	monosaccharid Know about, cl	des. Stere	eochemistry and configura	tion of the nucleus of steroids.	of amino	3	1	2	1		2	2	2
	acids, general	method	of synthesis & determinat	ion of structure of polynentides. Pr	rimary.	3	1	2	1		2	1	2
CO4	secondary tert	tiary & o	aternary structure of prot	eins			-	-	-		-	-	-
	Understand th	ho Sunt	basis and modicinal up	ens.	haabramina								
	Phytopharmac	outicals.	Recent development or	d commercialization of plant de	rived natural	•	1	2	1		2	2	2
CO5	products Strat	regies for	ranid identification of nov	el therapeutic leads from natural n	roducts	3	-	2	1		2	2	2
	productorecture			- ou de cloi									
12	3	strong	Contribution, 2 Average co						_			_	
12. Brief d	description of se	elf-learni	ng / E-learning componen										
1. https://v	www.intechope	en.com/t	ooks/terpenes-and-terper	noids/introductory-chapter-terpene	s-and-terpend	oids							
2. https://v	www.intechope	en.com/b	ooks/alkaloids-their-impo	rtance-in-nature-and-human-life/in	itroductory-ch	apter-a	alkaloids						
<ol> <li>https://s</li> <li>http://s</li> </ol>	study.com/acad	ton educ	son/sterolas-structure-fur	IsSTUD ndf									
5. https://i	nptel.ac.in/cont	tent/stor	age2/nptel_data3/html/m	hrd/ict/text/127106009/lec4.pdf									
13. Books	recommended												
1. Natural	products: Chem	histry and	Biological Significance	Mann, R.S.Davidson I R Hobbs d V	Banthrone and	BHar	horne I	ongmar	Esser				
2. Organic	Chemistry, Vol	2, I. L. Fi	nar, ELBS.		- and nope and				.,235CA.				
3. Chemist	try, Biological an	nd Pharm	nacological Properties of N	edicinal Plants from the Americas,	Ed. Kurt Hoste	ttmanr	n, M.P. G	iupta Ar	nda. Ma	rston, Ha	arwood	Academ	nic
4. Chemist	try of natural pro	oducts s	.V.Bhat, B.A.Nagasamnagi	. M. Sivakumar									
	, in the second pro		,										

- Natural products from plants, Peter B. Kaufman, Leland J. Creke, Sara Warber, James A. Dupe, Harry L. Brielmann , CRC publication
   Organic chemistry of natural products, Vol. I and II , Gurdeep Chatwal, Himalya Publishing house.

1. Nai	me of the Department:	Chemistry												
2.Cou	rse Name	CORROSION, LUBRICA	TION AND PAIN	T TECHNOLOGY			L			Т			Ρ	
3.Cou	rse Code	CH410					3			1			0	
4.Typ	e of Course (use tick ma	ark)				Co	re( √ )		D	E( )			FC( )	
5.Pre-	requisite (if any)	B.Sc. with Chemistry	6.Frequency (ι	use tick marks)	Even ( V )	C	)dd ()		Either	Sem ()		Ev	rySen	n( )
7.Tota	al Number of Lectures,T	futorials, Practicals												
Lectur	res=30			Tutorials=10			Pract	ical=Ni	il					
8. COU formu	JRSE OBJECTIVES: Mair lation of industrial pain	n objective includes dee ts, dyes and varnishes.	p understanding	of mechanism of cor	rosion, lubricatio	n and act	ion of l	ubricar	nts, prop	erties, o	constit	tuents	and	
9. COU	RSE OUTCOMES (CO):													
After th	e successful course con	npletion, learners will d	evelop following	g attributes:										
00	RSE OUTCOME (CO)	Evaluin the theories on	d machanisms a	f correction Describe		<b>S</b>		lifforon	+ corroci	on tune	c For	mulate	induc	+
	CO1	relevant surface treatn	nent methods for fundamentals of	r metals and alloys a	nd corrosion prot	ection str	ategies	S.		on type	in wit	mulate		tion
	CO2	requirements, as well a and their solutions, def	is on the lubricar end the selectio	nts properties. Know n of an appropriate l	how to recomme ubricant for perfe	end a lubr ect lubrica	icant a tion.	nd how	to ident	ify the	cause	s of in-	service	issues
	CO3	Describe the ingredient film. Will be familiar formulations.	ts and characteri with the compo	istics of paint. Evalua osition of paints and	te the properties coatings and m	(adhesion nodern te	n, hard chnolo	ness, tl gies u	hickness, sed in tł	extent ne prep	of cur paratic	re, etc. on of p	) of the paint/c	e cured oatings
CO4         Comprehension of properties, constituents and formulations of pigments and dyes, differentiate dyes and pigments, their mechanisms of action and applications.           Comprehensive understanding of properties, constituents formulations and uses of user integrations.         Development of properties, constituents formulations and uses of user integrations.														isms of
COS         Comprehensive understanding of properties, constituents, formulations and uses of varnishes. Develop an appropriate choice of coating material (paint, pigment, dye or varnish) based on the nature of the substrate.														coating
10.Un	it wise detailed conten	t	-											
Unit-1		Number of lectures=0	8	Title of the unit: C	orrosion						<u> </u>			
Introdu	ction to corrosion, caus	se of corrosion, Theorie	s of Corrosion, N	Nechanism of Electro	chemical or Wei	t corrosio	n, dry Watori	corrosi	on, Facto rrosion	Stross	iencin	ig corre	Osion; Microb	Types of
corrosic Galvani	on, Fatigue Corrosion, Fi zing, Tinning and Electro	retting Corrosion; Prote	ction from corro	sion: Design and Mat	erial selection, Ca	athodic &	Anodi	c prote	ction, Co	rrosion	inhib	itors, P	Passivit	иотодіса У,
Unit-2		Number of lectures=0	8	Title of the unit: Lub	rication									
Introdu	ction, Friction and wear	, Lubricants, Theories o	f Friction, Lubrica	ation and wear, Mech	nanism of lubricat	tion- Fluic	l or Hy	drodyn	amic; lut	ricatio	n, Bou	indary	and ex	treme
pressur	e lubrication; Classifica	tion of lubricants: Solid	, Semisolid, Syn	thetic lubricants, lub	ricating oils - ve	getable o	ils, ani	mal oil	s, minera	al oils,	blende	ed oils,	, lubric	ating
emulsio	n, greases; Properties c	of lubricating oils, cutting	g fluids, selectior	n of lubricants.										
Unit-3		Number of lectures=0	8	Title of the unit: Pair	nt Technology									
Introdu	ction to paint, ingredier	it and classification; Ess	ential concepts of liquids films of	of paint formulation,	formulation of co	bating for	mas or Id stan	nry, ste dard sr	el work,	aircraft	s, auto ainte :	omobil and ma	e, diste	empers,
Unit-4		Number of lectures=0	18 R	Title of the unit: Pigr	nents and Dyes	1031, WOI		uaru sp	Jeemeatic		annts			
Introdu	ction to pigments, gene	ral and physical propert	ies: Preparation	properties and uses	of Black pigment	t (Carbon	black).	Yellow	pigment	(chror	ne vel	low). R	ed pig	ment
(Red lea	ad), Green pigment (Ch	rome green), White pig	ment (ZnO), Blue	e pigment (Ultramari	ne blue); Propert	ies of Coa	ating, s	olvent	plasticiz	ers Dye	s: Intr	oducti	on,	
Classific	ation, Methods of dyei	ng, Basic operations in c	lyeing, Study of I	Phenolphthalein, Me	thyl orange and C	Crystal vio	let. Dif	ference	e betwee	n pigm	ent an	nd dye.		
Unit-5		Number of lectures=	08	Title of the unit: Vari	nishes									
Introdu	ction to varnishes, phys	sical properties of varni	shes; Constituen	its of varnishes, class	ification and form	mulation	of indu	istrial v	arnishes	; Chara	cteris	tics of	good v	arnish;
COs			Attributes				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	Explain the theories an	d mechanisms of corros	ion. Describe, id	entify, analyze, and o	ompare different	t								
CO1	corrosion types. Formu protection strategies.	late industry relevant s	urface treatment	t methods for metals	and alloys and co	orrosion	3	2	2	2		2	2	2
	Comprehension of the	fundamentals of lubri	cants, lubricatio	n and the lubricants	operating requi	rements,								
<b>CO3</b>	relationship with the	lubrication requirement	nts, as well as	on the lubricants p	roperties. Know	how to	3	2	2	2		2	1	2
02	recommend a lubricant	t and how to identify the	e causes of in-se	rvice issues and their	solutions, defend	d the	5	-	2	-		2	-	2
	selection of an approp	riate lubricant for perfec	t lubrication.											
CO3	extent of cure, etc.) of	ts and characteristics of the cured film. Will be f	paint. Evaluate 1 amiliar with the	the properties (adhes composition of paint formulations	sion, hardness, th s and coatings an	ickness, d	3	2	2			2	1	2
CO4	Comprehension of prop	perties, constituents and app	d formulations of	f pigments and dyes,	differentiate dye	es and	3	2	1			1	2	2
CO5	Comprehensive unders	standing of properties, c	onstituents, forr	nulations and uses of	varnishes. Devel	lop an	3	2	1			1	1	2
	appropriate choice of c	, vating material (paint, j	Strong contribu	tion 2 Average cont	ribution 1 Low	contribut	ion							
12.Bri	ef description of self-le	arning /E-learning com	ponent			continuati								
1. ht	tps://www.youtube.coi	m/watch?v=50xdXq91T	V0											
2. ht	tps://www.youtube.co	m/watch?v=WQ8v-UcA	CTE											
3. ht	tps://www.youtube.com	m/watch?v=Keff0zA7Zq	8											
4. ht	tps://nptel.ac.in/conter	nt/storage2/nptel_data3 /library/view/basic_civil	3/html/mhrd/ict	/text/116102052/lec	3.pd chanter010 vhtm	1								
13 Ro	oks recommended		engineering/978	5151729063/XIIUIII/	chapter 010.XIIIII									
1. Fr	iction and Lubrication of	f Solids - Bowden, F.P. a	nd D. Tabor Part	t   &    Clare-don Pres	s. Oxford (1954)									
2. Ar	n Introduction to Metall	ic Corrosion – 3rd Ed., L	Jlick R. Evans, Ed	ward Arnold Ltd. And	ASM (1981)									
3. Co	orrosion and Corrosion (	Control 3rd Ed., H.H. Uh	ling & R.Winston	Revie, Wiley-Inter S	ciences, New Yor	rk (1985)								
4. Co	prrosion Engineering, 3r	d, Ed., M.G. Fontana, M	cGraw Hill, New	York (1986).										

1. Name	e of the Departm	ient: Chemistry					-					
2. Cours	se Name	PHARMACEUTICAL CHEM	ISTRY		I	L			Т			Р
3. Cours	se Code	CH411			3	3		1			0	
4. Type	of Course (use t	ick mark)			Co	re ( √ )			DE (	)		FC ( )
5. Pre-re	equisite (if any)	B.Sc. with Chemistry	6. Frequency (use tick marks)	Even (V)	Od	ld ( )		Eithe	r Sem	()	Every	/ Sem ( )
7. Total	Number of Lect	ures, Tutorials, Practicals										
Lecture	s = 30		Tutorials = 10		Pra	actical =	Nil					
8. COU cardiov	RSE OBJECTIVES ascular drugs, Di	: Students to understand the Sy rug Design.	nthesis, uses and mode of action of Ar	ntibiotics and Su	llpha Drug	s ,Antip	/retics	s analg	gesics,	Anestl	netic di	ugs,
9. COU After the	RSE OUTCOMES successful cours	(CO): e completion, learners will dev	elop following attributes:									
COURSE (	OUTCOME (CO)		AT	TRIBUTES								
	CO1	Evaluate the concept of antibio	otics. Classification, synthesis, mode of	action and use	s of differe	ent type	s of ar	ntibiot	ics.			
	CO2	Analyze classification, structure	e, synthesis and uses of analogues of p	-aminophenol,	Salicylic ad	cid, Pyra	zolon	es and	l Pyraz	olodin	ones.	
	CO3	Create the basic knowledge, Cl	assification, Synthesis and mode of act	tion of Inhalatic	n, Intrave	nous an	esthe	tics an	d Basa	l anes	thetics.	
	CO4	Analyze classes, structure, synt Antiarrhythmic agents.	hesis and mode of action of cardiac gl	ycosides Digoxi	n, and Digi	toxin; A	nti-hy	/pertei	nsive a	nd hyp	otensi	ve drugs,
COS Comprehension of analogues and prodrugs; concept of lead; factors governing drug design; rational approach to drug design; revolutions in drug discovery, research and development strategies.												
10, Unit	wise detailed o	ontent										
Unit-1	N	umber of lectures = 08	Title of the unit: Antibiotics and Su	Ipha Drugs								
Introduct structure Neomycir sulphame	ion and classifica and mode of ac and Kenamycin thazine and sulp	tion of antibiotics; beta lactam tion of first, second, third and . Chloramphenicol: its structure haacetamide.	antibiotics: penicillins, its structure and fourth generation cephalosporins. An , synthesis and mode of action. Synthe	d mode of actio ninoglycoside a esis and uses of	n, synthes ntibiotics: sulphathia	is of Per structu zole, su	nicillir re and Iphag	n-v. Ce d mod guanidi	phalos e of a ne, sul	porins ction ( phadia	: classi of Strep azine,	fication, otomycin,
Unit-2	N	umber of lectures =08	Title of the unit: Antipyretics analge	esics								
Introduct	ion, classification	structure, synthesisanduses of a provide the synthesis and pyrazological synthesis and	naloguesotp-aminophenol:Paracetamo	Di,Phenacetinan	dantifebri	n;Salicyl	icacid	lanalo	gues:A	spirin,	Salol,	no
Init_3		umber of lectures = 08	Title of the unit: Anesthetic drugs	Dipyrone, rhen	yibutazone	с, охурп	enbu	1020110		uipiiii	pyrazo	lic
Introduct	ion Classification	a Synthesis and mode of action	of: Inhalation anesthetics: Vinyl ether	Cyclopropane	and Eluoro	vono: li	ntrave	anous	anosth	otics	Thione	ntal
Sodium&	MethohexitalSoc	lium:Basalanesthetics:Procanin	ehvdrochloride. Tetracainehvdrochlorid	de Butacainehv	drochlorid	e.Benza	mineł	hvdroc	hloride	and	mope	iitai
Pyrocanir	e hydrochloride					0,001120		.,		24114		
Unit-4	N	umber of lectures = 08	Title of the unit: Cardiovascular dru	Igs								
Introduct	ion, classification	n, structure and mode of action	of cardiac glycosides Digoxin, and Digi	toxin; Anti-hype	ertensive a	nd hypo	tensi	ve dru	gs: stri	ucture	, synth	esis and
modeofa	ctionofLosartan,	Clonidine,Hydralazine,Methyldo	paandDiazoxide;Antiarrhythmicagents	s:structure,synt	hesisandm	odeofad	tiono	ofDiiso	pyram	ide,		
Procainar	nide, Propranolo	l, Beritylium Tosilate;Vasopress	or drugs: structure, synthesis and moc	le of action of Is	oxsupurin	e, Pr en	yl ami	ine.				
Unit-5		Number of lectures = 08	Title of the unit: Drug Design									
Introduct	ion; analogues a	nd prodrugs; concept of lead; fa	ctors governing drug design; rational a	approach to dru	g design; [	Drug des	sign: t	the me	thod c	of varia	tion; D	rug
design an	d development:	preamble, revolutions in drug d	iscovery, research and development st	trategies.		U	0					0
11. CO-PO	O mapping											
COs			Attributes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Evaluate the con of antibiotics.	ncept of antibiotics. Classification	on, synthesis, mode of action and uses	of different typ	es <b>3</b>	1	2	2	2	3	2	2
CO2	Analyze classific Pyrazolones and	ation, structure, synthesis and u I Pyrazolodinones.	uses of analogues of p-aminophenol, S	alicylic acid,	3	1	2	2	2	3	2	2
603	Create the basic	knowledge, Classification, Synt	hesis and mode of action of Inhalation	, Intravenous	2	1	2	2	2	2	2	2
	anesthetics and	Basal anesthetics.			3	1	-	2	2	5	2	2
CO4	Analyze classes, Anti-hypertensi	structure, synthesis and mode ve and hypotensive drugs, Antia	of action of cardiac glycosides Digoxin, Irrhythmic agents.	, and Digitoxin;	3	1	2	2	2	3	3	2
	Comprehension	of analogues and prodrugs; cor	ncept of lead; factors governing drug d	esign; rational			_	_	_	_	_	
C05	approach to dru	g design; revolutions in drug di	scovery, research and development str	ategies.	3	1	2	2	2	3	2	2
		3 Strong contribution, 2 Averag	e contribution , 1 Low contribution									
12. Brie	f description of	self-learning / E-learning compo	onent									
1.	https://www.y	outube.com/watch?v=NGwP47	1sehl									
2.	https://www.y	outube.com/watch?v=Ac6yMW	Лобук									
3.	https://www.y	in /courses (104101006 /downlo	JKUC									
4. 5.	https://www.v	outube.com/watch?v=2vLDzMS	So2Tc&list=PLg8Xhs-vwgxLSKf7XRovnlr	Y6aGHseZrv&ir	dex=43							
13. Books	recommended			, and a second s								
1.	Burger's Media	inal Chemistry: Mangrove E. W	olff, 4th Edition, John Wiley and Sons									
2.	Medicinal Cher	mistry by Asutosh Kar , New Age	International publication									
3.	Principles of M	edicinal Chemistry: W.O.Foye.										
4.	The Pharmaco	ogical Basis of Theraputics : L.S.	Goodman and A.Gilman									
5.	Wilson's Medie	cinal Chemistry The Organic Che	mistry of Drug Synthesis: D. Lednicer a	and L.A.Mitsche	r							

1.Nam	e of the Departme	nt: Chemistry										
2.Cour	se Name	SURFACE CHEMISTRY AND EL	ECTROCHEMISTRY		L		1	Г			Ρ	
3.Cour	se Code	CH420			3		1	1			0	
4.Type	of Course (use tick	(mark)			Core( v	)	D	E()		I	•C( )	
5.Pre-	requisite (If any)	B.Sc. with Chemistry	6.Frequency(usetickmarks)	Even (√)	Odd (	1	Either	Sem ( )		Evei	ry Sen	n()
7.Tota	I Number of Lectur	es, Tutorials, Practicals										
Lectur	es=30		Tutorials=10		Practical=Nil							
8. COU	JRSE OBJECTIVES: S	tudents gain the knowledge of s	econdary plant metabolites such as te	erpenoids, all	kaloids, carb	phydrat	es, Amiı	no Acid	, Pept	ides &	& Prot	eins,
steroid	ls, Synthesis and me	edicinal uses of; caffeine, theoph	ylline, theobromine and Phytopharm	naceuticals.								
9. COUR	SE OUTCOMES (CO	):										
After th	e successful course	completion, learners will develo	op following attributes:									
COURSE	OUTCOME (CO)	ATTRIBUTES										
	CO1	Students would develop concep Freundlich and Gibbs adsorption characterize surface of differen	of monolayer and multilayer adsorp n isotherm and their applications. The t system.	tion; perceiv y also got ins	e the differe sight the imp	nt theor	ry of ads	sorption	n <i>viz,</i> l hnique	Langn es to	nuir,	
	CO2	reverse micelles and get sound	the role of surface active reagents a insight of potential develop between a	and thermod solid and liqu	uid i.e. zeta p	otential	tion, sta I.	ibilizati	on, m	icroer	nulsic	'n,
	СО3	Students would able to differen electrical double layer and Butle	tiate between ionic and molar conduc er –Volmer equation.	ctivity for stro	ong and wea	< electro	olyte an	d unde	rstand	d the (	conce	pt of
CO4         Students would able to distinguish difference between galvanic and electrolytic cell; perceive the concept of Nernst equation and thermodynamics of electrochemical cell. They also got the sound understanding of polarization and overvoltage.           Students would able to understand the role of electrochemistry for analysis of correction phonomenon and identify the different												
CO5         Students would able to understand the role of electrochemistry for analysis of corrosion phenomenon and identify the different electrochemical energy resources.												
10.Uni	it wise detailed con	tent										
Unit-1		Number of lectures=08	Title of the unit: Process at Solid S	urface								
Growth adsorpti tempera	and structures of so on, temperature de ature programmed t	olid surfaces, Physisorption and ependence of adsorption, stickin techniques. Surface imaging electronic structures and the surface imaging electronic structure	Chemisorption, Freundlich, Langmuir a grobability. Surface analytical techn tron microscopy.	and BET isoth iques, spectr	nerms, Gibbs oscopies (Au	Adsorp ger, ph	tion iso otoelect	therm, tron an	disso d vibr	ciative ationa	e al)	
Unit-2		Number of lectures=08	Title of the unit: Surface and Interf	ace								
Surface	active reagents, cla	ssification of surface active reag	ents, micellization, hydrophobic and h	ydrophilic in	teraction, cr	tical mi	celle co	ncentra	ation(	CMC),	kraft	
tempera	ture, factors affecti	ing CMC of surfactant, counter i	on binding to micelle, thermodynamic	s of micelliza	ation, stabiliz	ation, n	nicroem	ulsion,	revers	se mio	elles,	
surface	films(electrokinetics	s phenomenon) Zeta potential.										
Unit-3		Number of lectures=08	Title of the unit: Conductance and	Ionization								
Ionic cor Kohlraus at electr	nductance, drift spe sh's law, Ostwald's d ode-Butler-Volmer	ed, electrical force, molar condu dilution law, conductometric an equation and its applications	uctivity, strong and weak electrolytes and weak electrolytes and be a second to the second seco	and their mo double layer,	lar conducta , ficks first an	nce, lav d secon	v of inde id law o	epende f diffus	nt mig ion, Ta	gration afel pl	n of ic ot, pr	ons: ocess
Unit-4	oue putter ronner	Number of lectures=08	Title of the unit: Electrochemical Co	ells								
Daniell r	eversible and irrev	ersible cells, cell representation	s and half cell reactions. E.M.FF The	rmodynamic	s of electroc	nemical	system	s: Nern	ist eau	uatior	is. vai	rieties
of elect	rodes, standard e	lectrode potential. Type of b	oundary between half cell and liq	uid junction	potentials,	Conce	ntration	cells,	Appli	icatio	ns of	EMF
measure electrod	ements-determinati les), Polarization, Ov	on of activity coefficient, compo vervoltage.	osition of complex ions, solubility prod	lucts, measu	rement of p⊦	and pK	a (Hydr	ogen, C	Quinhy	dron	e, Gla	SS
Unit-5		Number of lectures=08	Title of the unit: Corrosion and Cor	nversion of E	lectrochemi	al Ener	gy					
Introduc	ction, definition and	types, mechanism of electroche	emical corrosion, methods of preventi	ion of corrosi	ion , dry cells	, lead b	atteries	, alkalir	ne cell	s (Edi	son ce	ell),
Fuel cell	s, Biological energy	and conversions.										
11. CO-F	PO mapping				<b>N</b>			<b>DO4</b>	DOF	DOC	007	DOG
COS	Ctudopto would do	F	Attributes	lifforont those	PU		2 PO3	P04	P05	PU6	P07	PU8
CO1	adsorption viz, Lan insight the importa	gmuir, Freundlich and Gibbs ads nce of various techniques to cha	orption isotherm and their application aracterize surface of different system.	ns. They also	got 3	1	3	1		3	3	3
CO2	Students would abl stabilization, micro liquid i.e. zeta pote	e to recognize the role of surfac emulsion, reverse micelles and ntial	e active reagents and thermodynamic get sound insight of potential develop	cs of micelliza between sol	ation, id and 3	1	3	1		3	2	3
CO3	Students would abl and understand the	e to differentiate between ionic e concept of electrical double lay	and molar conductivity for strong and yer and Butler –Volmer equation.	d weak elect	rolyte	1	2	1		3	2	2
CO4	Students would abl Nernst equation an polarization and ov	e to distinguish difference betw d thermodynamics of electrocher ervoltage	een galvanic and electrolytic cell; perc emical cell. They also got the sound ur	ceive the con nderstanding	cept of of	1	2	1		2	1	3
CO5	Students would abl	e to understand the role of elec	trochemistry for analysis of corrosion rces.	phenomeno	n and	1	3	1		2	2	3
		3 Strong	contribution, 2 Average contribution	1 Low contr	ibution							
12.Brie	ef description of se	f learning/E-learning compone	nt									
1.	https://nptel.ac.	in/content/storage2/courses/10	)3103026/pdf/mod2.pdf									
2.	https://www.yo	utube.com/watch?v=zdhDei1Jol	1									
3.	https://www.yo	utube.com/watch?v=R2UhAdqi	(bs									
4.	http://www.umi	ch.edu/~chem260/fall01/lectur	e37.pdf									
5.	nttp://www.grie	t.ac.in/nodes/EC_UNIT_2.pdf										
13. Bo	oks recommended:					NI-		,				
1.	Bockris LO M P	addy A K N. Modern Electrocher	runuamentais and APPLICATIONS 2 <sup>nd</sup>	Eurrion John	willy & Sons	New Y	UTK 2004	۷.				
2.	Atkins P. Paula I	Diver and Atkins Physical Chemi	stry 8 <sup>th</sup> Edition Oxford 2016.	0.								
4.	Puri, Sharma, L.F	R., and Pathania, M.S., Principles	of Physical Chemistry 50 <sup>th</sup> Edition, Vis	hal publishin	g Co.							

1.Nam	ne of the Departmen	t: Chemistry										
2.Cou	rse Name	COORDINATION AND ORGAN ELEMENTS	OMETALLIC CHEMISTRY OF TRANSITIO	N		L		Т			Ρ	
3.Cou	rse Code	CH421				3		1			0	
4.Туре	e of Course(use tick i	nark)			Co	re( √ )		DE	()		FC( )	
5.Pre-	requisite (if any)	B.Sc. with Chemistry	6.Frequency (use tick marks)	Even (V)	Odd ()		Ei	ither Se	em ( )	Ever	ySem(	)
7.Tota	I Number of Lecture	s, Tutorials, Practicals										
Lectur	es=30		Tutorials=10		Practical	=Nil						
8. COL	JRSE OBJECTIVES: St	udents gain the knowledge of s	econdary plant metabolites such as ter	penoids, all	kaloids, o	arbohyd	rates	, Amino	o Acid, P	eptides	& Pro	teins,
steroio	ds, Synthesis and me	dicinal uses of; caffeine, theopl	ylline, theobromine and Phytopharma	aceuticals.								
9. COUF	RSE OUTCOMES (CO)	:	following attack to the									
After th	e successful course o	ompletion, learners will develo	op jollowing attributes:	ITEC								
COOKSL		tudents will have a firm found	ation in the approaches of fundamenta	l atomic str		nd the ne	ariodi	city of t	transitio	n olom	onts in	the
	CO1	periodic table.	ation in have a basic understanding of r		ro for tr		motal				cholati	on
	CO2	AoT of the octahedral complxe	s, prediction of molecular geometries of	of selected r	nolecula	r species	i.	compie	exes, che			л <b>і</b> ,
	CO3 3	students will have a firm found	ation in have a basic understanding of r	magnetism	of the co	mplexes						
	CO4	tudents will be able understan	d the knowledge in fundamentals of or	ganometall	ic compo	ounds.				<u> </u>		
	CO5	itudents will be able to create t ynthesis.	he pathways for the organometallic co	mpounds as	s industr	ial cataly	tic ap	plicatio	ons in th	e vario	us orga	inic
10.Un	it wise detailed cont	ent										
Unit-1	•	Number of lectures=08	Title of the unit: Basics of Coordin	nation Cher	nistry							
General nomenc	characteristics prop clature of coordinatio	erties of transition elements we on compounds isomerism in co	erner's theory effective atomic number ordination compounds polymerization	shape of d ionisation	orbitals hydrate	bonding Inkage c	in tra oordi	nsition nation	metal contraction	omplex isome	æs rism	
stereois	omerism geometrica	Tand optical isomerism.	Title of the units of Plack Motal Ch	anaista .								
Unit-2	bond theory and by	Number of lectures=08	nd colitting TD and c4 v system space	emistry	arios and	offoct o	f.cov	longu	Cravetal E	iold cta	bilizati	on
energy	high and low spin or	tahedral complexes John telle	r distortion that crystal field and the	square plar	ar Cryst	al Field	rvsta	al field	theory i	ieiu sta ises ar	d limit	ation
microsta	ates and term symbo	Is Russell saunders coupling i.e	spin orbit coupling ground state of ele	ment with z	z=1-10, s	pin Cros	sover		cheery c			
Unit-3	}	Number of lectures=08	Title of the unit: Bonding and Prop	perties of C	omplexe	s						
High and	d low spin states, mo	lecular orbital theory, octahed	ral complexes, nephelauxetic series ba	ck bonding	involving	g pi dono	or and	l accept	tor ligan	ds pi in	seo2 a	and o3
sf6 and	HF to organ and te	nable sugano diagram electror	ic absorption spectra of octahedral a	nd tetrahed	dral com	plexes cl	harge	transf	er spect	ra inte	rpretat	ion of
electron	nic absorption spectro	a of use of reach parameters m	agnetic properties of transition metal c	complexes s	pin-orbit	couplin	g the	effect o	of tempe	erature	on	
Unit-4		Number of lectures=08	Title of the unit: Organometallic C	hemistry of	f Transiti	on Flem	ents					
Organor	metallic compounds.	ligand hapticity .18 electron ru	le in metal carbonyls: homiletic and he	teroleptic c	omplexe	s synergi	istics	effort f	actor aff	ecting	the	
magnitu eliminat	ude of stretching frections. Alkyl.carbine	uency synthesis and structure	of Fe carbonyl complexes fruits of unity 3 diene complexes.	reaction o	f organo	metallic	comp	ound o	xidative	additic	on redu	ictive
Unit-5	;	Number of lectures=08	Title of the unit: Application of Or	ganometal	lic Chem	istry						
Applicat	tion of Organometall	c Chemistry:- organometallics:	organolithium magnesium zinc copper	and titaniu	m reage	nts . Cata	alytic	cycle of	f wacker	proces	ss.	
Homoge	enneuos catalysis: all	ene (olefin) and alkaline metal	Wikinsons catalytic cycle, hydroformy	lation (oxo-	process)	,						
Heterog	geneous catalysis: co	nmercial application: Ziegler-N	atta catalysis and haber process.									
11. CO-I	PO mapping				0.01	202	000	204	0.05	200	007	200
COs	Charles to still be as	Attri	butes	and the s	PO1	PO2	PO3	P04	PO5	P06	P07	P08
CO1	periodicity of transit	ion elements in the periodic ta	ble.	ind the	3	2	1	2	2	1	1	2
CO2	Students will have a complexes, chelate	firm foundation in the basic ur chelation, MoT of the octahed	derstanding of nomenclature for trans Iral complexes, prediction of molecular	ition metal geometrie	s <b>3</b>	2	1	2	2	1	1	2
CO3	Students will have a	firm foundation in basic under	standing of magnetism of the complexe	es.	3	1	1	2	2	2	1	2
CO4	Students will be able	e understand the knowledge in	fundamentals of organometallic compo	ounds.	3	1	1	2	2	2	1	2
CO5	Students will be able applications in the v	e to create the pathways for the arious organic syntheses.	e organometallic compounds as industr	rial catalytic	3	1	1	2	2	2	1	2
		3 Strong	contribution, 2 Average contribution , 1	1 Low contri	ibution							
12.Bri	ef description of self	learning/E-learning component	nt									
1. ht	tps://nptel.ac.in/cou	rses/104/101/104101121/										
2. ht	tps://nptel.ac.in/con	tent/syllabus_pdf/104101090.	odf									
3. ht	tp://www.ncert.nic.i	n/ncerts/l/lech109.pdf										
4. nt 5. ht	tps://nptel.ac.in/cou	rses/104103022/										
13. Bo	oks recommended:	, ==										
1. F. Alk	pert cotton, Geoffrey	Wikinson, Carlos A, Murillo and	Manfred Bochmann. Advanced inorga	nic chemist	ry, 6th e	dition, w	iley Ir	ndia Pvt	: LTD.			
2. J.D Le	e. Concise inorganic	Chemistry, 5th edition, Wiley I	ndia Pvt LTD.									
3. JH Hu	heey , inorganic che	mistry- principles, structure and	I reactivity , Harper and Row publisher	Inc . New Y	ork (1972	2).						

1 Namo	of the Department: (	Chomistry									
2 Course	Name							т		D	
3 Course	Code	CHA22			0			0		۲ ۵	
4 Type of	f Course (use tick ma	ark)				1	וח	= ( )			
5. Pre-rec	nuisite (if any)	B Sc with Chemistry	6. Frequency (use tick marks) Even (v)		Odd ()	,	Fithe	<u>r Sem ( )</u>	-	Every S	em ()
7. Total N	lumber of Lectures. 1	Futorials, Practicals			000()		2.11.10				()
Lectures =	= 00		Tutorials = 00	Pract	ical = 08	}					
8. COURSE	<b>OBJECTIVES:</b> Imparti	ing of scientific method	ology, Development of practical/technical skills, The abil	ity to wo	ork effec	tively a	nd safel	y in a lab	orator	y enviro	onment,
Developing	transferable skills (te	eam work, time manage	ement), Enhancing communication skill.								
9. COURSE	OUTCOMES (CO):										
After the su	uccessful course com	pletion, learners will d	evelop following attributes:								
COURSE OU	UTCOME (CO)		ATTRIBUTES								
	CO1	Understand the basic	c analytical and technical skills to work effectively in the	arious f	ields of a	chemist	ry				
	CO2	Able to detect adulte	rants in the given food sample.				tal		1 1 1 - 1		
	CO3	lycopene, nicotine, la	ictose and casein, lecithin Caffeine from tea. Preparation	of Aceta	anilide, <i>l</i>	le of oli Aspirin,	Paracet	anue of ol amol.	I. ISOIA	tion of	
	CO4	Remember to keep re	ecords of all performed experiments in the manner, which	ch is requ	uired in	laborat	ory.				
	CO5	Analyze the importar	nce of personal safety and care of equipment's and chem	icals.							
10. List of e	experiments										
1. Deter	mination of strength	of acid against strong b	ase by pH meter.								
2. Meas	urement of surface to	ension of a liquid by cap	villary rise method								
3. Deter	mination of optical re	otation of cane sugar.	a cil								
4. Deter	mination of saponing	ie in the given oil	Toll.								
6. Estima	ation of amino acid.										
7. Estima	ation of Glucose.										
8. Separ	ation of essential oils	s by soxhlet extractor.									
9. Isolati	ion of Lycopene from	i tomato.									
10. Isolati	ion of Nicotine from t	iobacco.									
12 Isolati	ion of lecithin from e	esin non nink. og volk									
13. Isolati	ion of Caffeine from	tea.									
14. Prepa	aration of Magnesium	n bisilicate (antacid).									
15. Prepa	aration of Paracetamo	ol.									
16. To pre	epare the iron(III) eth	nylenediaminetetraacet	alato complex, Na[Fe(EDTA)]·3H <sub>2</sub> O								
11. CO-PO	mapping										
COs		Attributes		PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8
CO1	Understand the bas chemistry	ic analytical and techni	cal skills and to work effectively in the various fields of	3	1	1	1		2	1	2
CO2	Able to detect adult	terants in the given foo	d sample.	3	1	3	1		3	3	2
	Know the determin	ation of strength of aci	d, optical rotation of cane sugar. Saponification value of								
CO3	oil, acid value of oil	. Isolation of lycopene,	nicotine, lactose and casein, lecithin	3	1	1	1		2	1	2
	Caffeine from tea. F	reparation of Acetanili	de, Aspirin, Paracetamol.								
CO4	Remember to keep laboratory.	records of all performe	d experiments in the manner, which is required in	3	1	1	1		2		
CO5	Analyze the importa	ance of personal safety	and care of equipment's and chemicals.	3	1	1	1		2	1	3
	3 Stro	ong contribution, 2 Ave	rage contribution , 1 Low contribution								
12. Brief de	escription of self- lea	rning / E-learning com	ponent								
1. https://	/www.youtube.com/	watch?v=MTsn1-ToKqC	2								
2. http://w	www.bellevuecollege	edu/wp-content/uplo	ads/sites/140/2014/06/aspirin_tablets_titration.pdf								
3. https://	/www.frontiersin.org /www.youtube.com/	vatch?v=1tmgLIVSVPo	2015.00196/10II 4								
5. https://	/www.youtube.com/	watch?v=KZ35K05SA7g									
6. https://	/www.youtube.com/	watch?v=249FNCSR-Cv		20		2010	.10				
7. nttps://	www.niser.ac.in/sps	/sites/uerauit/files/bas	ic_page/ourrace%20tension%20by%20capillary%20rise%	zometh	0u_%20	2018.p	ui				
13. BOOKS	a Practical Chomistre	u: lagdamba Singh L D	S Vaday, Jaya Singh, J. R. Siddigui, Progoti Edition								
2. Practice	al Organic Chemistry	A.I. Vogel	a radav, saya singii, i.n. sidulqui, Plagati Eultioli.								
3. Practica	al Physical Chemistry	: B. Viswanathan and P	.S. Raghavan.								
4. Experin	nental Inorganic Che	mistry – W.G.Palmer.									

1. N	lame of the Departmen	t: Chemistry									
2. (	Course Name	POLYMER CHEMISTRY			L		1	-		Р	
3. 0	Course Code	CH501			3		1			0	
4. T	ype of Course (use tick	mark)		C	ore ( √ )		DE	()		FC (	)
5. P	re-requisite (if any)	B.Sc. with Chemistry 6. Frequency (	use tick marks) Even ()	0	dd ( v )		Either S	em ( )	Εv	ery Sen	n ()
7. T	otal Number of Lecture	s, Tutorials, Practicals	·	•							
Lectu	res = 30		Tutorials = 10	Practio	cal = Nil						
8. CO	URSE OBJECTIVES: The	main objective of this course is to stu	dy the mechanism of polymer pre	eparatio	on, thei	r proce	essing t	echniqu	ies, cor	nmerci	al uses,
identi	fication techniques and	preparation process of vinyl polymers, po	olyamides, polyesters, synthetic rubb	bers, cel	llulose a	ind cop	olymer	resins			
9. COL	IRSE OUTCOMES (CO):										
After tl	ne successful course con	npletion, learners will develop following a	attributes:								
COL	JRSE OUTCOME (CO)	ATTRIBUTES									
	<u> </u>	Evaluate the different mechanisms of pol	lymer preparation and their classific	ation.	- h- a 1 a						
	<u> </u>	Analyze various processing techniques of	Polymers and evaluate the identifica	ation te	cnnique	s such	as ir, n	IVIR OF I	olyme	rs.	
	<u> </u>	Analyze various processing techniques of	invl polymers, polyamide, polyester	s and ri	hhor						
	<u> </u>	Understand the Vulcanization of Rubber	and synthesis of Synthetic Rubber a	nd vario	nus othe	er conc	lvmer r	esins			
10 11	nit wise detailed conter	t	and synthesis of synthetic hubber a		545 0111		nymer i	c51115.			
Unit-	1	Number of lectures = 08	itle of the unit: Polymer & Polyme	rization	1						
Monon	- ners. functionality. degr	ee of polymerizations, classification of po	olymers, glass transition, melting tra	nsition	. criteria	a for ru	ubberine	ess. pol	vmeriza	tion m	ethods:
additio	n and condensation; the	ir kinetics, metallocene polymers and oth	her newer techniques of polymeriza	ation, co	opolyme	erizatio	on, mon	omer re	eactivity	y ratios	and its
significa	ance, kinetics, different	copolymers, random, alternating, azeotro	pic	-							
Unit-3	2	Number of lectures = 08 Ti	itle of the unit: End group analysis	5							
Solubili	ty and swelling, Concep	t of molecular weight distribution and its	significance, concept of average mo	olecular	weight	, deter	minatio	n of nu	mber a	verage,	weight
average	e, viscosity average and	Z-average molecular weights, polymer cry	stallinity, analysis of polymers using	IR, XRE	), micro	scopic	(optical	and ele	ectronic	:) techn	iques.
Unit-	3	Number of lectures = 08 Ti	itle of the unit: Polymer processin	ig Techr	niques						
Commo	odity and general-purpo	se thermoplastics: PE, PP, PS, PVC, Polyest	ters, Acrylic, PU polymers. Engineeri	ng Plast	ics: Nyle	on, PC,	PBT, PS	U, PPO	, ABS, F	luoropo	olymers
Thermo	osetting polymers: Polyu	rethane, PF, MF, UF, Epoxy, Unsaturated p	polyester, Alkyds. Natural and synth	etic rub	bers: R	ecover	y of NR	hydroca	arbon fi	rom late	ex; SBR,
Nitrile,	CR, CSIM, EPDIM, IIR, BR,	Silicone, TPE, Specialty plastics: PEK, PEE	K, PPS, PSU, PES etc. Biopolymers su	ch as Pi	LA, PHA	/PHB.					
Unit-4	t aca batwaan blands and	Number of lectures = 08	alumors for blonding blond missibili	ty mice	ible and	immic	ciblo bl	ands th	ormody	marnice	nhaco
mornho	logy polymer alloys p	olymer eutertics plastic-plastic rubber-pl	lastic and rubber-rubber blends ER	P narti	rulate l	ong ar	nd short	fihre re	pinforce	namics od comi	o, priase nosites
Polyme	r reinforcement, reinfor	cing fibers – natural and synthetic, base po	olymer for reinforcement (unsaturat	ted poly	/ester),	ingredi	ients / r	ecipes f	or reinf	orced p	olymer
compo	site.				,	0	-				•
Unit-	5	Number of lectures = 08 Tit	tle of the unit: Vulcanization of re	ubber							
Polyme	r compounding-need a	nd significance, different compounding ir	ngredients for rubber and plastics	(Antiox	idants,	Light s	tabilizeı	rs, UV s	stabilize	ers, Lub	ricants,
Process	sing aids, Impact modifie	rs, Flame retardant, antistatic agents. PVC	Stabilizers and Plasticizers) and thei	r functio	on, use	of carb	on blacl	<, polyn	ner mixi	ng equi	pment,
cross-li	nking and vulcanization,	vulcanization kinetics									
11. CO-	PO mapping	644.::ht.c.		<b>DO1</b>	002	000	<b>DO</b> 4	DOF	DOC	007	<b>DO</b> 0
COS		Attributes		PUI	PUZ	PU3	P04	PU5	P06	P07	PU8
CO1	Evaluate the different	mechanisms of polymer preparation and t	their classification.	3	2	1	1	1	2	2	2
	Understand the colliga	tive properties of Polymers and evaluate	the identification techniques such								
CO2	as IR, NMR of Polymers	5.		3	1	1	1	1	2	1	2
						•	-				
CO3	Analyze various proces	sing techniques of Polymer.		3	1	2	2	1	3	2	3
CO4	I Inderstand the prepar	ation process of vinyl polymers, polyamid	e polyesters and rubber	2	2	2	2	1	'n	2	'n
		ation process of viry polymers, polyania	ie, polyesters and rubber.	3	2	3	2	-	5	2	3
CO5	Understand the Vulca	nization of Rubber and synthesis of Syr	nthetic Rubber and various other	3	2	2	2	1	3	2	3
	copolymer resins.										
10.0		3 Strong contribution,	2 Average contribution, 1 Low cont	ributio	n						
12. B	rief description of self-le	earning / E-learning component									
1. n 2 h	ttps://nptel.ac.in/conter	nt/storage2/courses/103103029/pdf/mod	17.pdf								
2. II 3. hi	tp://eacharva inflihnet	ac in/data-server/eacharva documents/5	5daa452e41301c73a2cb5ac_INFIFP	208/80	)6/FT/le	r%20-	3 ndf				
4. h	ttps://nptel.ac.in/conter	nt/storage2/courses/103103029/pdf/mod	17.pdf		, , , , , , ,		5.p.a.				
5. h	tps://nptel.ac.in/conter	t/storage2/nptel_data3/html/mhrd/ict/to	ext/113105028/lec20.pdf								
<b>13.</b> B	ooks recommended:										
1. Pi	rinciples of polymer che	nistry: A Ravve, 2nd Edition, Kluwer Acade	emic publications								
2. P	olymer Science and tech	nology: Joll. R. Fried, Prentice – Hall.									
3. Pi	inciples of polymer syst	ems: F. Rodriguez, Claude Cohen, C.K. Obe	er, L.A. Archer, Vth Edition, Taylor &	Francis	5						
4. In	troduction to polymers:	R.J. Young and P.A. Lovell, 2nd Edition, No	etron Thornes publications								
p. P	olymer chemistry – an in	troduction, ivialcolm D. Stevens, Oxford U	university press.								

5. Polymer chemistry – an introduction, Malcolm D. Stevens, Oxford University press.

1. N	lame of the Department	:: Chemistry					-		
2. 0	ourse Name	ORGANIC REACTION, REAGENTS & HETEROCYCLIC CHEMISTRY	L		1	-		Р	
3. 0	ourse Code	CH513	3		1			0	
4. T	ype of Course (use tick	mark)	Core ( √ )	)	DE	()		FC()	)
5. P	re-requisite (if any)	B.Sc. with Chemistry 6. Frequency (use tick marks) Even ()	Odd (V)		Either S	em ()	Ev	erv Sen	n ()
7. T	otal Number of Lecture	s Tutorials Practicals							
Lectu		Tutorials - 10	Practical - Nil	1					
8 COLL	RSE OBJECTIVES: To un	derstand organic name reaction rearrangement and its mechanism. Use of	reagents in o	raanic	synthes	is nron	aration	and ch	hemical
o. COO	as of beterocyclic compo	ucistand organic name reaction, realitangement and its methanism, ose or	leagents in o	iganic	synthes	is, piep	aration		lenncai
		unus.							
5. COO Δfter ti	nse oorcowies (co). ne successful course com	inletion learners will develon following attributes:							
	IRSE OUTCOME (CO)	ATTRIBUTES							
		Mechanistic concept of some name reactions such as Mannich reaction. St	ork Enamine I	reactio	n Shan	iro reac	tion Pr	erkin re	eaction
	CO1	Sharpless Asymmetric Enoxidation Dieckmann condensation and Knoevenag	el condensatio	n	n, snap	no reac			action,
		Explain the mechanism of some important rearrangement like Pinacol-ninacol	one rearrange	ments	Benzil-	Benzilic	acid re:	arrange	ments
	CO2	Curtius rearrangements. Schmidt reaction, Lossen rearrangements. Baever Vi	lliger reaction	and Fa	, benzii worskii i	rearrang	rement	s	
		Analyze and compare the uses of some important reagents in organic transfo	rmation like or	xidatio	n. reduc	tion. de	hvdrati	on, alky	vlation
	CO3	acvlation etc.				, ac		0, a,	,,
	CO4	Evaluate the methods for the synthesis of some important five membered he	terocyclic com	าทดแทต	ls and it	s chemi	al read	tion	
	C05	Comprehension for the synthesis of some important six membered beterocyc	lic compound	s and i	ts chem	ical reac	tion		
10.11	it where the line is a second			Junui	to enem	learread	cion.		
10. 0	hit wise detailed conten	t							
Unit-		Number of lectures = 08    Itle of the unit: Name reactions		1.11					1.
Mannie	h reaction, Stobbe con	densation, Stork Enamine reaction, Shapiro reaction, Perkin reaction, Wo	odward hydro	oxylatic	on, Prev	ost hyd	roxylat	ion, Ro	obinson
annula	ions, Sharpless Asymme	tric Epoxidation, Ulimann reaction, Benzoin condensation, Dieckmann conder	isation and Kn	oeven	agei con	densatio	on		
Unit-	2	Number of lectures =08   litle of the unit: Rearrangements							
Pinacol	-pinacolone rearranger	nents, Wagner-Meerwein rearrangements, Benzil-Benzilic acid rearrang	gements, Sor	nmele	t Hause	er rear	rangem	ients,	Curtius
rearran	gements, Schmidt reacti	on, Lossen rearrangements, Neber rearrangements, Baeyer Villiger reaction a	nd Favorskii re	earrang	gements				
Unit-	3	Number of lectures = 08 Title of the unit: Reagents							
Use of f	ollowing reagents in orga	anic synthesis: Dicyclohexylcarbodiimide (DCC), Gilman's reagent (lithium dime	thyl cuprate),	Lithiun	n alumir	ium hyo	lride (Li	AIH4), 9	Sodium
borohy	dride (NaBH4), Lithium c	liisopropylamide (LDA), trimethylsilyl iodide, Wilkinson's catalyst, Pyridinium (	Chlorochromat	te (PCC	:), Perbe	nzoic ac	id		
Unit-	1	Number of lectures = 08 Title of the unit: Introduction to con	densed five m	nembe	red hete	erocycle	S		
Introdu	ction of petroleum ref	ining, cracking, application of cracking, synthetic petrol, Bergius process	, Fischer-Trop	osh pr	ocess, o	octane i	numbe	r, flash	point,
determ	ination of flash point, sy	nthesis of pure chemicals from petrochemicals.							
Unit-	5	Number of lectures = 08 Title of the unit: Introduction to cond	ensed six men	nbered	l hetero	cycles			
Metho	ls of synthesis with spe	cial reference to Knorr synthesis, Pall-Knorr synthesis and Hantzsch synthe	sis, chemical	reactic	ons of p	yrrole, f	uran a	nd thio	phene,
mechai	nism of electrophilic sub	stitution reactions of pyrrole, furan and thiophene							
11. CO-	PO mapping								
COs		Attributes	PO1 PO2	PO3	PO4	PO5	PO6	P07	PO8
	Mechanistic concept o	f some name reactions such as Mannich reaction, Stork Enamine reaction,		_					
CO1	Shapiro reaction, Perki	n reaction, Sharpless Asymmetric Epoxidation, Dieckmann condensation and	3 2	3	2	1	2	3	3
	Knoevenagel condensa	tion							
	Explain the mechanism	of some important rearrangement like Pinacol-pinacolone rearrangements,		_					
CO2	Benzil-Benzilic acid	rearrangements, Curtius rearrangements, Schmidt reaction, Lossen	3 2	2	2	1	2	3	3
	rearrangements, Baeye	r Villiger reaction and Favorskii rearrangements							
CO3	Analyse and compare t	he uses of some important reagents in organic transformation like oxidation,	3 2	2	2	1	2	3	3
	reduction, dehydration	, alkylation, acylation etc.	_					-	_
CO4	Evaluate the methods f	or the synthesis of some important five membered heterocyclic compounds	3 2	3	2	1	2	3	3
	and its chemical reaction	n.		-					
CO5	Comprehension for the	synthesis of some important six membered heterocyclic compounds and its	3 2	2	2	1	2	3	3
005	chemical reaction.		J 2	-	-	-	-	3	3
		3 Strong contribution, 2 Average contribution, 1 Low cont	ribution						
12. B	ief description of self-le	arning / E-learning component							
1. h	tps://www.organic-cher	nistry.org/namedreactions/beckmann-rearrangement.shtm							
2. h	tps://www.youtube.com	n/watch?v=F_xKfs4gzLg							
3. ht	tps://nptel.ac.in/course	s/104/103/104103111/							
4. ht	tps://www.youtube.com	n/watch?v=lG-4TJsAwGY							
5. h	tps://nptel.ac.in/course	s/104/105/104105034/							
<b>13.</b> B	ooks recommended:								
1. A	dvanced Organic Chemis	try (Reactions, Mechanisms and Structure): Michel B. Smith and Jerry March,	4th Edition, W	iley In	terscien	ce Publi	cation.		
2. A	Guidebook to Mechanis	m in Organic Chemistry by Peter Sykes, Six edition, Pearson publication.	- ,						
3. O	rganic Chemistry by Rob	ert Thornton Morrison, Robert Neilson Boyd, and Saibal Kanti Bhattacharjee, S	Seventh editio	n, Peai	rson put	lication			
4. O	rganic Chemistry by Jona	than Clayden, Nick Greeves, and Stuart Warren, Second edition, Oxford Publi	cation.		-				
5. O	rganic Chemistry by T.W	Graham Solomons, and Craig B. Fryhle, Ninth edition, Wiley Publication.							
6. O	rganic Chemistry by IL Fi	nar Volume 1 & 2 Sixth edition Pearson Publication							
ם ל	, ,								
<i>i</i> . <i>D</i>	esigning organic synthes	is by S. Warren, Wiley.							
7. D 8. So	esigning organic synthes ome Modern methods of	is by S. Warren, Wiley. Forganic synthesis by – W. Carruthers, Cambridge.							
7. D 8. So 9. H	esigning organic synthes ome Modern methods of eterocyclic Chemistry by	is by S. Warren, Wiley. Forganic synthesis by – W. Carruthers, Cambridge. raj K Bansal, New Age International							

1.	Name of the Departmen	t: Chemistry							
2.	Course Name	CHEMICAL KINETICS AND CHEMICAL EQUILBRIUM	L		-	Г		Р	
3.	Course Code	CH514	3			1		0	
4.	Type of Course (use tick	mark)	Core ( v	)	DE	()		FC (	)
5.	Pre-requisite (if any)	B.Sc. with Chemistry 6. Frequency (use tick marks) Even ()	Odd ( v	)	Either S	Sem ( )	E١	very Ser	n ()
7.	Total Number of Lecture	s, Tutorials, Practicals							
Lectu	ıres = 30	Tutorials = 10	Practical = N	il					
8. COL	JRSE OBJECTIVES: This c	ourse is designed for postgraduate students of chemistry as a broad base in	roduction to	chemio	cal kinet	ics and	chemic	al equi	librium.
After s	uccessfully completion of	f course, the student will able understand the chemical dynamics of complex	reaction and	their n	nechanis	sm. Inte	resting	ly, it als	o deals
with h	omogenous catalysis and	its applications.							
9. CO Δfter t	the successful course con	nnletion learners will develon following attributes:							
CO	URSE OUTCOME (CO)	ATTRIBUTES							
		Students would able to analyze theories of reaction rates by taking collision t	heory of bim	oleculai	r reactio	n and a	ctivated	d compl	ex, as a
	CO1	reference and also understand the how the concentration of inert salt affect	the rate of ch	nemical	reactior	۱.			-
	CO2	Students evaluate fundamentals of Homogeneous catalysis with reference of	Enzyme cata	lysis. T	hey got	sound i	nside o	f affect	solvent
	602	on the rate of chemical reaction.							
		Students would develop the concept of chemical dynamics; Lindemann H	inshelwood a	and Ric	e-Ramsp	erger-k	(assel-N	/larcus	[RRKM]
	CO3	theory. They got the sound insight of fast reactions by flow method, Relaxat	on method, a	and Flas	sh photo	lysis an	d their	applica	tions in
		research. Students would develop the concent of spontapeity: AG and how the Van't H	offequations	nlavve	ny impo	rtant ro	le in he	mogen	
	CO4	well heterogeneous equilibrium. They got the sound insight with reference o	f Le-Chatelier	's princ	iple and	its indu	istrial a	pplicati	ons.
		Students would able to illustrate how the ionic strength is affecting activity co	efficient and	mean a	ctivity co	oefficier	nt of ele	ctrolyte	es. They
	CO5	also got the concept of Debye-Huckel limiting law and its importance.			•			•	
10. L	Init wise detailed conter	t							
Unit	-1	Number of lectures = 08 Title of the unit: Theories of Reaction	Rates						
Kinetic	theory of collision, Sterio	c factor, Extension of collision theory, Conventional transition state theory, The	rmodynamic	s aspect	s of CTS	T, Kinet	ic and t	hermod	lynamic
contro	l of reactions, Salt effects	s, Steady state kinetics, Kinetic isotopic effect.							
Unit	- <b>2</b>	Number of lectures = 08   Litle of the unit: Solution Kinetic		1.1.1.1.1.1.					
Homo	geneous catalysis (acid-b s affecting the rate react	ase catalysis), Enzyme kinetics – Michaelis-Menten kinetics, Lineweaver-Burk	plot, Enzyme	Innibit	ion; com	ipetitive	e and n	oncomp	jetitive,
I Init.	.2	Number of lectures = 08 Title of the unit: Chemical Dynamic	s						
Unimo	lecular reactions and the	er treatments (Lindemann Hinshelwood and Rice-Ramsperger-Kassel-Marcus	- [RRKM] theo	orv). Co	mplex re	actions	(chain	reactio	ns. and
oscilla	tory reactions), Studies o	f fast reactions by flow method, Relaxation method, Flash photolysis.	[]	.,,,			(		,
Unit	4	Number of lectures = 08 Title of the unit: Chemical Equilibri	um						
Sponta	aneity of chemical reacti	ons; Gibbs energy minimum; Perfect gas equilibria; Gibbs free energy chang	e for the rea	ction a	nd chen	nical qu	otient;	Express	sion for
therm	odynamic equilibrium co	nstant; Equilibrium Calculations, Response of equilibrium to pressure, volume	and temper	ature, T	he van't	: Hoff e	quation	, Le-Cha	atelier's
princip	le.	Tials of the units							
Unit	5 trongth Activity coeffici	Number of lectures = 08 Inte of the unit:	trana alaatra	lutor [	John II	uekel li	miting		otrified
interfa	ces Overnotential Flect	rolytic conductivity		nytes, L	еруе-п		inning	idw, Ele	cumeu
11. CO	-PO mapping								
COs		Attributes	PO1 PO2	PO3	PO4	PO5	PO6	P07	PO8
	Students would able to	o analyze theories of reaction rates by taking collision theory of bimolecular							
CO1	reaction and activated	complex, as a reference and also understand the how the concentration of	3 2	1	1	1	2	3	3
	inert salt affect the rat	e of chemical reaction.							<u> </u>
CO2	Students evaluate fun	damentals of Homogeneous catalysis with reference of Enzyme catalysis.	3 2	2	1	1	2	3	3
	Students would dove	or affect solvent on the rate of chemical reaction.							<u> </u>
CO3	Ramsperger-Kassel-Ma	rcus [RRKM] theory. They got the sound insight of fast reactions by flow	3 2	2	1	1	1	2	3
	method, Relaxation me	ethod, and Flash photolysis and their applications in research.	-	_	_	-	_	-	
	Students would develo	p the concept of spontaneity; $\Delta G$ and how the Van't Hoff equations play very							
CO4	important role in homo	ogeneous as well heterogeneous equilibrium. They got the sound insight with	3 2	2	1	1	2	3	3
	reference of Le-Chateli	er's principle and its industrial applications.							<u> </u>
	Students would able to	b illustrate how the ionic strength is affecting activity coefficient and mean					-		
COS	importance	electrolytes. They also got the concept of Debye-Huckel limiting law and its	3 Z	2	1	1	2	5	3
	importance.	3 Strong contribution 2 Average contribution 1 Low cont	ribution						<u> </u>
12. B	rief description of self-le	parning / F-learning component	- ibutton						
1. h	ttps://nptel.ac.in/conter	ht/storage2/courses/122101001/downloads/lec-32.pdf							
2. h	ittps://www.youtube.com	n/watch?v=gN-yU0MDFzE							
3. h	ttps://www.youtube.com	n/watch?v=c34viSd-dVA							
4. h	ttps://www.khanacaden	ny.org/science/chemistry/chemical-equilibrium							
<b>13.</b> B	ooks recommended:								
1. P	nysical Chemistry, P.W.A	itkins and J. D. Paulo, Oxford, 2013, 10th edition New Delhi.							
2. C 3. P	Physical Chemistry Geogr	e Woodbury, Brooks/ Cole Publishing, 1997, Pacific Grove, LISA							
4. P	hysical Chemistry, T. Eng	el and P. Reid, Pearson, 2006, 1st edition, New Delhi.							
5. K	inetics and Mechanism o	f Chemical Transformations, J. Rajaraman and J.Kuriacose, McMillan.							

	ame of the Departme	nt: Chemistry										
2. Co	ourse Name	INORGANIC REACTION	IS, MECHANISM	AND CATALYSIS		L		т			Р	
3. Co	ourse Code	CH515				3		1			0	
4. Ty	ype of Course (use tic	a mark)				Core	(√)	DE (	)		FC (	)
5. Pi	re-requisite (if any)	B.Sc. with Chemistry	6. Frequency	y (use tick marks)	Even ( )	Odd (	√)	Either Se	em ( )	Ev	ery Sen	n ()
7. To	otal Number of Lectu	es, Tutorials, Practicals										
Lectur	es = 30			Tutorials = 10		Practi	ical = Nil					
8. COUR	RSE OBJECTIVES: To co	mprehend inorganic reactior	n mechanisms, in	fluencing factors, and	the significance of	f inorganic e	elements	in context v	vith bio	inorga	nic che	mistry.
9. COU	IRSE OUTCOMES (CO)											
After th	e successful course co	mpletion, learners will devel	iop following att	ributes:	TTDIDI ITES							
COOK		Explanation of the basic conc	cepts related to s	tability of coordination	complexes and a	n elementa	rv idea w	vill be impar	ted rega	rding t	he basi	cs of
	C01	reaction mechanisms.	fragetion mashe		somployos will be	discussed		h the factor		ng tho		
	CO2	reactions.			complexes will be	uiscusseu a	along wit		sanecu	ing the		
	CO3	nculcation of higher order th	ninking ability in s	students to compreher	nd the inner and o	uter sphere	e reaction	15.				
	CO4	Set the overture of Bio-inorg	anic chemistry al	ong with the elucidation	on of the role of in	organic ele	ments in	the metabo	lism.			
	CO5 Comprehension of the structure, functioning and role of important bio-inorganic moieties as well as the role of metal ions in body.											
10. Un	nit wise detailed conte	nt										
Unit-1		Number of lectures = 08		Title of the unit: Typ	es of Mechanisms	;						
Basic co effect ar	ncepts as kinetic and t nd macrocyclic effect.	hermodynamic stability and	lability, stability c	constants; HSAB princip	le, Factors affecti	ng the stabi	lity of co	mplexes wit	h specia	l emph	asis to	chelate
Unit-2	·	Number of lectures = 08	Ī	Title of the unit: Typ	es of Mechanisms	: Substituti	on React	ions in Coo	dinatio	n Com	pounds	
Substitu	ition reactions in coor	lination compounds: Substit	ution reactions ir	n square planar comple	exes, Trans effect,	trans series	s, Substit	ution in octa	hedral	comple	exes, SN	1, SN2,
SNICB m	nechanisms, steric effe	cts on substitutions.										
Unit-3	•	Number of lectures = 08		Title of the unit: Liga	nd Transfer and E	lectron Tra	nsfer Rea	actions in Co	ordinat	tion Co	mpoun	ds
Inner an	nd outer sphere reacti	ons, Electron Transfer reaction	ons, Potential ene	ergy diagrams as a con	ceptual tool, Mare	cus equatio	n, Types	of and facto	rs affec	ting ele	ectron t	ransfer
reaction	15.			Title of the unit Met	al long in Dialogia	al Custome						
Unit-4	contial and trace met	Number of lectures = 08		The of the unit: Met	ai ions in biologic	ai systems						
(a) ES (b)Vit	tamin B12, methyl col											
(c) Bi	cannin 222) meenigi eek	alamine. Biomethylation.										
	ological nitrogen fixat	alamine, Biomethylation. on, molybdenum nitrogenas	e, spectroscopic	and other evidence,								
oth	ological nitrogen fixat er nitrogenases mode	alamine, Biomethylation. on, molybdenum nitrogenas systems.	e, spectroscopic	and other evidence,								
oth Unit-5	ological nitrogen fixat er nitrogenases mode	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08	e, spectroscopic	and other evidence, Title of the unit:								
oth Unit-5 Heme p	ological nitrogen fixat er nitrogenases mode i roteins and oxygen u	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 itake, structure and function	e, spectroscopic	and other evidence, Title of the unit: myoglobin, homocyar	ins and hemeryth	nrin, model	synthetic	complexes	of iron,	and co	opper E	lectron
oth Unit-5 Heme p Transfer	ological nitrogen fixat er nitrogenases mode roteins and oxygen up in Biology Structure a	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 itake, structure and function nd function of metalloprotei	e, spectroscopic of hemoglobin, ins in electron tra	and other evidence, Title of the unit: myoglobin, homocyar ansport processes-cyto	ins and hemeryth chromes and ion	nrin, model sulphur pro	synthetic teins.	complexes	of iron,	and co	opper E	lectron
oth Unit-5 Heme p Transfer 11. CO-F	ological nitrogen fixat er nitrogenases mode roteins and oxygen u r in Biology Structure a <b>D mapping</b>	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 itake, structure and function nd function of metalloprotei	e, spectroscopic of hemoglobin, ins in electron tra	and other evidence, Title of the unit: myoglobin, homocyar ansport processes-cyto	ins and hemeryth chromes and ion	nrin, model sulphur pro	synthetic teins.	c complexes	of iron,	and co	opper E	lectron
oth Unit-5 Heme p Transfer 11. CO-F COs	ological nitrogen fixat er nitrogenases mode roteins and oxygen u r in Biology Structure a PO mapping	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 itake, structure and function nd function of metalloprotei	e, spectroscopic of hemoglobin, ins in electron tra Attributes	and other evidence, <b>Title of the unit:</b> myoglobin, homocyar ansport processes-cyto	ins and hemeryth chromes and ion	nrin, model sulphur pro	synthetic teins.	c complexes	of iron,	and co	opper E	lectron
oth Unit-5 Heme p Transfer 11. CO-F COs CO1	ological nitrogen fixat er nitrogenases mode roteins and oxygen uj r in Biology Structure a PO mapping Explanation of the ba be imparted regardir	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 take, structure and function nd function of metalloprotei sic concepts related to stabil	e, spectroscopic of hemoglobin, ins in electron tra Attributes ity of coordinatic banisms	and other evidence, Title of the unit: myoglobin, homocyar ansport processes-cyto pon complexes and an e	ins and hemeryth chromes and ion s lementary idea wi	nrin, model sulphur pro PO1 ill 3	synthetic teins. PO2 I 1	c complexes	of iron, PO5 2	and cc PO6 3	ppper E	PO8
othe Unit-5 Heme p Transfer 11. CO-F COs CO1	ological nitrogen fixat er nitrogenases mode roteins and oxygen up r in Biology Structure a PO mapping Explanation of the ba be imparted regardir Detailed study and a	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 itake, structure and function nd function of metalloprotei sic concepts related to stabil g the basics of reaction mechanisr	e, spectroscopic of hemoglobin, ins in electron tra Attributes lity of coordinatio hanisms. ns in coordinatio	and other evidence, Title of the unit: myoglobin, homocyar ansport processes-cyto on complexes and an e n complexes will be dia	ins and hemeryth chromes and ion s lementary idea wi	nrin, model sulphur pro	synthetic teins. PO2 I 1	c complexes	of iron, PO5 2	and cc PO6 3	PO7	PO8
oth Unit-5 Heme p Transfer 11. CO-F COs CO1 CO2	ological nitrogen fixat er nitrogenases mode roteins and oxygen up r in Biology Structure a PO mapping Explanation of the ba be imparted regardir Detailed study and a the factors affecting	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 itake, structure and function nd function of metalloprotei sic concepts related to stabil g the basics of reaction mechanism the rate of reactions.	e, spectroscopic of hemoglobin, ins in electron tra Attributes lity of coordination hanisms. ns in coordination	and other evidence, Title of the unit: myoglobin, homocyar ansport processes-cyto on complexes and an e n complexes will be dis	ins and hemeryth chromes and ion s lementary idea wi scussed along with	nrin, model sulphur pro PO1 ill 3	synthetic teins. PO2 I 1 1	c complexes PO3 PO4 2 2 2 2	of iron, PO5 2 2	and cc PO6 3 3	PO7 2 2	PO8 2 2
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oth Unit-5 Heme p Transfer 11. CO-F COs CO1 CO2 CO3 CO4 CO5	ological nitrogen fixat er nitrogenases mode roteins and oxygen up r in Biology Structure a PO mapping Explanation of the ba be imparted regardir Detailed study and at the factors affecting Inculcation of higher Set the overture of B metabolism. Comprehension of th metal ions in body.	alamine, Biomethylation. on, molybdenum nitrogenas systems. Number of lectures = 08 itake, structure and function nd function of metalloprotei sic concepts related to stabil g the basics of reaction mechanism he rate of reaction mechanism he rate of reactions. order thinking ability in studio o-inorganic chemistry along e structure, functioning and a	e, spectroscopic of hemoglobin, ins in electron tra Attributes lity of coordinatio hanisms. ms in coordinatio ents to comprehe with the elucidar role of important	and other evidence, Title of the unit: myoglobin, homocyar ansport processes-cyto on complexes and an e n complexes will be dis- end the inner and outer tion of the role of inor bio-inorganic moieties n. 2 Average contribut	ins and hemeryth chromes and ion s lementary idea wi scussed along with r sphere reactions ganic elements in s as well as the rol <b>ion. 1 Low contri</b>	rrin, model sulphur pro III 3 a s. 3 the 3 e of 3 bution	synthetic teins. PO2 I 1 1 1 1 1 1	PO3     PO4       2     2       2     2       2     2       2     2       2     2       2     2       2     2       2     2       2     2       2     2       2     2       2     2	of iron, <b>PO5</b> 2 2 2 2 2 2 2 2 2	and cc PO6 3 3 3 3 3 3 3	PO7           2           2           3           2	PO8 2 2 2 2 2 2 2 2 2
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1. Nam	ne of the Departme	ent: Chemistry			-			1		-			
2. Course	Name	QUANTUM CHEMISTRY: A N	IOLECULAR APPROACH			L		Т			Р		
3. Course	Code	СН516				3		1			0		
4. Type of	Course (use tick m	ark)				Core	()	DE	[(√)		FC ( )		
5. Pre-req	uisite (if any)	BSc. with Chemistry	6. Frequency (use tick marks)	Even ( )		Odd (	√)	Eithe	r Sem ( )	E١	very Sem	i()	
7. Total N	umber of Lectures,	Tutorials, Practicals											
Lectures =	: 30		Tutorials = 10		Prac	ctical =	Nil						
8. COURSE	OBJECTIVES: Quan	tum chemistry uses high-leve	I mathematics as a tool to understar	nd atomic and	l mole	ecular s	tructure	, prope	rties, ene	ergy as v	well as c	hemical	
reactivity. I	t introduces the m	athematical foundations of a	a variety of wave functions as well a	s a practical,	hands	s-on ex	perience	e. The r	nain obj	ective o	f compu	tational	
chemistry is	c to solve chemical p	problems by simulating chemic	ai systems (molecular, biological, mat	erials) in orde	r to pr	ovide re	ellable, a	accurate	and con	nprenen	sive into	rmation	
After the su	ccessful course co	npletion, learners will develo	p following attributes:										
COURSE OU	JTCOME (CO)		A1	TRIBUTES									
	CO1	Apply the knowledge of matri	ces to solve the problems.										
	CO2	Understand the basic concept	s and ideas of Quantum Mechanics.								·		
CO3         Solve the time dependent Schrödinger-equation for discrete two-level systems and being able to apply this to simple problems involving electron spin and photon polarization.           Apply the technique of separation of variables to solve problems in more than one dimension and to understand the role of degeneracy in the													
CO4 Apply the technique of separation of variables to solve problems in more than one dimension and to understand the role of degeneracy in the occurrence of electron shell structure in atoms.													
CO5 To understand analysis of indeterminate structures and adopt an appropriate structural analysis technique													
10. Unit w	rise detailed conte	Number of loctures - (		lathomatical	Cones	nt							
Matrices (2)	x2 3x3) only Multi	nlication inverse of matrix (i	dentity matrix) 2v2 2v2 2v2 1 commu	tative propert	ies of	matrice	as com		her 7 ar	nd its con	mnley co	niugata	
Z*. Expansio	on of series lex. sin:	c. cosx. ln(1+x) ln(1-x)]. stirli	ng approximation.	tative propert	163 01	matrice	-5, com	JEX HUI			inplex co	njugate	
Unit-2		Number of lectures =0	8 Title of the unit: Introductory C	uantum Mec	hanics	s							
Black-body	radiation, Planck's	adiation law, photoelectric ef	fect, heat capacity of solids, Bohr's mo	del of hydrog	en ato	om (wit	hout de	rivation	) their so	lution of	overall	solution	
and its defe	cts, Compton effec	t, de-Broglie's hypothesis, the	Heisenberg's uncertainty principle, H	amiltonian Op	erato	r.							
Unit-3		Number of lectures = 0	8 Title of the unit: Elementary Q	antum Mech	anics-	-1							
Postulates o	of quantum mechai	nics, Eigen value equations &	unction, concept of Wave function, n	ormalization a	and or	thogon	alizatior	n of wav	e functio	n, Quan	tum me	chanical	
operator, co	ommutation of ope	rators, Time dependent and t	me independent Schrödinger wave ed	uation and its	s impo	ortance.							
Unit-4		Number of lectures = 0	1 Itle of the unit: Elementary Q	antum Mech	anics-	-   - f. a.u.h.: h.			ور ما م م	· · · · · · ·			
Particle in a in quantum	mechanics (Lx, Ly,	bx, physical interpretation of Lz), Harmonic oscillator, Rigid	ne wave function, radial hode, wave f rotor.	unction and sr	nape o	of orbita	al, radia	probab	llity dens	sity, Ang	ular mol	nentum	
Unit-5		Number of lectures =	08 Title of the unit: Approximate I	Vethods									
The variatio Orbital Theo	on theorem, Pertur ory Huckel theory c	bation theory (first order and f conjugated systems, Bond o	non- degenerate). Applications of va rder and charge density calculations,	riation metho Applications t	od and o ethy	d pertul ylene, b	bation t outadier	heory o ie, cyclo	f the Hyd propeny	drogen a I radical	atom. M , cyclobu	olecular ıtadiene	
etc.													
11. CO-POT		Attri	autos	D	01 0		DO3		POF	POG	PO7	DO8	
cos		Attri	Jutes	P		PU2	PU3	PU4	PUS	PUO	P07	PUo	
CO1	Apply the knowled	lge of matrices to solve the pr	oblems.		2	1	2	1	1	2	2	2	
CO2	Understand the b	asic concepts and ideas of Qua	antum Mechanics.		2	1	2	1	1	2	2	2	
CO3	Solve the time dep able to apply this	bendent Schrödinger-equation to simple problems involving	n for discrete two-level systems and be electron spin and photon polarization.	eing	2	1	2	1	1	2	2	2	
CO4	Apply the techniq and to understand atoms.	ue of separation of variables t I the role of degeneracy in the	o solve problems in more than one di occurrence of electron shell structur	mension e in	2	1	2	1	1	2	1	2	
CO5	To understand an analysis technique	alysis of indeterminate structu	ires and adopt an appropriate structu	ral	3	1	2	1	1	2	2	2	
	3 St	rong contribution, 2 Average	contribution, 1 Low contribution										
12. Brief d	lescription of self-l	earning / E-learning compone	ent										
1. https://	www.khanacadem	y.org/math/precalculus/x9e8	a4f98389efdf:matrices/x9e81a4f983	39efdf:mat-int	tro/a/i	'intro-to	o-matric	es					
2. https://	www.youtube.com	/watch?v=8JF6lvPBAzk	22/										
4. https://	www.voutube.com	/watch?v=SOmi5iT2VLU	15/										
13. Books	recommended:	,											
1. Physic	al Chemistry P W	Atkins, Oxford Press, 7thEdn											
2. Introd	uction to Quantum	Chemistry, A.K. Chandra, Tat	a McGraw Hill.										
3. Quant	um Chemistry, Ira	N. Levine, Prentice Hall.											
4. Modei	rn Spectroscopy, J.I	M. Hollas, John Wiley.											
5. Introd	uction to Molecula	r Spectroscopy, G.M. Barrow,	McGraw Hill.										
o. Basic F	rinciples of Spectr	оscopy, к. chang, McGraw Hil											

1. Nam													
	e of the Department	: Chemistry											
2. Cours	se Name	BIOINORGANIC AND S	UPRAMOLECULAR (	CHEMISTRY			L			Г		Р	
3. Cours	rse Code	CH506					3			1		0	
4. Type	e of Course (use tick r	nark)				C	Core ( )		DE	(√)		FC (	)
5. Pre-r	requisite (if any)	B.Sc. with Chemistry	6. Frequency (use	e tick marks)	Even ()	0	dd (√)		Either 3	Sem ( )	Εv	ery Ser	n ()
7. Tota	I Number of Lectures	, Tutorials, Practicals	-										
Lectures =	= 30		Tuto	orials = 10		Pract	ical = N	il					
8. COURSE	OBJECTIVES: The co	urse aims at providing u	inderstanding of the	e chemistry of d-l	block metals in n	netallop	bouroteins	and of	metal	based t	oloactiv	e comp	bounds,
		gintion, interactions resp			ieculai systems a		ne use	ormeta		uicine.			
After the su	uccessful course com	pletion, learners will dev	elop following attri	butes:									
COURSE O	OUTCOME (CO)			TA	TRIBUTES								
	CO1 Stude	nt would be able to unde	erstand the role of ic	ns in biological sy	vstem.								
	CO2 Stude	nts evaluate fundamenta	als of enzyme reaction	ons and metalloer	izymes.								
	CO3 Stude	nts would develop the co	oncept of metal acid	reactions, and ac	Iministration of c	lrugs.							
-	CO4 Stude	ents would restate differe	nce between differe	ent modes of mole	ecular reactions.								
10 11-11-11	vise detailed content		ine concepts of supr		istry.								
10. Onit V	wise detailed content	abor of locturos - 08	Title	of the unit: Mot	lions in Biologic	al fund	ions						
A brief intro	oduction to bio-inore	anic chemistry. Role of m	netal ions present in	biological system	is with special re	ference	to Na <sup>+</sup>	K <sup>+</sup> and	Mg <sup>2+</sup> ic	ns: Na/	/K pumr	: Role (	of Mg <sup>2+</sup>
ions in ener	rgy production and cl	nlorophyll. Role of Ca <sup>2+</sup> in	blood clotting, stab	ilization of protei	n structures and	structur	al role	(bones)				,	0
Unit-2	Nur	nber of lectures = 08	Title	of the unit: Met	alloenzymes			<u>, ,</u>					
Enzyme, co	enzyme, apoenzyme	and holoenzyme, Zinc en	zymes: carboxypepti	dase, carbonic an	hydrase and alco	hol deh	ydroge	nase. Iro	on enzy	mes-cat	talase a	nd pero	oxidase.
Copper enz	zymes -superoxide dis	mutase. Molybdenum er	nzymes – xanthine ox	idase.									
Unit-3	Nur	nber of lectures = 08	Title	of the unit: Met	al-Nucleic Acid In	nteracti	ons					<u>.</u> .	
Metals use	d for diagnosis and o	chemotherapy with parti-	cular reference to a	nticancer drugs.	cis-platin-indicat	ion and	contra	indicat	ions. A	dminist	ration c	of drug	and its
linit 4	Nur	abor of locturos - 08	Title o	of the unit: Sunra	g autilitistration	istrv							
Concepts a	and language. Molecu	llar recognition: Molecul	ar receptors for diff	erent types of m	olecules includir	ng ariso	nic sub	strates.	design	and sv	nthesis	of core	ecentor
molecules a	and multiple recognit	ion.											
Unit-5	Nur								U				cceptor
(1) 5	1 Mul	nber of lectures = 08	Title o	of the unit: App	lications of Supra	amolec	ular Spe	cies/Co	ompour	nds			
(A) Supram	nolecular reactivity a	nber of lectures = 08 nd catalysis. (B) Transpo	Title ort processes and ca	of the unit: App arrier design. (C)	<b>lications of Supr</b> a	amolect devices	ular Spe . Supra	ecies/Co molecu	ompour lar pho	ids tochem	nistry, si	upramo	plecular
electronic, i	nolecular reactivity a ionic and switching	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam	Title of the of self-assembly	o <mark>f the unit: App</mark> nrier design. (C) in supramolecula	lications of Supra Supramolecular r chemistry.	amolect devices	ular Spe . Supra	ecies/Co molecu	ompour lar pho	ids tochem	nistry, si	upramo	plecular
electronic, i	nolecular reactivity a ionic and switching mapping	nber of lectures = 08 nd catalysis. (B) Transpo ; devices. (D) Some exam	Title of rt processes and ca ple of self-assembly	of the unit: App Irrier design. (C) in supramolecula	<b>lications of Supr</b> a Supramolecular r chemistry.	amolect devices	ular Spe	cies/Co molecu	ompour lar pho	nds tochem	histry, si	upramo	blecular
electronic, i 11. CO-PO I COs	nolecular reactivity a ionic and switching mapping	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At	Title of rt processes and ca ple of self-assembly tributes	of the unit: App prrier design. (C) in supramolecula	lications of Supra Supramolecular r chemistry.	devices	ular Spe . Supra PO2	ecies/Co molecu PO3	ompour lar pho PO4	ids tochem PO5	histry, st PO6	upramo PO7	plecular PO8
electronic, i 11. CO-PO i COs Stu	nolecular reactivity a ionic and switching mapping udent would be able t	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of	Title of rt processes and ca ple of self-assembly tributes ions in biological sys	of the unit: App nrrier design. (C) in supramolecula stem.	lications of Supra Supramolecular r chemistry.	ewices PO1 3	ular Spe Supra	rcies/Co molecu PO3	ompour lar pho PO4 3	nds tochem PO5 2	PO6	upramo PO7 3	PO8
electronic, i 11. CO-PO I COs CO1 Stu CO2 Stu	nolecular reactivity a ionic and switching mapping udent would be able to udents evaluate fund.	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of amentals of enzyme react	Title of rt processes and ca ple of self-assembly tributes ions in biological syst tions and metalloen	of the unit: App urrier design. (C) in supramolecula stem. zymes.	lications of Supra Supramolecular r chemistry.	PO1 3	PO2	ecies/Co molecu PO3 1	PO4 3 3	nds tochem PO5 2 1	PO6 3 3	PO7 3 3	PO8 3
electronic, i 11. CO-PO I COs CO1 Stu CO2 Stu CO3 Stu	nolecular reactivity a ionic and switching mapping udent would be able t udents evaluate fund. udents would develop	nber of lectures = 08 nd catalysis. (B) Transpo ; devices. (D) Some exam At co understand the role of amentals of enzyme react o the concept of metal ac	Title of ort processes and ca ple of self-assembly tributes ions in biological system tions and metalloen id reactions, and add	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr	lications of Supra Supramolecular r chemistry.	PO1 3 3 2	PO2	PO3 1	PO4 3 3	PO5 2 1	PO6 3 3	upramo PO7 3 3	PO8 3 3
electronic, i 11. CO-PO I COS CO1 Stu CO2 Stu CO3 Stu CO3 Stu	nolecular reactivity a ionic and switching mapping udent would be able t udents evaluate fund udents would develop	nber of lectures = 08 nd catalysis. (B) Transpo ; devices. (D) Some exam At co understand the role of amentals of enzyme react o the concept of metal ac difference between diffe	Title of ort processes and ca ple of self-assembly tributes ions in biological syst tions and metalloen id reactions, and add	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr	lications of Supra Supramolecular r chemistry.	PO1 3 3 3 3	PO2 1 1 1	PO3 1 1	PO4 3 3 3	rds tochem PO5 2 1 1	PO6 3 3 3	upramo PO7 3 3 3	PO8 3 3 2
electronic, i 11. CO-PO I COS CO1 Stu CO2 Stu CO3 Stu CO3 Stu CO4 Stu	nolecular reactivity a ionic and switching mapping udent would be able t udents evaluate fund udents would develop udents would restate	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe	Title of ort processes and ca ple of self-assembly tributes ions in biological syst tions and metalloen id reactions, and adu	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions.	lications of Supra Supramolecular r chemistry.	PO1 3 3 3 3 3	PO2 1 1 2	PO3 1 1 1	PO4 3 3 3 3	PO5 2 1 1 2	PO6 3 3 3 3 3	PO7 3 3 3 3 3	PO8 3 3 2 2
electronic, i 11. CO-PO I COS Stu CO1 Stu CO2 Stu CO3 Stu CO4 Stu CO5 Stu	nolecular reactivity a ionic and switching mapping udent would be able t udents evaluate fund udents would develop udents would restate udents would able to	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At o understand the role of amentals of enzyme react the concept of metal ac difference between diffe apply the concepts of sup	Title of rt processes and ca ple of self-assembly tributes ions in biological syst tions and metalloen id reactions, and adu rent modes of mole pramolecular chemis	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions.	lications of Supra Supramolecular r chemistry.	PO1 3 3 3 3 3 3 3	PO2 1 1 2 2	PO3 1 1 1 1	PO4 3 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3 3	PO7 3 3 3 3 3 3 3	PO8 3 3 2 2 2
electronic, i 11. CO-PO i CO3 Stu CO2 Stu CO3 Stu CO3 Stu CO4 Stu CO5 Stu	nolecular reactivity a ionic and switching mapping udent would be able t udents evaluate fund udents would develop udents would restate udents would able to	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe apply the concepts of sup 3 Stro	Title of rt processes and ca ple of self-assembly tributes ions in biological syst tions and metalloen id reactions, and add rent modes of mole pramolecular chemis	of the unit: App arrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry.	lications of Supra Supramolecular r chemistry. ugs.	PO1 3 3 3 3 3 3 3 3	PO2 1 1 1 2 2	PO3 1 1 1 1 1	PO4 3 3 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3 3 3	PO7 3 3 3 3 3 3 3 3	PO8 3 3 2 2 2 2
electronic, 11. CO-PO COS CO1 Stu CO2 Stu CO3 Stu CO3 Stu CO4 Stu CO5 Stu 12. Brief of	nolecular reactivity a ionic and switching mapping udent would be able to udents evaluate fund udents would develop udents would restate udents would able to description of self-lea	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe apply the concepts of sup 3 Stro arning / E-learning compo	Title of ort processes and ca ple of self-assembly tributes ions in biological syst tions and metalloen id reactions, and add rent modes of mole pramolecular chemis ong contribution, 2 4 onent	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut	lications of Supra Supramolecular r chemistry. ugs.	PO1 3 3 3 3 3 ibution	PO2 1 1 1 2 2	PO3 1 1 1 1 1	PO4 3 3 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3 3	PO7 3 3 3 3 3 3 3	PO8 3 3 2 2 2
electronic, 11. CO-PO I COS CO1 Stu CO2 Stu CO3 Stu CO3 Stu CO4 Stu CO5 Stu 12. Brief of 1. http:/	nolecular reactivity a ionic and switching mapping udent would be able t udents evaluate fund udents would develop udents would restate udents would restate udents would able to description of self-lea //chemistry.du.ac.in/	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe apply the concepts of sup 3 Stro arning / E-learning compo- study_material/4102-B/1	Title of ort processes and ca ple of self-assembly tributes ions in biological sys- tions and metalloen id reactions, and add erent modes of mole pramolecular chemis ong contribution, 2 A onent .%20Role%20of%20	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%201ons%2	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr	PO1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	PO2 1 1 1 2 2 ttems.pu	PO3 1 1 1 1 1 1 1	PO4 3 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3 3	PO7 3 3 3 3 3 3	PO8 3 3 2 2 2
electronic, i 11. CO-PO I COS CO1 Stu CO2 Stu CO3 Stu CO3 Stu CO4 Stu CO5 Stu 12. Brief ( 1. http:/ 2. https:	molecular reactivity a ionic and switching mapping udent would be able to udents evaluate fund udents would develop udents would restate udents would restate udents would able to description of self-ler //chemistry.du.ac.in/: //www.rsc.org/even	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of amentals of enzyme react the concept of metal ac difference between difference between difference apply the concepts of sup 3 Strop aming / E-learning compu- study_material/4102-B/1 ts/detail/46673/natural-	Title of ort processes and ca ple of self-assembly tributes ions in biological sys- tions and metalloen id reactions, and adu- pramolecular chemis ong contribution, 2 A onent .%20Role%20of%20 and-artificial-metallo	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20lons%2 enzymes-faraday	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr 0in%20Biological -discussion	PO1 3 3 3 3 3 ibution	PO2 1 1 2 2 ttems.pr	PO3 1 1 1 1 1 df	PO4 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3	PO7 3 3 3 3 3 3	PO8 3 3 2 2 2 2
CO1         Stur           CO2         Stu           CO2         Stu           CO3         Stu           CO4         Stu           CO5         Stu           CO4         Stu           CO5         Stu           C04         Stu           C05         Stu           C04         Stu           C05         Stu           1.         https://           3.         https://           3.         https://	nolecular reactivity a ionic and switching mapping udent would be able to udents would develop udents would develop udents would restate udents would able to description of self-lea //chemistry.du.ac.in/: ://www.rsc.org/even ://www.youtube.com	nber of lectures = 08 nd catalysis. (B) Transpo c devices. (D) Some exam At co understand the role of amentals of enzyme react o the concept of metal ac difference between difference between difference apply the concepts of sup 3 Strop arning / E-learning compu- study_material/4102-B/1 ts/detail/46673/natural-a v/watch?v=1Wc4jTH2v-a v/watch?v=0CPBcc0k	Title of Title of Title of ple of self-assembly tributes ions in biological system tions and metalloen id reactions, and add prent modes of mole pramolecular chemistry onent .%20Role%20of%20 and-artificial-metallor /	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20lons%2 enzymes-faraday	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr Oin%20Biological -discussion	PO1 3 3 3 3 3 ibution	PO2 1 1 1 2 2 stems.p	PO3 1 1 1 1 1 df	PO4 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3 3	upramo PO7 3 3 3 3 3 3	PO8 3 3 2 2 2 2
CO1         Stur           CO2         Stu           CO3         Stu           CO4         Stu           CO5         Stu           CO4         Stu           CO5         Stu           CO4         Stu           CO5         Stu           CO4         Stu           C05         Stu           2.         https:           3.         https:           5.         https:	nolecular reactivity a ionic and switching mapping udent would be able to udents evaluate fund. udents would develop udents would restate udents would able to description of self-lea //chemistry.du.ac.in/: ://www.rsc.org/even ://www.youtube.com	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam Att o understand the role of amentals of enzyme react o the concept of metal ac difference between diffe apply the concepts of sup 3 Stro arning / E-learning compu- study_material/4102-B/1 ts/detail/46673/natural- at/watch?v=1Wc4jTH2v_w //watch?v=QQRpcot0k_l g/journals/chemistrv/see	Title of rt processes and ca ple of self-assembly tributes ions in biological sys- tions and metalloen id reactions, and adu- prent modes of mole pramolecular chemis tong contribution, 2 # onent .%20Role%20of%20 and-artificial-metallo / ctions/supramolecul	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20lons%2 venzymes-faraday ar-chemistry	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr Oin%20Biological -discussion	PO1 3 3 3 3 3 IMURAN	PO2 1 1 1 2 2 ttems.p	PO3 1 1 1 1 1 df	PO4 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3	PO7 3 3 3 3 3 3	PO8 3 3 2 2 2
Image: Non-Structure         Structure           electronic, i         11. CO-PO I           CO3         Stu           CO2         Stu           CO3         Stu           CO4         Stu           CO5         Stu           CO4         Stu           CO5         Stu           12.         Brief of           1.         http:/           3.         https:           5.         https:           13.         Books	nolecular reactivity a ionic and switching mapping udent would be able f udents evaluate fund. udents would develop udents would restate udents would able to description of self-lea //chemistry.du.ac.in/: ://www.rsc.org/even ://www.youtube.com ://www.youtube.com ://www.frontiersin.oi	her of lectures = 08 and catalysis. (B) Transpo devices. (D) Some exam Att co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe apply the concepts of sup 3 Stro anning / E-learning compu- study_material/4102-B/1 ts/detail/46673/natural- at/watch?v=1Wc4jTH2v_w //watch?v=1Wc4jTH2v_w //watch?v=QQRpcot0k_l g/journals/chemistry/sec	Title of rt processes and ca ple of self-assembly tributes ions in biological sys- tions and metalloen- id reactions, and add prent modes of mole pramolecular chemis ong contribution, 2 # onent .%20Role%20of%20 and-artificial-metallo / ctions/supramolecul	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20lons%2 penzymes-faraday ar-chemistry	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr 0in%20Biologica -discussion	PO1 3 3 3 3 3 ibution	PO2 1 1 1 2 2 ttems.pd	PO3 1 1 1 1 1 1 df	PO4 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3	PO7 3 3 3 3 3 3	PO8 3 3 2 2 2
II. CO-PO I         CO1         CO2         CO3         Stu         CO3         Stu         CO4         Stu         CO5         Stu         CO4         Stu         CO5         Stu         CO4         Stu         CO5         Stu         CO5         Stu         CO5         Stu         1.         https:         3.         https:         5.         https:         1.         Princi	nolecular reactivity a ionic and switching mapping udent would be able to udents evaluate fund udents would develop udents would develop udents would restate udents would able to description of self-lee //chemistry.du.ac.in/: ://www.rsc.org/even ://www.youtube.com ://www.youtube.com ://www.frontiersin.or s recommended: iples of Bioinorganic (	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam Att co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe apply the concepts of sup 3 Stroc arming / E-learning compu study_material/4102-B/1 ts/detail/46673/natural-a v/watch?v=1Wc4jTH2v_w v/watch?v=QQRpcot0k_I rg/journals/chemistry/sec Chemistry, S.J. Lippard an	Title of rt processes and ca ple of self-assembly tributes ions in biological sys- tions and metalloen id reactions, and adu rent modes of mole pramolecular chemis ong contribution, 2 A onent .%20Role%20of%20 and-artificial-metalloc ctions/supramolecular d J.M. Berg, Univers	of the unit: App arrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20lons%2 enzymes-faraday ar-chemistry ity Science Books	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr Oin%20Biological -discussion	PO1 3 3 3 3 3 ibution	PO2 1 1 1 2 stems.p	PO3 1 1 1 1 1 1 df	PO4 3 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3	PO7 3 3 3 3 3 3	PO8 3 3 2 2 2
II. CO-PO I         CO1         CO2         Stu         CO3         Stu         CO4         Stu         CO5         Stu         CO4         Stu         CO5         Stu         CO4         Stu         CO5         Stu         CO5         Stu         CO5         Stu         1.         https:         3.         https:         Stu	nolecular reactivity a ionic and switching mapping udent would be able to udents evaluate fund udents would develop udents would develop udents would restate udents would able to description of self-lee //chemistry.du.ac.in/: ://www.rsc.org/even ://www.youtube.com ://www.youtube.com ://www.frontiersin.or s recommended: iples of Bioinorganic Coorganic Chemistry, I.	nber of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam At co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe apply the concepts of sup 3 Stro arning / E-learning compe study_material/4102-B/1 ts/detail/46673/natural-a //watch?v=1Wc4jTH2v_w //watch?v=1Wc4jTH2v_w //watch?v=QQRpcot0k_I rg/journals/chemistry/sec	Title of rt processes and ca ple of self-assembly tributes ions in biological sys- tions and metalloen. id reactions, and add rent modes of mole pramolecular chemis ong contribution, 2 / onent .%20Role%20of%20 and-artificial-metallo / ctions/supramolecular d J.M. Berg, Univers pard and J.S. Valenti	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20lons%2 venzymes-faraday ar-chemistry ity Science Books ne, University	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr Oin%20Biological -discussion	PO1 3 3 3 3 3 ibution 1%20Sys	PO2 1 1 1 2 2 terms.p	PO3 1 1 1 1 1 1 1	PO4 3 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3 3	PO7 3 3 3 3 3 3	PO8 3 3 2 2 2
cos     cos       cos     cos       cos     stu       stu     stu       cos     stu       stu     stu	nolecular reactivity a ionic and switching mapping udent would be able to udents evaluate fund udents would develop udents would restate udents would able to description of self-lea //chemistry.du.ac.in/: ://www.rsc.org/even ://www.youtube.com ://www.youtube.com ://www.frontiersin.or s recommended: iples of Bioinorganic Co organic Chemistry, I. ce Books.	her of lectures = 08 nd catalysis. (B) Transpo devices. (D) Some exam Att co understand the role of amentals of enzyme react o the concept of metal ac difference between diffe apply the concepts of sup 3 Stro arning / E-learning compo study_material/4102-B/1 ts/detail/46673/natural-a /watch?v=1Wc4jTH2v_w /watch?v=QQRpcot0k_I g/journals/chemistry/sec Chemistry, S.J. Lippard an Bertini, H.B. Gray, S.J. Lipp	Title of the set of th	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20Ions%2 venzymes-faraday ar-chemistry ity Science Books ne, University	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr 0in%20Biological -discussion	PO1 3 3 3 3 3 ibution	PO2 1 1 1 2 2 ttems.p	PO3 1 1 1 1 1 1 df	PO4 3 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3	PO7 3 3 3 3 3	PO8 3 3 2 2 2
II. CO-PO I         CO3         CO1         Stu         CO2         Stu         CO3         Stu         CO4         Stu         CO5         Stu         CO4         Stu         CO5         Stu         Stu         CO5         Stu	nolecular reactivity a ionic and switching mapping udent would be able f udents evaluate fund udents would develop udents would develop udents would restate udents would able to description of self-lea (/chemistry.du.ac.in/: ://www.rsc.org/even ://www.youtube.com ://www.youtube.com ://www.youtube.com ://www.frontiersin.or s recommended: iples of Bioinorganic C organic Chemistry, I. ce Books. anic Biochemistry vol	nber of lectures = 08 nd catalysis. (B) Transpo (devices. (D) Some exam Att co understand the role of amentals of enzyme react o the concept of metal ac difference between diffe apply the concepts of sup <b>3 Stro</b> arning / E-learning compu- study_material/4102-B/1 ts/detail/46673/natural-a //watch?v=1Wc4jTH2v_w //watch?v=1Wc4jTH2v_w //watch?v=QQRpcot0k_I g/journals/chemistry/sec Chemistry, S.J. Lippard an Bertini, H.B. Gray, S.J. Lipp s I and II. ed. G.L. Eichhor	Title of the set of th	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Average contribut Metal%20Ions%2 enzymes-faraday ar-chemistry ity Science Books ne, University	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr 0in%20Biological -discussion	PO1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	PO2 1 1 1 2 2 ttems.p	PO3 1 1 1 1 1 df	PO4 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3	PO7 3 3 3 3 3	PO8 3 3 2 2 2
(A) suprami electronic, i 11. CO-PO I COS CO1 Stu- CO2 Stu- CO3 Stu- CO3 Stu- CO4 Stu- CO5 Stu- CO5 Stu- CO5 Stu- CO5 Stu- CO5 Stu- CO5 Stu- CO5 Stu- CO5 Stu- Stu- Stu- Stu- Stu- Stu- Stu- Stu-	nolecular reactivity a ionic and switching mapping udent would be able t udents evaluate fund udents would develop udents would develop udents would restate udents would able to description of self-lea (/chemistry.du.ac.in/s ://www.rsc.org/even ://www.youtube.com ://www.youtube.com ://www.youtube.com ://www.youtube.com ://www.frontiersin.or srecommended: iples of Bioinorganic C organic Chemistry, I. ce Books. anic Biochemistry vol ress in Inorganic Chemistry	nber of lectures = 08 nd catalysis. (B) Transpo (devices. (D) Some exam At co understand the role of amentals of enzyme react to the concept of metal ac difference between diffe apply the concepts of sup <b>3 Stro</b> arning / E-learning compu- study_material/4102-B/1 ts/detail/46673/natural-a h/watch?v=1Wc4jTH2v_w v/watch?v=1Wc4jTH2v_w v/watch?v=QQRpcot0k_1 rg/journals/chemistry/sec Chemistry, S.J. Lippard an Bertini, H.B. Gray, S.J. Lipp s I and II. ed. G.L. Eichhor histry, Vols 18 and 38 eds J.M. Lehn, VCH	Title of the second sec	of the unit: App prrier design. (C) in supramolecula stem. zymes. ministration of dr cular reactions. stry. Werage contribut Metal%20lons%2 enzymes-faraday ar-chemistry ity Science Books ne, University	lications of Supra Supramolecular r chemistry. ugs. tion, 1 Low contr 0in%20Biological -discussion	PO1 3 3 3 3 3 ibution	PO2 1 1 1 2 2 ttems.p	PO3 1 1 1 1 1 df	PO4 3 3 3 3 3	PO5 2 1 1 2 3	PO6 3 3 3 3 3	PO7 3 3 3 3 3	PO8 3 3 2 2 2

1. Name	of the Departmer	t: Chemistry								
2. Course	e Name 🛛 🛛 🛛	HEMISTRY LAB PRACTICAL-III		L			т		Р	
3. Course	e Code	CH517		0			0		8	
4. Type o	f Course (use tick	mark)		Core ( v	)	DE	()		FC (	)
5. Pre-ree	quisite (if any)	BSc. with Chemistry 6. Frequency (use tick marks) Even (		Odd (v	')	Eithe	r Sem ( )	)	Every S	em ( )
7. Total N	Number of Lecture	s, Tutorials, Practicals			,					
Lectures	= 00	Tutorials = 00	Prac	tical = 08	3					
8. COURS	E OBJECTIVES: Im	parting of scientific methodology, Development of practical/technical skills, the	bility to w	ork effe	ctively a	nd safe	y in a lal	borator	y enviro	onment
developin	ng transferable ski	ls (team work, time management), Enhancing communication skill.								
9. COURS	E OUTCOMES (CO	):								
After the s	uccessful course c	ompletion, learners will develop following attributes:								
COURSE O	UTCOME (CO)	ATTRIBUTES								
	CO1	Understand the basic analytical and technical skills and technical skills to work	effectively	in the v	arious fi	elds of a	chemistr	<u>у</u>		<del></del>
	CO2	Able to prepare Phenol formaldehyde resin, Urea formaldehyde resin, Nylon ( cream	6, soap, s	hampoo	, vanish	ing crea	m, hand	l lotion,	lather	shaving
	СО3	Know about the Estimation of ascorbic acid, calcium thioglycolate, lakes and fill content, moisture content	ers, zinc-p	yrithione	e, acetic	acid, pr	otein co	ntent, f	at cont	ent, sal
	CO4	Remember to keep records of all performed experiments in the manner which	s required	l in laboi	ratory.					
	CO5	Analyze the importance of personal safety and care of equipment's and chemic	als.							
10. List of	experiments									
Preparatio	n of Phenol forma	dehyde resin.								
2. Preparat	tion of Urea forma	ldehyde resin.								
3. Preparat	tion of Nylon 66.									
4. Synthesi	s of Dibenzal acet	one from benzaldehyde.								
5. Sandme	yer reaction: p-chl	orotoluene from p-toluidine.								
6. Compare	e the strength of ⊦	ICI and H2SO4 by studying the rate of hydrolysis of methyl acetate.								
7. Determi	nation of sugar/gl	ucose content in the given sample of food.								
8. Estimati	on of ascorbic acid	in the given fruit juice.								
9. Observe	the effect of (Tem	perature) on equilibrium systems on Cobalt (II) Chloride Complex								
10. To dete	ermine the solubili	ty product for sparingly soluble salt (e.g. lead sulphate or bariu Sulfate).								
Effect of co	oncentration: The	purpose of this part is to observe the effect of certain stresses (ion concentratio	ı) on equi	librium s	ystems.					
12. The eq	uilibrium between	Fe3+ and Fe(CNS) <sup>2+</sup> .								
11 CO PO	manning									
COs	Attributes									
003	Attributes		P01	PO2	PO3	PO4	PO5	P06	P07	P08
C01	Understand the various fields of	basic analytical and technical skills and technical skills to work effectively in chemistry	the 3	1	1	1	1	2	1	2
CO2	Able to prepare vanishing cream	Phenol formaldehyde resin, Urea formaldehyde resin, Nylon 66, soap, shampoo , hand lotion, lather shaving cream	3	1	3	1	1	3	3	2
CO3	Know about the acetic acid, prot	Estimation of ascorbic acid, calcium thioglycolate, lakes and fillers, zinc-pyrithio ein content, fat content, salt content, moisture content	<sup>ie,</sup> 3	1	1	1	1	2	1	2
CO4	Remember to ke laboratory.	ep records of all performed experiments in the manner which is required in	3	1	1	1	1	2	1	1
CO5	Analyze the imp	ortance of personal safety and care of equipment's and chemicals.	3	1	1	1	1	2	1	3
	3	Strong contribution, 2 Average contribution, 1 Low contribution								
12. Brief d	escription of self-	learning / E-learning component								
1. http:// 2. http://	www.khalidshadio www.inference.or	l.com/uploads/3/9/2/0/3920808/phenol_formaldehyde_resin.pdf g.uk/sustainable/LCA/elcd/external_docs/n66_311147f8-fabd-11da-974d-0800	00c9a66.	pdf						
3. https:/	/www.youtube.co	m/watch?v=eA9I2MkWMW0								
4. https://	/www.youtube.co	m/watch?v=Tu_sWoHULtY /abs/10.1021/acf01572011								
6. https://	/pubs.acs.org/uoi, /nptel.ac.in/conte	abs/10.1021/acouts/a011 nt/storage2/courses/102103047/PDE/mod1.pdf								
7. http://	www.denverinstru	iment.com/denverusa/media/pdf/titration_notes/food_beverage/Determination_	n_of_Salt	_in_Butt	er.pdf					
8. http://	dmsc2.dmsc.mop	n.go.th/webroot/drug/km/lab_analysis/Karl%20Fischer%20Titration.pdf								
13. Book	s recommended:									
1. Advan	ce Practical Chemi	stry: Jagdamba Singh, L.D.S Yadav, Jaya Singh, I.R. Siddiqui, Pragati Edition.								
2. Practic	al Organic Chemis	try A.I.Vogel.								
3. Practic	al Physical Chemis	try: B. Viswanathan and P.S. Raghavan.								
4. Experii	mental Inorganic (	Chemistry – W.G.Palmer.								

2.         Course Name         MOLECURA SPECTROSCOPY AND SPECTRAL TECHNIQUES         L         T         P           3.         Course Code         CFSB         1         0           4.         Type of Course (use lick mark)         5.         Free-regulation (1)         Extended (1)	2. Course Name         MOLECURAR SPECTROSCOPY AND SPECTRAL TECHNIQUES         L           3. Course Gode         CH518         3           4. Type of Course (use tick mark)         Core ( v)           5. Pre-requisite (flamy)         B.S. with Chemistry         6. Frequency (use tick marks)         Prenetial = Nil           5. COURSE OUEST The main aim of this course is to provide students a concept about how to commonly used molecular spectro.         Prenetial = Nil           3. COURSE OUECTWES: The main aim of this course is to provide students a concept about how to commonly used molecular spectro.         Prenetial = Nil           3. COURSE OUECTWES: The main aim of this course is to provide students a concept about how to commonly used molecular spectro.         ATTRIBUTES           3. COURSE OUTCOMES (CO)         ATTRIBUTES         COURS OUTCOMES (CO)         ATTRIBUTES           COURS OUTCOMES (CO)         Course to completion. Learners will develop following attributes:         COURS OUTCOMES (CO)         ATTRIBUTES           COURS OUTCOMES (CO)         And Rama Spectrum, rotational and where and Rama Spectrum, rotational and where and Rama Spectrum, rotational and where the analist spectroscopy         10. Understand the significance of group, ubgroup, relation between orders of a finite group and its sub patintry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its sub patintry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its sub prenis ymmetry gode, sing	1.	1. Name of the Department: Chemistry       2. Course Name       MOLECULAR SPECTROSCOPY AND SPECTRAL TECHNIQUES																																																																																																																																																																																																																																																																																																						
3.         Conser Code         CP33         1         0           4.         Type of Counse Code         CP4 (V)         DE(L)         FC (V)         Set (V)         DE(L)         Even (V)         DE(L)         D	3. Course Code         [CH513         3           4. Type of Course (use tick mark)         [Core (4)]         [Core (4)]           7. Total Number of Lectures, Tutorials, Practicals         [Exturnes]         [Core (4)]           8. COURSE OBJECTIVES: The main aim of this course is to provide students a concept about how to commonly used molecular appect howhedge of each threse methods and their usage in molecular and electronic structure determination.           9. COURSE OUTCOMES (CO)         ATTRIBUTES           Part the successful course completion, learners will develop following attributes:         COURSE OUTCOMES (CO)           COU         To understand the significance of group theory for chemistry, which allow the prediction of many molecule. A prediction of the course base principles. The concept of the prediction of spectral lines.           CO2         Co1         To understand the significance of group theory for chemistry. Which allow the prediction of spectral lines.           CO3         Understand rotational spectra of rigid diatomic molecules. selection rules, linteraction of spectral lines.           CO4         Explainty in the able to understand the basics of Mossbauer/ NRF spectroscopy           10. Unit wise detailed content         Intel of the unit: Vibrational Spectroscopy           10. Unit wise detailed content         Intel of the unit: Vibrational Spectroscopy           10. Unit wise detailed content         Intel of the unit: Notational Spectroscopy           10. Unit wise detailed co	2.	Course Name	MOLECULAR SPECTROSCOPY AND SPECTRAL TECHNIQUES     L     T       CH518     3     1										Р																																																																																																																																																																																																																																																																																											
4.         Type of Course (use titk mark)         EC()         EC()         EC()           5.         Precequity (If any)         B.S. with Chemistry         6. Frequency (use titk mark)         Eventy (Sen 004)         Ether Sen (I)         Servers (Sen 104)           3.         COURSE OUTCOMES (CO):         Horders = 10         Practical = Nil         Eventy Sen (I)         Servers (Sen 104)	Image of Course (use tick mark)         Core (v)           5. Pre-regulate (if any)         BSc. with Chemistry         Even (v)         Odd ( )           7. Total Number of lectures, Tutorials, Practicals         Tutorials = 10         Practical = Mil           S. COURSE COBJECTIVES: The main aim of this course is to provide students a concept about how to commonly used molecular spectrix         Practical = Mil           S. COURSE COURCEMES (CO)         ATTRIBUTES         COURSE COURCEMES (CO)         ATTRIBUTES           COURSE COURCEME (CO)         Course (use completion, learners will develop following attributes:         COURSE COURCEME (CO)         ATTRIBUTES           COURSE COURCEME (CO)         Course (use completion, learners will develop following attributes:         COURSE COURCEME (CO)         ATTRIBUTES           COURSE COURCEME (CO)         To understand the significance of group theory for chemistry, which allow the prediction of many molecule.           CO2         Can explain wibrating diatomic molecule, selection rules, interaction of spectral lines.         CO4           CO3         Understand rotational ad ybrational and ybrational and ybrational and ybrational and ybrational and ybrational spectra.         CO4           CO4         To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy splitting, Spin, Hamiltonian, Measurement techniques.           CO5         Students and Symetry operation, definitions of group, subgroup, relato	3.	Course Code	ode         CH518         3         1           Course (use tick mark)         Core (√)         DE ( )         F												0																																																																																																																																																																																																																																																																																									
S.         Descension of electrone, Totalis, Practical = NI         Total Number of Lectrone, Totalis, Practical = NI         Solution Number of Lectrone, Total Number of Lectrone, Totalis, Practical = NI         Solution Number of Lectrone, Totalis, Practical = NI         Solution Number of Lectrone, Number of Lectrone, Number of Lectrone, Solution, Number of Lectrone,	S. Pre-requisite (if any)         B.S.E. with Chemistry         6. Frequency (use tick marks)         Even (v)         Odd ()           Total Number of Lectures, Tutorials, Practicals         Intervalues 10         Practical = Nil           S. COURSE OUTCOME (CO)         ATTRIBUTES         ATTRIBUTES         Course out Course (store) is bound by the output of th	4.	Type of Course (use	tick m	iark)					Co	ore ( √ )		DE	()		FC (	)																																																																																																																																																																																																																																																																																								
Total Number of Lectures, Totals, Practicals           Total Number of Lectures, Totals, Practicals           Excurse 30         Totals 10         Practical = Nil           8. COURSE OUECOMES (CO):         After the successful outer completion, learners will develop fallowing attributes:         Attributes         Attributes           COURSE OUTCOMES (CO):         Attributes:         Attributes:         Attributes:         Attributes:           CO1         To understand the significance of group theory for chemistry, which allow the practiculor of many molecular properties.         Co1         Constance of the develop fallowing attributes:           CO2         Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, singeto of goetTal lines.         Understand traditional Ream Spectrum rotational attributes interaction of spectral lines.           CO3         Understand the significance of group, subgroup, cold cold spectral lines.         To learn Basic principles, Zero field splitting and Kramer's degeneracy, factors affecting the 'g' value, hyperfine coupling constants, hyperfine optimity, spin, simitonian, Measurement techniques         Symptry technicarity in Chemistry           10. Unit wise detailed content         The of the unit Concept of Group theory in Chemistry         Symptry Chemistry           Unit2         Number of lectures 0         Thie of the unit's concept of or up theory in chemistry           Unit2         Number of lectures 0         Symptry beconcition, definitions of groups, subgr	Total Number of Lectures 30         Tutorials = 10         Practical = Nii           8. COURSE OUECTIVES: The main aim of this course is to provide students a concept about how to commonly used molecular spect knowledge of each of these methods and their usage in molecular and electronic structure determination.         Practical = Nii           9. COURSE OUTCOME (CO)         ATTRIBUTES           COURSE OUTCOME (CO)         Can explain wibrating diatomic molecule, anney levels of a diatomic molecule, simple harmonic and ani and Raman Spectrum. rolational and wibrational Raman Spectrum. rolational and phratomal spectra and PQB branches.           CO3         Understand trotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.           CO4         To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy splitting, Spin, Hamittonian, Measurement techniques           CO5         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           10. Unit wise detailed content         Unit:2         Number of lectures 30           Unit:2         Number of lectures 30         Title of the unit: Concept of Group theory in Chemistry Symmetry operation, definitions of group, subgroup, relationbetween orders of a finite group and its subponser y instrument of the spectroscopy           10. Unit wise detailed content         Unit:2         Number of lectures 30         Title of the unit: Wastonal Spectroscopy           10. Unit wise detailed content         Unit:2         Number of le	5.	Pre-requisite (if any	/)	B.Sc. with Chemis	try 6. Fre	quency (use	tick marks)	Even ( V )	C	) dd (		Either	Sem ( )	E١	very Ser	n ()																																																																																																																																																																																																																																																																																								
Lectors = 30         Practical * 10         Practical * 10           62.00RSE 00ERTWES: The main and ribis course is to provide students and electronic structure determination.         5.00RSE 00ERTWES: The main and ribis course is to provide students and electronic structure determination.           3.00URSE 00ERTWES: The main and ribis course is to provide students and electronic structure determination.         5.00URSE 00ERTWES: The main and ribis course is to provide students and electronic structure determination.           3.00URSE 00ERTWES: The main and ribis course is to provide students and electronic structure determination.         5.00URSE 00ERTWES           0.00URS 00ERTWES         To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.           0.01         To understand the significance of group theory for chemistry, which allow the prediction of spectral lines.           0.02         Line anasis principles, Zeo field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine oplitting, spin, trainitional, Measurement techniques           0.05         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           10.01t1         Number of lectures = 06         Title of the unit: Concept of Group theory in Chemistry           Symmetry operation, definitions of groups, CA, Co, Cho, Cho the Character table         Unit 2           Number of lectures = 06         Title of the unit: Vorational Spectroscopy           0.01t3         Number	Lectures = 30 Protection Process Proces Process Process Process Process Process Process Proces	7.	Total Number of Le	ctures,	, Tutorials, Practicals							-																																																																																																																																																																																																																																																																																													
a. CONSE CONTECTORES (INTES) the main and of this cospin to the set provide subtrains a contexpt adout how do texture into a main and the cospin of the set entropy and their sage in molecular and their sage in the significance of group theory for chemistry, which allow the prediction of many molecular properties. CO1 CO CO2 CO3	a. COURSE ODECIVES: In main and in the course is to provide students a concept about now to commonly used molecular spect involvedge of each of these methods and their usage in molecular and electronic structure determination. 9. COURSE OUTCOMES (CO): ATTIBUTES COURSE OUTCOMES (CO): ATTIBUTES COURSE OUTCOMES (CO): ATTIBUTES COL To understand the significance of group theory for chemistry, which allow the prediction of many molecul and Raman Spectrum, rotational and vibrational Raman Spectra and PQR branches. CO3 Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines. CO4 To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy splitting, Spin, Hamiltonian, Measurement techniques CO5 Students will be able to understand the basics of Mossbauer/ NRF spectroscopy 10. Unit wise detailed content Unit.1 Number of lectures = 08 Title of the unit: Concept of Group theory in Chemistry Symmetry eroup. Schonflies symbols, representations of groups, subgroup, relationbetween orders of a finite group and its sub- Point symmetry eroup. Schonflies symbols, representations of groups, conc, Chi, Dhi etc. Character table Unit.2 Number of lectures = 08 Title of the unit: Wistrational Spectroscopy Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, spectroscopy Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, spectroscopy Basic principles, Zero field splitting, and Kramer's degeneracy, Applications. Unit.3 Number of lectures = 08 Title of the unit: Nostanal Spectroscopy Basic principles, Zero field splitting, and Kramer's degeneracy, Applications. Unit.4 Number of lectures = 08 Title of the unit: Nostanal Spectroscopy Basic principles, Zero field splitting, and Kramer's degeneracy, Applications. Unit.5 Number of lectures = 08 Title of the unit: Nostanal Spectroscopy Basic principles, Zero field splitt	Lectu	ires = 30		n aine af this an una i	te evenide et	Tutorial	s = 10		Pract	ical = N	i <b>l</b>																																																																																																																																																																																																																																																																																													
10. COURSE OUTCOMES (CO)     After the successful course completion, learners will develop following attributes:     CO1     To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.     CO2     C1     To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.     C03     Understand rotational and vibrational administry of theory in Chemistry which allow the prediction of spectral lines.     C03     Understand rotational spectra of rigid dataomic molecule, spectral meta-cline molecule, spectral lines.     C03     Understand rotational spectra of rigid dataomic molecule, spectral meta-cline molecule, spectral lines.     C04     To learn Basic principles, Zero field splitting and Kramer's degeneracy. Factors affecting the 'g' value, hyperfine coupling constants, hyperfine pitting, Spin, Hamiltonian, Measurement techniques     C05     Students will be able to understand the basics of Mossbauer/ NRF spectroscopy     10. Unit <b>1</b> Number of lectures = 06     Trite of the unit: Concept of Group theory in Chemistry     Ymmutry operation, definitions of group, c. Or, Or, Che, Chent C-Character table     Value 1     Number of lectures = 06     Trite of the unit: Worational Spectro. Or of the constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, liters of whorational frequencies of different functional requencies of different functional requencies of different functional regulation and energies, effect of anharmonic motion and isotope on the spectrum, liters of whorational frequencies of different functional regulation and determined introduce determines.     Unit 3     Number of lectures = 08     Trite of the unit: Rotational Spectroscopy     Rotational Sympetry operation, defermine and stribution operation, degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, heterfine splitting.     Spin constant	S. COURSE COTCOMES (CO):     After the successful course completion, learners will develop following attributes:     COURSE COTCOME (CO)     After the successful course completion, learners will develop following attributes:     COURSE COTCOME (CO)     Course concorder (CO	8. COL	edge of each of thes	ne mai se metl	n aim of this course is nods and their usage	to provide sti in molecular a	udents a conc ind electronic	structure det	rmination	sea mo	leculars	spectro	сору т	ecnniqu	les wor	k, a the	oretical																																																																																																																																																																																																																																																																																								
After the successful course completion, learners will develop following attributes:           COURSE OUTCOME (O)           ATTRIBUTES           COU         To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.           CO2         Con explain wibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine optimics, Signi, riamitonian, Measurement techniques           CO4         The orthogon of program to the sales of Mossbauer/ NRF spectroscopy           I. Unit vise detailed content           Units - The orthogon of program to the sales of Mossbauer/ NRF spectroscopy           Integram to the content           Units - The orthogon of program to the sales of Mossbauer/ NRF spectroscopy           Integram to the content of group score, C, Crw, Chi, Dnh etc. Character table           Units - The orthogon of the sales of the program to collator, energy levels of a rigid rotor (Sactor and Sactor program to scallator, energy levels of a rigid rotor, Isoano is program to scallator, scallator, sector and bara denergic, field orthogon Principle, witrational spectrum, intensity, determination of force constant and quilitative relational force constant. And quilitative relational do content scale denerging rotor, scale of witrational spectrum, intensity, determination of the content scale	After the successful course completion, learners will develop following attributes:         ATTRIBUTES           COURSE OUTCOME (CO)         Counderstand the significance of group theory for chemistry, which allow the prediction of many molecu           CO2         Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and and and Raman Spectra and PQB branches.           CO3         Understand rotational spectra of rigid diatomic molecule, selection rules, interaction of spectral lines.           CO4         splitting, Spin, Hamiltonian, Measurement techniques           CO5         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           10. Unit wise detailed content         Number of lectures = 08         Title of the unit: Concept of Group theory in Chemistry Symmetry elements and symmetry operation, definitions of group; subgroup, relationbetween orders of a finite group and its subplexits symbols, representations of groups: cn, Cnv, Cnh, Dnh etc. Character table           Unit: 2         Number of lectures = 08         Title of the unit: Vibrational Spectroscopy           Review of linear harmonic oscillator, energy levels of a rigid rotor inde, pure vibrational Spectrum, inteas of vibration of molecules, rigid rotor model, energy levels of a rigid rotor indes pure vibrational Spectroscopy.           Costastification of molecules, rigid rotor model, energy levels of a rigid rotor indexing hard strates of spectrasory.           Costastification of molecules, rigid rotor model, energy levels of a rigid rotor indexing in ricipies), selection rules, paretrise. <td>9. C</td> <td></td> <td>(CO):</td> <td>ious and their usuge</td> <td></td>	9. C		(CO):	ious and their usuge																																																																																																																																																																																																																																																																																																				
COURCE COURSE OUTCOME (CO)         Variable State of group theory for chemistry, which allow the prediction of many molecular properties.           CO1         To understand the significance of group theory for chemistry, which allow the prediction of an any molecular properties.         Co1         Co1           CO2         Consequina Valuational Spectra of rigid diatomic molecule, selection rules, interaction of spectral lines.         To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques           CO5         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy         Intermine constants, constants, description of coups coups outprove, factors affecting the 'g' value, hyperfine coupling constants, hyperfine ophilting, Spin, Hamiltonian, Measurement techniques           Ymmetry elements and Symmetry operation, definitions of groups, coup, subgroup, rolationbetween orders of a finite group and its subgroup. Conjugacy relation and classes.           Ymmetry elements and Symmetry operation, definitions of groups. Co, Cu, Ch, Ch, Ch, Ch, Ch, Ch, Ch, Ch, Ch, Ch	COURSE OUTCOME (CO)         ATTRIBUTES           C01         To understand the significance of group theory for chemistry, which allow the prediction of many molecu and Raman Spectrum, rotational and vibrational Raman Spectra and PQB branches.           C03         Understand rotational apectra of rigid diatomic molecules, selection rules, Interaction of spectral lines.           C04         Fo learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy splitting, Spin, Hamiltonian, Measurement techniques           C05         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           10. Unit wise detailed content         Number of lectures = 08         Title of the unit: Concept of Group theory in Chemistry Symmetry elements and symmetry operation, definitions of group, subgroup, relationbetween orders of a finite group and its sub point symmetry group. Schonliker, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, idea of vibratio groups, morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches.           Unit-3         Number of lectures = 08         Title of the unit: Notational Spectroscopy           Classification of molecules, sigil ortor model, energy levels of a rigil ortor (semi-classial principles, Spectral in rules, spectral in distribution (Mawell-Boitzman distribution) determination of bool length, qualitative description princip rotoping constants, h Measurement techniques, calculation of number of signal, degeneracy, Applications.           Unit-3         Number of lectures = 08         Title of the unit: Mossbau	After t	he successful course	e com	oletion, learners will	levelop follov	ving attribute	es:																																																																																																																																																																																																																																																																																																	
C01       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.         C02       Can explain wibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Raman Spectrum. Inclusion and Spectral lines.         C03       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.         C04       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 's' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques         OS       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy       Unit Sector Secto	Co1         To understand the significance of group theory for chemistry, which allow the prediction of many molecul and Rama Spectrum, rotational and vibrational Raman Spectra and PQR branches.           CO3         Understand rotational and vibrational Raman Spectra and PQR branches.           CO3         Understand rotational and vibrational Raman Spectra and PQR branches.           CO4         Io learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy pplitting, Spin, Hamiltonian, Measurement techniques           CO5         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           10. Unit wise detailed content           Unit:1         Number of lectures = 08         Title of the unit: Concept of Group theory in Chemistry           Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           Dint wime ty operation, definitions of group, subgroup, relationbetween orders of a finite group and its subploit symmetry group. Schonflies symbols, representations of groups: Ch.Or., Ch.O., Dh tect. Character table           Unit: 1         Number of lectures = 08         Title of the unit: Notational Spectroscopy           Review of linear harmonic model, energy levels of a rigid rotor (semi-classical principles, spectral ince, sice of vibratio groups, morse potential energy diagram, Franck Condon Principle, vibrationa	COUR	SE OUTCOME (CO)					AT	TRIBUTES																																																																																																																																																																																																																																																																																																
CO2       Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Rama Spectrum. Totalonal Rama Spectra and PGR branches.         CO3       Understand rotational spectra of rigid diatomic molecules, interaction of spectral lines.         CO4       To learn Basic principles, 2ero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques         CO5       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy         10. Unit vise detailed content       Intel of the unit: Concept of Group theory in Chemistry         Winnet of Spectra = 08       Title of the unit: Vibrational Spectroscopy         Unit 2       Number of lectures = 08       Title of the unit: Vibrational Spectroscopy         Review of linear harmonic oscillator, energy levels of single harmonic coscillator, selection rules, pure vibrational spectroscopy. ROB branches.         Unit 2       Number of lectures = 08       Title of the unit: Rotarate: table         Unit 3       Number of lectures = 08       Title of the unit: Rotarate: table         Unit 4       Number of lectures = 08       Title of the unit: Rotarate: table         Unit 3       Number of lectures = 08       Title of the unit: Rotarate: table         Unit 4       Number of lectures = 08       Title of the unit: Rotarate: table         Unit 4	C02       and Rama Spectrum. rotational and vibrational Rama Spectra and PQR branches.         C03       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.         C04       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy splitting, Spin, Hamiltonian, Measurement techniques         C05       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy         10. Unit wise detailed content       Unit-1         Number of lectures = 08       Title of the unit: Concept of Group theory in Chemistry         Symmetry group. Schonflies symbols, representations of groups: Cn, Cnv, Cnh, Dnh etc. Character table       Unit-2         Number of lectures = 08       Title of the unit: Vibrational Spectroscopy         Review of linear harmonic oscillator, energy levels of a nigid rotor social pacto pace harmonic and Spectroscopy. Review of linear harmonic oscillator, energy levels of a nigid rotor (semi-classical principles), selection rules, spectral lines, spectral indistribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative elactroscopy. POL Spranches.         Unit-3       Number of lectures = 08       Title of the unit: Mostabauer Spectroscopy.         Cassification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral lines of (1) bonding and Kramer's degeneracy, Applications.         Unit-4       Number of lectures = 08       Title of the unit: Mostabauer Spectroscopy </td <td></td> <td>CO1</td> <td>To un</td> <td>derstand the significa</td> <td>nce of group t</td> <td>heory for che</td> <td>mistry, which</td> <td>allow the predic</td> <td>tion of I</td> <td>many m</td> <td>olecula</td> <td>ar prope</td> <td>erties.</td> <td></td> <td></td> <td></td>		CO1	To un	derstand the significa	nce of group t	heory for che	mistry, which	allow the predic	tion of I	many m	olecula	ar prope	erties.																																																																																																																																																																																																																																																																																											
CO3       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.         CO4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfing constants, hyperfine coupling constants	CO3         Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.           CO4         To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy splitting, Spin, Hamiltonian, Measurement techniques           CO5         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           I.0. Unit wise detailed content         Inite of the unit: Concept of Group theory in Chemistry           Symmetry elements and symmetry operation, definitions of group, subgroup, relationbetween orders of a finite group and its subploint symmetry group. Scholine symbols, representations of groups: Cn, C, Ch, Dh the L. Character table           Unit 2         Number of lectures = 08         Title of the unit: Wibrational Spectroscopy           Review of linear harmonic oscillator, energy levels of simple harmonic motion and isotope on the spectrum, lidea of vibratio groups, morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy_RDR branches.           Unit 3         Number of lectures = 08         Title of the unit: Chatalonal Spectroscopy           Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, sloppe effect           Unit 4         Number of lectures = 08         Title of the unit: Mossbauer Spectroscopy           Basic principles, Zero field splitting and Kramer's degeneracy, Applications.		CO2	Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of ligh and Raman Spectrum. rotational and vibrational Raman Spectra and PQR branches.																																																																																																																																																																																																																																																																																																					
CO4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine         CO5       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy         JOUNT Wise detailed content         Unit3       Number of lectures = 08       Title of the unit: Concept of Group theory in Chemistry         Winter       Number of lectures = 08       Title of the unit: Vhortalina Spectroscopy         Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational Spectroscopy       Velocitation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, lide of vibrational Frequencies of different functional frequencies of different functional groups, more potential energy diagram, franck Condon Principle, Vibrational-Fockings, Spectral Intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect, stark effect and applications.         Unit4       Number of lectures = 08       Title of the unit: Rotational Spectroscopy       Velocitation (Species Spectral Intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect, stark effect and applications.         Unit4       Number of lectures = 08       Title of the unit: Rotational Spectroscopy       Velocitations.       Velocitations.         Basic principles, Zero field splitting and Kramer's d	To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hy splitting, Spin, Hamiltonian, Measurement techniques           COS         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           10. Unit wise detailed content           Unit-1         Number of lectures = 08         Title of the unit: Concept of Group theory in Chemistry           Symmetry operation, definitions of group, subgroup, relationbetween orders of a finite group and its subploit symmetry group. Schoholies symbols, representations of groups: Cn, Cn, Chn, Dnh etc. Character table           Unit-2         Number of lectures = 08         Title of the unit: Vibrational Spectroscopy           Review of linear harmonic oscillator, energy levels of a rigid rotor (semi-classical principles), selection rules, pure vibrational spectrum, intensiti groups, morse potential energy diagram, Franck Condon Principle, Vibrational-rotation spectroscopy         Cassification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect           Unit-3         Number of lectures = 08         Title of the unit: Nosbauer Spectroscopy           Basic principles, Zero field splitting and Kramer's degeneracy, Applications.           Unit-5 <th col<="" td=""><td></td><td>CO3</td><td colspan="12">Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.</td><td></td></th>	<td></td> <td>CO3</td> <td colspan="12">Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.</td> <td></td>		CO3	Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.																																																																																																																																																																																																																																																																																																				
Students will be able to understand the basics of Mossbauer/NRF spectroscopy         ID. Unit wise detailed content         Unit-1       Number of lectures = 08       Title of the unit: Concept of Group theory in Chemistry.         Vision of locatures = 08       Title of the unit: Concept of Group theory in Chemistry.         Vision of locatures = 08       Title of the unit: Visional Spectroscopy         Vision of locatures = 08       Title of the unit: Visional Spectroscopy         Number of lectures = 08       Title of the unit: Notational Spectroscopy         Number of lectures = 08       Title of the unit: Notational Spectroscopy.         Number of lectures = 08       Title of the unit: Notational Spectroscopy.         Other Spectra Spectroscopy.         Other Spectra	COS         Students will be able to understand the basics of Mossbauer/ NRF spectroscopy           10. Unit wise detailed content           Unit:1         Number of lectures = 08         Title of the unit: Concept of Group theory in Chemistry           Symmetry group. Schonfiles symbols, representations of groups, subgroup, relationbetween orders of a finite group and its subport symmetry group. Schonfiles symbols, representations of groups: Cn, Cnv, Cnh, Dnh etc. Character table           Unit:2         Number of lectures = 08         Title of the unit: Vibrational Spectroscopy           Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectroscopy, PCR branches.         Unit:3           Unit:3         Number of lectures = 08         Title of the unit: Rotational Spectroscopy           Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, gualitative description of non-rigid rotor, isotope effect           Unit:4         Number of lectures = 08         Title of the unit: Nossbauer Spectroscopy           Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h         Measurement techniques, calculation of number of signal, degeneracy, Applications.           Unit-5         Number of lectures = 08         Title of the unit: Mossbauer Spectroscopy           Basic p		CO4	To lea splittii	rn Basic principles, Z ng, Spin, Hamiltonian	ero field splitt Measuremer	ing and Kram It techniques	ier's degenera	cy, Factors affec	ting the	e 'g' valı	ue, hyp	erfine	coupling	g consta	ants, hy	perfine																																																																																																																																																																																																																																																																																								
10. Unit wise detailed content         Unit-1       Number of lectures = 08       Title of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Group theory in Chemistry         Visit of the unit: Concept of Concep	10. Unit wise detailed content         Unit-1       Title of the unit: Concept of Group theory in Chemistry         Symmetry elements and symmetry operation, definitions of group, subgroup, relationbetween orders of a finite group and its sub         Point symmetry group. Schonflies symbols, representations of groups, subgroup, relationbetween orders of a finite group and its sub         Point symmetry group. Schonflies symbols, representations of groups, subgroup, relationbetween orders of a finite group and its sub         Point symmetry operation, definitions of group, subgroup, relationbetween orders of a finite group and its sub         With 20         Number of lectures = 08       Title of the unit: Vibrational Spectroscopy         Quality of the colspan="2">Colspan="2">Sint Sint Sint Sint Sint Sint Sint Sint		CO5	Stude	nts will be able to une	lerstand the b	asics of Moss	bauer/ NRF sp	ectroscopy																																																																																																																																																																																																																																																																																																
Units       Number of lectures = 08       Title of the unit: Concept of Group theory in Chemistry useroup. Conjugacy relation and kases.         Yeinet symmetry group. Schonflies symbols, representations of group; schonflies symbols, representations of group; schonflies symbols, representations of group; con, Cnv, Cnh, Dnh etc. Character table       Vente Symmetry group. Schonflies symbols, representations of group; schonflies, perturn, intensity, determination of force constant and dualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, intensity, distribution using population groups, morse potential energy diagram, Franck Condon Principel, vibartional-Recorecopy         Unit 3       Number of lectures = 08       Title of the unit: Rotational Spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid rotor (seniclassical principles), selection rules, perturn, intensity, distribution using population.         Unit 4       Number of lectures = 08       Title of the unit: Noshauer Spectroscopy         Basic principles of Mossbauer (NFR spectroscopy) (senar shift reg. yeals), selection rules, perturn, intensity, distribution using population.         Unit 4       Number of lectures = 08         Basic principles of Mossbauer (NFR spectroscopy) (senar shift reg. yeals)       Number of lectures = 08         Basic principles of Mossbauer (N	Unit:1         Number of lectures = 08         Title of the unit: Concept of Group theory in Chemistry           Symmetry elements and symmetry operation, definitions of group, subgroup, relationbetween orders of a finite group and its sub           Point symmetry group. Schonflies symbols, representations of groups: Cn, Cnv, Cnh, Dnh etc. Character table           Unit:2         Number of lectures = 08           Title of the unit: Vibrational Spectroscopy           Review of linear harmonic oscillator, energy levels of simple harmonic oncion and isotope on the spectrum, idea of vibrational spectroscopy.           Unit:3         Number of lectures = 08           Title of the unit: Rotational Spectroscopy           Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect           Unit:4         Number of lectures = 08         Title of the unit: Rotational Spectroscopy           Basic principles, Zero field splitting and Kramer's degeneracy, Applications.         Unit:4           Unit:5         Number of lectures = 08         Title of the unit: Rotational Spectroscopy           Basic principles, develop / NRF spectroscopy, Isomer shift and ruclear Zeema splitting, spectral parameters and spectrum integents use of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compou number, structure.           11:0:O-PO m	10. L	Init wise detailed co	ontent																																																																																																																																																																																																																																																																																																					
symmetry elements and symmetry operation, deminions of group, subgroup, relationedween orders of a ninte group and its subgroup. Conjugacy relation and classes. Point symmetry group. Schofflies symbols, representations of groups: Cn, Cn, Character table  Unit-2  Number of lectures = 08  Title of the unit: Vibrational Spectroscopy Review of linear harmonic oscillator, energy levels of simple harmonic motion and loatope on the spectrum, intensity, determination of force constant and bund energies, effect of anharmonic motion and loatope on the spectrum, intensity, determination of force constant and bund energies, effect of anharmonic motion and loatope on the spectrum, idea of vibrational frequencies of different functional groups, mores potential energy diagram, Franck Condon Principle, vibrational-rotational Spectroscopy, RDB branches. Unit-3  Number of lectures = 08  Title of the unit: Rotarianal Spectroscopy and the subgroup is spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bod length, qualitative description of non-rigid rotor, isotope effect, stark effect and applications. Unit-4  Number of lectures = 08  Title of the unit: Rotariana Spectroscopy Classification of molecules, calculation of number of signal, degeneracy, Applications. Unit-5  Number of lectures = 08  Title of the unit: Mittor Mossbauer Spectroscopy Basic principles of Mossbauer NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displav, Application of M-L bond, coordination number, structure.  Cos  Cos  Cos  Cos  Attributes  Cos  Attributes  Poin Point poin	Symmetry elements and symmetry operation, demintions of group, subgroup, relationneeween orders of a inite group and its sub point symmetry group. Schonflies symbols, representations of groups: Co., Crv, Ch., Dh. Dh. etc. Character table Unit 2 Number of lectures = 08 Title of the unit: Vibrational Spectroscopy Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensit qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibratio groups., morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy. QR branches. Unit 3 Number of lectures = 08 Title of the unit: Rotational Spectroscopy Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect Unit 4 Number of lectures = 08 Title of the unit: Rotational Spectroscopy Basic principles, Zero field splitting and Kramer's degeneracy. Factors affecting the 'g' value, hyperfine coupling constants, h Measurement techniques, calculation of number of signal, degeneracy, Applications. Unit 5 Number of lectures = 08 Title of the unit: Mosbauer Spectroscopy Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds molecular properties. Co1 no derstand the significance of group theory for chemistry, which allow the prediction of many perfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques (Co2 anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman perfine coupling constants, hyperfine splitting, Spin,	Unit	-1	Num	iber of lectures = 08		Title of th	e unit: Concep	ot of Group theo	ry in Ch	emistr	y la																																																																																																																																																																																																																																																																																													
Onit-2       Number of lectures = 08       Title of the unit: Vibrational Spectroscopy         Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and bug energies, effect of anharmonic motic and isotope on the spectrum, idea of vibrational frequencies of different functional groups, morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches.         Unit-3       Number of lectures = 08       Title of the unit: Rotational Spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid roir (seni-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect, stark effect and applications.         Unit-4       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy. Applications.       Values, notice and splitting, and Kramer's degeneracy. Applications.         Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L bond, coordination number, structure.         11.Co-PO mapping.       PO1       PO2 <td>Inite of geoperation and provide the unit: Vibrational Spectroscopy         Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensiti qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, intensiti qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibration groups, morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches.         Unit-3       Number of lectures = 08       Title of the unit: Rotational Spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effectures = 08         Unit-4       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Applications.       Unit-5       Number of lectures = 08         Dunit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displistudies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds         11. Co-PO mapping       Cos       Attributes       PO1       PO2       PO2         Cos<td>Symm Point s</td><td>etry elements and s</td><td>ymme honflie</td><td>try operation, definit</td><td>ons of group,</td><td>subgroup, re ns: Cn Cnv C</td><td>nh Dnh etc C</td><td>n orders of a fini haracter table</td><td>te grou</td><td>p and it</td><td>s subgi</td><td>roup. Co</td><td>onjugac</td><td>y relatio</td><td>on and</td><td>classes.</td></td>	Inite of geoperation and provide the unit: Vibrational Spectroscopy         Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensiti qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, intensiti qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibration groups, morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches.         Unit-3       Number of lectures = 08       Title of the unit: Rotational Spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effectures = 08         Unit-4       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Applications.       Unit-5       Number of lectures = 08         Dunit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displistudies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds         11. Co-PO mapping       Cos       Attributes       PO1       PO2       PO2         Cos <td>Symm Point s</td> <td>etry elements and s</td> <td>ymme honflie</td> <td>try operation, definit</td> <td>ons of group,</td> <td>subgroup, re ns: Cn Cnv C</td> <td>nh Dnh etc C</td> <td>n orders of a fini haracter table</td> <td>te grou</td> <td>p and it</td> <td>s subgi</td> <td>roup. Co</td> <td>onjugac</td> <td>y relatio</td> <td>on and</td> <td>classes.</td>	Symm Point s	etry elements and s	ymme honflie	try operation, definit	ons of group,	subgroup, re ns: Cn Cnv C	nh Dnh etc C	n orders of a fini haracter table	te grou	p and it	s subgi	roup. Co	onjugac	y relatio	on and	classes.																																																																																																																																																																																																																																																																																								
Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, intensity, determination of force constant and gualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, intensity, distribution using population distribution force constant and bond energies, effect of a rigid rotor isotope of the unit: Rotational Spectroscopy. PQR branches.         Unit-3       Number of lectures = 08       Title of the unit: Rotational Spectroscopy.         Unit-4       Number of lectures = 08       Title of the unit: Rotational Spectroscopy         Unit-4       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Jetro field splitting, and Kramer's degeneracy, Applications.         Unit-5       Number of lectures = 08         Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, logR brain and spectrum display. Application of the technique, claculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08         Tot understand the significance of group theory for chemistry, which allow the prediction of many for boding and Srave or ond sinciluling those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L boding a	Review of linear harmonic oscillator, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensit qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibratio groups., morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches. Unit-3 Number of lectures = 08 Title of the unit: Rotational Spectroscopy = 1 distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effec Unit-4 Number of lectures = 08 Title of the unit: Electron Spin Resonance Spectroscopy Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h Measurement techniques, calculation of number of signal, degeneracy, Applications. Unit-5 Number of lectures = 08 Title of the unit: Mossbauer Spectroscopy Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds member, structure. 11. CO-PO mapping COT To understand the significance of group theory for chemistry, which allow the prediction of many 1 1 1 Spectra and PQR branches. CO2 anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman 2 1 1 Spectra and PQR branches. CO3 Understand totational spectra of rigid diatomic molecule, selection rules, interaction of spectral lines. 2 2 2 CO4 hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques 2 2 2 CO5 Students will be able to understand the basics of Mossbauer/NRF spectroscopy 1 1 2 2 Strong constants, hyperfine splitting, Spin, Hamiltonian, Xeasurement techniques 2 2 Level 2 Students will be able to understand the basics of Mossbauer/NRF spectroscopy 1 1 1 2 3 Strong contribution, 2 Avera	Unit	·2	Num	ber of lectures = 08		Title of t	he unit: Vibra	ational Spectros	сору																																																																																																																																																																																																																																																																																															
qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups., morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches.         Unit-3       Number of lectures = 08       Title of the unit: Rotational Spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect, stark effect and applications.         Unit-4       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Applications.       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy.         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L bond, coordination molecule, range harmonic and including those of group theory for chemistry, which allow the prediction of many nolecular properties.       1       1       1       2       3       3       1       2         Cot       To understant the significance of group theory for chemistry, which allow the prediction of many nolecular properties.       1       1	qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibratio         groups, morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches.         Unit-3       Number of lectures = 08         Title of the unit: Rotational Spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution) (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect         Unit-4       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h       Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displitudies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundmer, structure.         11. CO-PO mappin       Cos       Attributes       PO1       PO2       PO2       PO3         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1       1 </td <td>Reviev</td> <td>of linear harmonic</td> <td>oscilla</td> <td>tor, energy levels of</td> <td>simple harmor</td> <td>nic oscillator,</td> <td>selection rules</td> <td>, pure vibrationa</td> <td>al specti</td> <td>rum, int</td> <td>ensity,</td> <td>determ</td> <td>nination</td> <td>of forc</td> <td>e const</td> <td>ant and</td>	Reviev	of linear harmonic	oscilla	tor, energy levels of	simple harmor	nic oscillator,	selection rules	, pure vibrationa	al specti	rum, int	ensity,	determ	nination	of forc	e const	ant and																																																																																																																																																																																																																																																																																								
groups., morse potentiel energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy. PQR branches. Unit-3 Number of lectures = 08 Title of the unit: Rotational Spectroscopy Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect, stark effect and applications. Unit-4 Number of lectures = 08 Title of the unit: Electron Spin Resonance Spectroscopy Basic principles, Zero field splitting and Kramer's degeneracy, Applications. Unit-5 Number of lectures = 08 Title of the unit: Botsbauer Spectroscopy Basic principles of Mossbauer/ NRF spectroscopy. Somer shift and nuclear Zeeman splitting, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L bond, coordination number, structure. 11. CO+D mapping CO1 No understand the significance of group theory for chemistry, which allow the prediction of any nolecular properties. CO2 an explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and spectra and PQR branches. CO2 anaharmonic oscillator, Scattering of light and Rama Spectrum. rotational and vibrational spectra and PQR branches. CO3 Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines. 2 2 2 2 2 3 2 2 2 2 2 2 3 2 2 2 2 2 2 2	groups, morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, QQ branches.         Unit-3       Number of lectures = 08       Title of the unit: Rotational Spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effecturies = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Applications.       Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displistudies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compound including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compound including those of intermediate spin, (2) Sn2+ and Sn4+ compo	qualita	qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional functional frequencies of different functional fu													nctional																																																																																																																																																																																																																																																																																									
Unit       Number of fectures = 08       Inte of the unit: Notational spectroscopy         Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect, stark effect and applications.         Unit - X       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Applications.       Title of the unit: Mostbauer Spectroscopy.         Unit-S       Number of lectures = 08       Title of the unit: Mostbauer Spectroscopy.         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) SN2+ and SN4+ compounds-nature of M-L bond, coordination number, structure.         11. CO-PO mapping       Cos       Attributes       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         Cos       Attributes       Ga idatomic molecule, simple harmonic and piper seminoric and piper seminoric and piper seminoric and PQR branches.       2       1       1       1       1       2       3       2       2       1       1       1       1       2	Unit:3         Number of lectures = 08         Interest of the direction of spectroscopy           classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral in distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect           Unit-4         Number of lectures = 08         Title of the unit: Electron Spin Resonance Spectroscopy           Basic principles, Zero field splitting and Kramer's degeneracy, Applications.         Unit-5         Number of lectures = 08           Unit-5         Number of lectures = 08         Title of the unit: Mossbauer Spectroscopy           Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundmer, structure.           11. CO-PO mapping         PO1         PO2         PO3           Coa         Attributes         PO1         PO2         PO3           coa         Attributes         Q         1         1         1           coa         Attributes         PO1         PO2         PO3           coa         Attributes         PO1         PO2         PO3           coa         Indextand the significance of group theory for chemistry, which allow the prediction of many molecular properties.         1	groups	roups., morse potential energy diagram, Franck Condon Principle, vibrational-rotation spectroscopy, PQR branches.																																																																																																																																																																																																																																																																																																						
Classification of Macele, single from the sent and generalization of sent and generalization of the sent and application of the sent and application.         Unit-4       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Applications.         Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Applications.         Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral maters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L bond, coordination moleculer, properties.         Cos       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         Cos       Attributes       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8       PO6       PO7       PO8       PO6       PO7       PO8       PO6 <td>Construction (Maxwell-Boltzmann distribution) determination of bord length, qualitative description of non-rigid rotor, isotope effect         Unit-4       Number of lectures = 08         Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h         Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08         Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundumber, structure.         11. CO-PO mapping       Cos       Attributes       PO1       PO2       PO3         Co1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1         Co3       understand rotational spectra of rigid diatomic molecule, selection rules, interaction of spectral lines.       2       2       2         Co4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2       2       2       2       2</td> <td>Classif</td> <td colspan="13">Unit-3 Number of lectures = 08 Title of the unit: Rotational Spectroscopy</td>	Construction (Maxwell-Boltzmann distribution) determination of bord length, qualitative description of non-rigid rotor, isotope effect         Unit-4       Number of lectures = 08         Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h         Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08         Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundumber, structure.         11. CO-PO mapping       Cos       Attributes       PO1       PO2       PO3         Co1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1         Co3       understand rotational spectra of rigid diatomic molecule, selection rules, interaction of spectral lines.       2       2       2         Co4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2       2       2       2       2	Classif	Unit-3 Number of lectures = 08 Title of the unit: Rotational Spectroscopy																																																																																																																																																																																																																																																																																																						
Unit 4       Number of lectures = 08       Title of the unit: Electron Spin Resonance Spectroscopy         Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L bond, coordination number, structure.         11. CO-PO mapping       COS       Attributes       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         CO1       molecular properties.       To understand the significance of group theory for chemistry, which allow the prediction of many monic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman S       2       1       1       1       2<	Unit-4         Number of lectures = 08         Title of the unit: Electron Spin Resonance Spectroscopy           Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h           Measurement techniques, calculation of number of signal, degeneracy, Applications.           Unit-5         Number of lectures = 08           Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds including those of intermediate spin, (2) Sn2+ a	distrib	Classification of molecules, rigid rotor model, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotone effect, stark effect and applications																																																																																																																																																																																																																																																																																																						
Basic principles, Zero field splitting and Kramer's degeneracy, Applications.       Mumber of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Unit >       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum display. Application of M-L bond, coordination number, structure.       Sn2 + and Sn4 + compounds-nature of M-L bond, coordination number, structure.         11. C0-PO mapping       COS       Attributes       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         CO1       To understand the significance of group theory for chemistry, which allow the prediction of mamping molecular properties.       1       1       1       1       2       3       3       1       2         CO3       Understand the significance of light and Raman Spectrum. rotational and vibrational Raman       2       1       1       1       3       2       2       1         CO3       Understand rotational spectra of rigid diatomic molecule, selection rules, interaction of spectral lines.       2       2       2       2       2       2       3       2       2       2       2       2       2       2       2       3       2       2       2       2       2 <td< td=""><td>Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h         Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08         Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundmer, structure.         11. CO-PO mapping       COs       Attributes       PO1       PO2       PO3         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1       1       1       1         CO2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman 2       1       2       2       2<td>Unit</td><td>4</td><td>Num</td><td>ber of lectures = 08</td><td></td><td>Title of th</td><td>e unit: Electro</td><td>n Spin Resonanc</td><td>e Spect</td><td>roscopy</td><td>/</td><td></td><td></td><td></td><td></td><td></td></td></td<>	Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, h         Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08         Basic principles of Mossbauer/NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundmer, structure.         11. CO-PO mapping       COs       Attributes       PO1       PO2       PO3         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1       1       1       1         CO2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman 2       1       2       2       2 <td>Unit</td> <td>4</td> <td>Num</td> <td>ber of lectures = 08</td> <td></td> <td>Title of th</td> <td>e unit: Electro</td> <td>n Spin Resonanc</td> <td>e Spect</td> <td>roscopy</td> <td>/</td> <td></td> <td></td> <td></td> <td></td> <td></td>	Unit	4	Num	ber of lectures = 08		Title of th	e unit: Electro	n Spin Resonanc	e Spect	roscopy	/																																																																																																																																																																																																																																																																																													
Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit 5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy.       Unit: Mossbauer Spectroscopy.       Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L bond, coordination number, structure.         To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         COS       Attributes       Of understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1       1       2       3       3       1       2         COS       Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and spectral and PQR branches.       2       1       1       1       3       2       2       1       1       3       2	Measurement techniques, calculation of number of signal, degeneracy, Applications.         Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundmere, structure.         11. CO-PO mapping       COs       PO1       PO2       PO3         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1	Basic	principles, Zero fiel	d split	ting and Kramer's d	egeneracy, Fa	actors affection	ng the 'g' val	ue, hyperfine co	oupling	consta	nts, hy	perfine	splittin	g, Spin	, Hami	ltonian,																																																																																																																																																																																																																																																																																								
Unit-5       Number of lectures = 08       Title of the unit: Mossbauer Spectroscopy         Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compounds-nature of M-L bond, coordination number, structure.         II. CO-PO mapping       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1       1       2       3       3       1       2         CO2       anharmonic oscillatori, Scattering of light and Raman Spectrum. rotational and vibrational Raman Spectra and PQR branches.       2       1       1       1       3       2       2       2       2       2       3       2       2       2       2       2       3       2	Unit-5         Number of lectures = 08         Title of the unit: Mossbauer Spectroscopy           Basic principles of Mossbauer/ NRF spectroscopy, Isomer shift and nuclear Zeeman splitting, spectral parameters and spectrum displ studies of (1) bonding and structures of Fe2+ and Fe3+ compounds including those of intermediate spin, (2) Sn2+ and Sn4+ compoundment, structure.           11. CO-PO mapping         COs         PO1         PO2         PO3           CO1         To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.         1 <td< td=""><td>Measu</td><td>rement techniques,</td><td>, calcul</td><td>ation of number of si</td><td>gnal, degener</td><td>acy, Applicatio</td><td>ons.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Measu	rement techniques,	, calcul	ation of number of si	gnal, degener	acy, Applicatio	ons.																																																																																																																																																																																																																																																																																																	
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Studies of (1) bonding and structures of P2+ and P3+ compounds including those of intermediate spin, (2) Sh2+ and Sh4+ compounds-nature of W-L bond, coordination number, structure.         11. CO-P mapping         COS       Attributes       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         COS       Attributes       PO1       1       1       1       1       2       3       3       1       2         COS       Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.       2       1       1       1       3       2       2       1       1       1       3       2       2       1       1       1       3       2       2       1       1       1       3       2       2       1       1       1       3       2       2       1       1       1       3       2       2       1       1       1       3       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2 <td< td=""><td>Studies of (1) bonding and structures of P22+ and P23+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including the spin (2) sh2+ and sh4+ compounds including those of intermediate spin (2) sh2+ and sh4+ compounds including thotes of a spin (2) sh2+ and sh4+ compounds i</td><td>Basic p</td><td>rinciples of Mossba</td><td>uer/ N</td><td>RF spectroscopy, Isor</td><td>ner shift and n</td><td>iuclear Zeema</td><td>an splitting, spe</td><td>ectral parameter</td><td>s and sp</td><td>ectrum</td><td>displa</td><td>y. Appli</td><td>cation o</td><td>of the te</td><td>chniqu</td><td>e to the</td></td<>	Studies of (1) bonding and structures of P22+ and P23+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including those of intermediate spin, (2) sh2+ and sh4+ compounds including the spin (2) sh2+ and sh4+ compounds including those of intermediate spin (2) sh2+ and sh4+ compounds including thotes of a spin (2) sh2+ and sh4+ compounds i	Basic p	rinciples of Mossba	uer/ N	RF spectroscopy, Isor	ner shift and n	iuclear Zeema	an splitting, spe	ectral parameter	s and sp	ectrum	displa	y. Appli	cation o	of the te	chniqu	e to the																																																																																																																																																																																																																																																																																								
11. CO-PO mapping         COs       Attributes       PO1       PO2       PO3       PO4       PO5       PO6       PO7       PO8         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1       1       1       1       1       1       1       1       2       3       3       1       2         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many molecular properties.       1       1       1       1       1       1       1       1       2       3       3       1       2         CO2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman       2       1       1       1       3       2       2       1       1       3       2       2       1       1       1       3       2       2       1       1       1       3       2       2       1       1       1       1       2       3       2       2       1       1       1       2       2       3       2       2       2       2       2       2       2       2       2 <t< td=""><td>Int. CO-PO mapping         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many notecular properties.       1       1       1         Co1       To understand the significance of group theory for chemistry, which allow the prediction of many notecular properties.       1       1       1       1         Co2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman       2       1       1         Spectra and PQR branches.       Co3       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.       2       2       2         Co4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, any perfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2         Co5       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy       1       1       2         3 Strong contribution, 2 Average contribution, 1 Low contribution         12. Brief description of self-learning / E-learning component         1.       https://www.youtube.com/watch?v=WukUvN721Ag       1       1       2         2.       https://www.youtube.com/watch?v=dU38K-5-j1g       1       1       2         3.       https://www.youtube.com/watc</td><td>numbe</td><td>er. structure.</td><td>struct</td><td>ures of rez+ and res</td><td>r compounds</td><td>including tho</td><td>se of internet</td><td>nate spin, (2) sh</td><td>z+ anu s</td><td>5114+ 00</td><td>mpour</td><td>ius-nati</td><td>are or iv</td><td>I-L DONG</td><td>, coorc</td><td>ination</td></t<>	Int. CO-PO mapping         CO1       To understand the significance of group theory for chemistry, which allow the prediction of many notecular properties.       1       1       1         Co1       To understand the significance of group theory for chemistry, which allow the prediction of many notecular properties.       1       1       1       1         Co2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman       2       1       1         Spectra and PQR branches.       Co3       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.       2       2       2         Co4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, any perfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2         Co5       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy       1       1       2         3 Strong contribution, 2 Average contribution, 1 Low contribution         12. Brief description of self-learning / E-learning component         1.       https://www.youtube.com/watch?v=WukUvN721Ag       1       1       2         2.       https://www.youtube.com/watch?v=dU38K-5-j1g       1       1       2         3.       https://www.youtube.com/watc	numbe	er. structure.	struct	ures of rez+ and res	r compounds	including tho	se of internet	nate spin, (2) sh	z+ anu s	5114+ 00	mpour	ius-nati	are or iv	I-L DONG	, coorc	ination																																																																																																																																																																																																																																																																																								
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N</td><td>A., Fundamentals of N</td><td>Aolecular Spec</td><td>ctroscopy, 4th</td><td>n Ed., Tata McC</td><td>Graw Hill, New D</td><td>elhi (20</td><td>17).</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>	Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman 2       1       1         CO2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman 2       1       1         Spectra and PQR branches.       2       2       2       2         CO3       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.       2       2       2         CO4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2         CO5       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy       1       1       2         3 Strong contribution, 2 Average contribution, 1 Low contribution         12. 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Can explain vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman 2       1       1         CO2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman 2       1       1         Spectra and PQR branches.       2       2       2       2         CO3       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.       2       2       2         CO4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2         CO5       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy       1       1       2         3 Strong contribution, 2 Average contribution, 1 Low contribution         12. Brief description of self-learning / E-learning component         1.       https://www.youtube.com/watch?v=WukUvN721Ag       2       2         2.       https://www.youtube.com/watch?v=dU38K-5-j1g       4       https://www.youtube.com/watch?v=eZ-Vnj0sS2M         5.       https://www.youtube.com/watch?v=Q2Fo5BAReGo       5       https://www.youtube.com/watch?v=Q2Fo5BAReGo	CO1	To understand th molecular propert	ie sign ties.	ificance of group the	ory for chem	histry, which	allow the pre	diction of many	1	1	1	2	3	3	1	2																																																																																																																																																																																																																																																																																									
CO2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman       2       1       1       1       3       2       2       1         Spectra and PQR branches.       2       1       1       1       3       2       2       1         CO3       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.       2       2       2       2       3       2       2       2         CO4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2       3       2       3       2       3       2       3       2       3       2       2       3       2       3       2       2       2       3       2       3       2       2       2       3       2       3       2       2       2       3       2       2       2       2       3       2       2       2       2       3       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2       2<	CO2       anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman       2       1       1         Spectra and PQR branches.       2       2       2       2         CO3       Understand rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines.       2       2       2         CO4       To learn Basic principles, Zero field splitting and Kramer's degeneracy, Factors affecting the 'g' value, hyperfine coupling constants, hyperfine splitting, Spin, Hamiltonian, Measurement techniques       2       2       2       2         CO5       Students will be able to understand the basics of Mossbauer/ NRF spectroscopy       1       1       2         String contribution, 2 Average contribution, 1 Low contribution         12. Brief description of self-learning / E-learning component         1.       https://www.youtube.com/watch?v=WukUvN721Ag       2       2         2.       https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html       3       https://www.youtube.com/watch?v=dU38K-5-j1g         4.       https://www.youtube.com/watch?v=eZ-Vnj0sS2M       5       https://www.youtube.com/watch?v=Q2Fo5BAReGo         12. Devlamemented		Can explain vibrat	ting di	atomic molecule, en	ergy levels of	a diatomic m	olecule, simpl	e harmonic and																																																																																																																																																																																																																																																																																																
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12. Brief description of self-learning / E-learning component         1. https://www.youtube.com/watch?v=WukUvN721Ag         2. https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html         3. https://www.youtube.com/watch?v=dU38K-5-j1g         4. https://www.youtube.com/watch?v=e7-Vni0sS2M	12. Brief description of self-learning / E-learning component         1. https://www.youtube.com/watch?v=WukUvN721Ag         2. https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html         3. https://www.youtube.com/watch?v=dU38K-5-j1g         4. https://www.youtube.com/watch?v=eZ-Vnj0sS2M         5. https://www.youtube.com/watch?v=Q2Fo5BAReGo		3 Strong contribution, 2 Average contribution, 1 Low contribution																																																																																																																																																																																																																																																																																																						
<ol> <li>https://www.youtube.com/watch?v=WukUvN721Ag</li> <li>https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html</li> <li>https://www.youtube.com/watch?v=dU38K-5-j1g</li> <li>https://www.youtube.com/watch?v=e7-Vni0sS2M</li> </ol>	<ol> <li>https://www.youtube.com/watch?v=WukUvN721Ag</li> <li>https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html</li> <li>https://www.youtube.com/watch?v=dU38K-5-j1g</li> <li>https://www.youtube.com/watch?v=eZ-Vnj0sS2M</li> <li>https://www.youtube.com/watch?v=Q2Fo5BAReGo</li> </ol>	12. E	rief description of s	self-lea	rning / E-learning co	nponent																																																																																																																																																																																																																																																																																																			
<ol> <li>https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html</li> <li>https://www.youtube.com/watch?v=dU38K-5-j1g</li> <li>https://www.youtube.com/watch?v=e7-Vni0sS2M</li> </ol>	<ol> <li>https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html</li> <li>https://www.youtube.com/watch?v=dU38K-5-j1g</li> <li>https://www.youtube.com/watch?v=eZ-Vnj0sS2M</li> <li>https://www.youtube.com/watch?v=Q2Fo5BAReGo</li> </ol>	1. ľ	1. https://www.youtube.com/watch?v=WukUvN721Ag																																																																																																																																																																																																																																																																																																						
3. https://www.youtube.com/watch?v=dU38K-5-j1g 4. https://www.youtube.com/watch?v=e7-Vpi0sS2M	<ol> <li>https://www.youtube.com/watch?v=dU38K-5-j1g</li> <li>https://www.youtube.com/watch?v=eZ-Vnj0sS2M</li> <li>https://www.youtube.com/watch?v=Q2Fo5BAReGo</li> </ol>	2. ľ	2. https://study.com/academy/lesson/vibrational-spectroscopy-definition-types.html																																																																																																																																																																																																																																																																																																						
https://www.voutube.com/watch?v=e7-Vni0sS2M	<ol> <li>https://www.youtube.com/watch?v=eZ-Vnj0sS2M</li> <li>https://www.youtube.com/watch?v=Q2Fo5BAReGo</li> </ol>	3. ľ	3. https://www.youtube.com/watch?v=dU38K-5-j1g																																																																																																																																																																																																																																																																																																						
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5. https://www.youtube.com/watch?v=Q2Fo5BAReGo	40 Deckson second al	5. ľ	nttps://www.y	outu	be.com/watch?	v=Q2Fo5B	BAReGo																																																																																																																																																																																																																																																																																																		
13. Books recommended:	13. BOOKS recommended:	<b>13.</b> E	ooks recommende	d:																																																																																																																																																																																																																																																																																																					
1. Physical Chemistry, P.W. Atkins, ELBS	1. Physical Chemistry, P.W. Atkins, ELBS	1. F	hysical Chemistry, F	P.W. A	kins, ELBS																																																																																																																																																																																																																																																																																																				
n an	Quantum Chemistry, By I.R.N. Levine, Privatice, Hall of India Ltd.     Quantum Chemistry, By B.K. Prasad, new age International	2. C	Juantum Chemistry,	, By I.R By R L	.N. Levine, Privatice,	1all of India Lt																																																																																																																																																																																																																																																																																																			
<ol> <li>Quantum Chemistry, By I.R.N. Levine, Privatice, Hall of India Ltd.</li> <li>Quantum Chemistry, By R.K. Prasad, new age International</li> </ol>	<ol> <li>Banwell C. N.; McCash, E. M., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill, New Delhi (2017).</li> </ol>	4. E	anwell C. N.; McCas	sh, E. N	A., Fundamentals of N	Aolecular Spec	ctroscopy, 4th	n Ed., Tata McC	Graw Hill, New D	elhi (20	17).																																																																																																																																																																																																																																																																																														

1. N	ame of the Depart	ment: Chemistry			1		-			-			
2. Co	ourse Name	GREEN CHEMISTRY				L		Т		_	Р		
3. Co	ourse Code	CH509			-	3		1		_	0		
4. Ty	ype of Course (use	tick mark)			C	ore ( )		DE (	√)	_	FC (	)	
5. Pi	re-requisite (if any	B.Sc. with Chemistry	6. Frequency (use tick marks)	Even ( V )	C	dd ( )	Ei	ither Se	em ( )	Ev	ery Ser	n ()	
7. To	otal Number of Leo	tures, Tutorials, Practicals											
Lectur	res = 30		Tutorials = 10		Practi	cal = Nil							
8. COU	JRSE OBJECTIVES: 1	his course is designed for po	ostgraduate students of chemistry a	nd industrial chemistr	y as a br	oad base	introdu	uction t	to analy	/tical in	strume	ntation	
techni	ques for the measu	rement of different chemic	al and physical properties of compo-	ounds and materials (	compos	ition, stru	ucture,	etc.). A thoir or	After su	ccesstu n	illy com	pletion	
				ious modern analytic	artechni	ques as v	well as i	uien op	Jeratio				
After th	e successful course	completion. learners will a	levelop following attributes:										
COURS	E OUTCOME (CO)	,,		ATTRIBUTES									
	CO1	Students would able to crea	te new routes for the synthesis of u	seful compounds wit	hout co	nsuming	harmfu	l solver	nts.				
	CO2	Students would be able to u	inderstand the principles of green c	hemistry									
	CO3	Students would able to app	y the important tools for the synthe	esis of useful compou	inds with	nout harn	ning of	enviror	nment.				
	CO4	Students would restate diffe	erence between different modes of	chromatographic sep	paration;	apply kn	owledg	ge of qu	ualitativ	ve and	quantit	ative	
-	analysis in various fields of chemical, pharmaceutical industry etc.												
40.11	CO5  Students would able to illustrate the future of green chemistry												
10. Un	10. Unit wise detailed content												
Dofinitic	an and concept of (	Rumber of lectures = 08	Groop Chamistry, Gools of Groop Ch	Introduction	of groop	Chomist	nu lim	itations	/Ohct/	oclos in	tho pu	rsuit of	
the goal	s of Green Chemist	rv	Green chemistry, doals of Green Cr	iennistry, ennergence	of green	Chemist	.1y, LIIII	Itations	S/ODSLA		the pu	isuit oi	
Unit-2		Number of lectures = 08	Title of the unit:	Principles of Green C	hemistr	v and De	signing	a Chen	nical sv	nthesi	s		
Twelve	orinciples of Green	Chemistry with their explanation	ations and examples: Designing a Gr	een Synthesis using th	nese prir	ciples: Pr	reventio	on of W	/aste/b	vprodu	icts: ma	iximum	
incorpor	ration of the mater	als used in the process into	the final products (Atom Economy);	prevention/minimiza	tion of h	azardous	s/toxic p	product	ts; desi	gning s	afer ch	emicals	
– differe	ent basic approach	es to do so; selection of a	ppropriate auxiliary substances (so	lvents, separation ag	gents), g	reen solv	vents, s	solventl	less pr	ocesses	s, immo	obilized	
solvents	and ionic liquids; e	nergy requirements for read	tions - use of microwaves, ultrason	ic energy; selection of	fstarting	material	s; avoid	dance o	funne	cessary	derivat	tization	
– carefu	I use of blocking/p	rotecting groups; use of cat	alytic reagents (wherever possible)	in preference to stoi	chiomet	ric reage	ents; de	signing	of bio	degrad	able pr	oducts;	
prevent	revention of chemical accidents; strengthening/development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical												
processes. Title of the unit: Green Synthesis / Positions L													
1 Green	Unit-3 Number of lectures = 08  Ittle of the unit: Green Synthesis/Reactions-I												
acetalde	ehyde, disodium in	ninodiacetate (alternative t	o strecker synthesis), citral, ibupro	fen, paracetamol, fu	rfural.2.	Microwa	ave assi	isted re	eaction	s in wa	ater: Ho	ofmann	
Eliminat	ion, Hydrolysis (of	benzyl chloride, benzamic	le, n-phenyl benzamide, methylbe	nzoate to benzole ad	cid), Oxi	dation (o	of tolue	ene, alc	ohols).	Micro	wave a	ssisted	
reaction	is in organic solven	s: Esterification, Fries rearra	angement, Orthoester Claisen Rearr	angement, Diels Alde	r Reactio	on, Decar	boxylat	tion. Mi	icrowa	ve assis	sted sol	id state	
reaction	is: Deacetylation, D	eprotection. Saponification	of esters, Alkylation of reactive met	thylene compounds, i	reductio	ns, synth	esis of r	nitriles	from a	ldehyd	es; anh	ydrides	
from dic	arboxylic acid; pyr	midine and pyridine derivat	tives; 1,2-dihydrotriazine derivatives	s; benzimidazoles.									
Unit-4		Number of lectures = 08	litie of the unit: G	reen Syntnesis/Reac	tions-II			-+: (			ation C		
1. Ultras	is Reformatsky rea	action 2 Selective methylat	ion of active methylene group usin	α dimethylcarbonate	· Solid-s	n, coupii tate nolv	ing read merizat	tion of	amorr	hous n	olymer	trecker s using	
dipheny	lcarbonate; Use of	"Clayan", a nonmetallic oxi	dative reagent for various reactions	; Free Radical Bromin	nation; F	tate poly tole of Te	ellurium	in Org	ganic Sv	nthese	es; Bioca	atalysis	
in Orgar	nic Syntheses.			,	,			- 0	,				
Unit-5		Number of lectures = 08	Title of the unit:	Future Trends in Gre	en Cher	nistry							
Oxidatio	on reagents and ca	talysts; Biomimetic, multifu	nctional reagents; Combinatorial gr	een chemistry; Prolif	eration (	of solven	tless re	actions	s; onco	valent	derivat	ization;	
Green cl	hemistry in sustain	able development.											
11. CO-F	PO mapping												
COs			Attributes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	
CO1	Students would at	ne to create new routes for	the synthesis of useful compounds	without consuming	3	1	1		2	3	2	3	
	Students would be	able to understand the priv	nciples of green chemistry		-	-+	-		-	-	-	-	
CO2		able to understand the prin			3	1	1		1	3	2	3	
CO3	Students would at	le to apply the important to	ools for the synthesis of useful comp	oounds without		,	, [			,			
	harming of enviro		3	T	1		T	3	2	2			
Students would restate difference between different modes of chromatographic separation; apply CO4 knowledge of qualitative and quantitative analysis in various fields of chemical pharmaceutical													
industry etc.										2			
	CO5 Students would able to illustrate the future of green chemistry												
CO5         Difference in duite the future of green chemistry         3         2         1         3         3         1         2													
3 Strong contribution, 2 Average contribution, 1 Low contribution													
12. Bri	ief description of s	elf-learning / E-learning con	nponent										
1. htt	tps://www.acs.org	/content/acs/en/greenchem	nistry/principles/12-principles-of-gro	een-chemistry.html									
2. htt	tps://www.youtub	e.com/watch?v=SvRe_wcOw	/3Q										
3. ntt	ups://extension.nai	varu.euu/biog/green-chem	isuy-anu-ule-future-of-sustainabilit	y/									
<b>13. BO</b>		Kidwai: New Tronds in Gro	en Chemistry, Anamalaya Publisher	s (2005)									
2. P1	L Anastes & LK. W	armer: Oxford Green Chemi	stry- Theory and Practical, Universit	v Press (1998)									
з. м.	.C. Cann & M.E. Co	nnely: Real-World cases in G	Green Chemistry, American Chemica	l Society, Washingtor	n (2000).								
4. M.	.A. Ryan & M. Tinn	esand, Introduction to Gree	n Chemistry, American Chemical Soc	ciety, Washington (20	)02). ,								

1. Na	1. Name of the Department: Chemistry																
2. Co	urse Name	COMPUTATIONAL METHODS IN CHEMISTRY CH519										т		Р			
3. Co	urse Code	CH519							3			1		0			
4. Tyj	pe of Course (u	(use tick mark) f any)								)	0	DE (√ )		FC (	)		
5. Pre	e-requisite (if a	iny)	B.Sc. with Chemistry		Odd ( )		Eithe	r Sem (	)	Every Se	m ()						
7. To	tal Number of	ber of Lectures, Tutorials, Practicals															
Lecture	Lectures = 30 Tutorials = 10 Practical = Nil																
8. COURS	SE OBJECTIVES:	: The obj	ective of this course is to	provid	le introduction	to chemoinform	atics, M	lolecula	r modeliı	ng for di	ug desig	ning and	l other a	rea of ch	emistry,		
informati	ics and biology.																
9. COURS	SE OUTCOMES	(CO):															
After the	e successful cou	rse com	pletion, learners will dev	elop fo	ollowing attrib	utes:											
COURS						ATTR	IBUTES										
	(0)	The stud	lent is expected to achiev		od grasn of the	e concents and ar	nlicatio	ons of c	hemoinfo	ormatics							
	CO2 Explain the various stages of drug discovery. Explain various structure-based drug design methods, define molecular modeling.																
	CO2 Explain the various stages of drug discovery. Explain various structure-based drug design methods, define molecular modeling.																
	CO4	Explain v	various structure-based o	rug de	sign methods,	bioinformatics in	drug d	evelopr	nent.								
	CO5	Underst	and, algorithm for time d	epend	ence; leapfrog	algorithm, Verlet	t algorit	hm, Bo	ltzman ve	elocity, d	duration	of the M	ID run e	tc.			
10. Uni	it wise detailed	content															
Unit-1		Numbe	er of lectures = 08		Title of the	unit: Introductio	on to ch	eminfo	rmatics								
Evolution	n of cheminfori	matics, h	nistory of chemical inform	nation	science, use c	of cheminformat	ics, pro	spectus	of chem	ninforma	atics, and	d history	of med	licinal ch	emistry.		
Prodrugs	and soft drugs	, drug ta	rget, drug solubility, natu	ral res	ources of lead o	compounds, pha	rmacok	kinetics and drug metabolism. Molecular modeling using computer.									
Unit-2		Numbe	er of lectures = 08		Title of the u	unit: Occupation	al Safet	ety; Molecular modeling									
Introduct	tion, force field	, quantu	m chemistry, Schrödinge	r equa	tion, potential	energy functions	, energ	gy minimization, local and global minima, saddle point, grid search.									
Semi-empirical methods (ZDO, MNDO, AM1, PM3). Molecular mechanics; Definition, balls and springs, force fields, bond-stretching, bond-bending, dihedral r										dral mot	ions, out						
of plane a	f plane angle potential, non-bonded interaction, coulomb interactions. Derivative methods; Steepest descent, conjugate gradient and Newton-Raphson method.											d.					
Unit-3 Number of lectures = 08 Title of the unit: Drug design and dis								overy (		f			:f	1:00 A.0.0	liestiewe		
of drug d	liscovery in-sili	n anu uis co drug c	lesigning area influencin	g deve o druo	discovery Intr	roduction of two	and thr	opmeni op-dime	nsional c	iuantita	tive struc		tivity rel	ationshi			
and its ro	ble in DDD.		aesigning, area innuerien	guiug	discovery. Intro	oddetion of two i		e-unne		luantita	live struc	cure ac	livity i ei	ationsing			
Unit-4		Numbe	er of lectures = 08		Title of the un	nit: Structure-bas	ed dru	g desigi	ning (SBD	)D)							
Introduction, target identification and validation, homology modeling, receptor mapping, active site analysis, pharmacophore mapping and grid maps. Ligand-based dru											sed drug						
designing	g (LBDD); Introd	duction,	lead designing, combinat	orial c	hemistry, high	throughput scree	ening (H	ITS), da	tabase g	eneratio	on and ch	nemical l	ibraries,	ADME p	roperty.		
Introduct	tion to docking,	, method	Is of docking, docking wit	h Auto	Dock, Vina, Do	ock etc.											
Unit-5	Unit-5 Number of lectures = 08 Title of the unit: Molecular dynamics (MD)																
Introduct	tion, Newton's	equatior	of motion, equilibrium	point, r	radial distributi	on function, pair	correla	tion fur	nctions, N	/D meth	nodology	, algorith	חm for ti י	me depe	ndence;		
leapfrog	algorithm, Verl	et algorit	thm, Boltzman velocity, c	uratio	n of the MD rur	n. Starting structu	ire, ana	lysis of	MD job, ı	uses in c	Irug desig	gning, lig	and pro	tein inte	ractions.		
11. CO-P	Omapping		A ++ -:	• • •				<b>DO1</b>	<b>DO</b> 2	002	004	DOF	DOC	0.07	DOG		
	he student is	ovpocto	Attribu	tes	of the concor	ate and applicat	ions of	PUI	PUZ	PU3	P04	P05	P06	P07	P08		
CO1 cł	hemoinformati	cs.		siasp				3	1	1		2	2				
co2 d	esign methods	, define r	nolecular modeling.	ery. E	-xplain variou	is structure-bas	ea arug	3	1	2		2	2				
соз <sup>th</sup> fa	he student is ex actors influenci	student is expected to achieve a better understanding of in-silico drug designing, and the tors influencing drug discovery							1	2		2	2				
CO4 Ex	CO4 Explain various structure-based drug design methods, bioinformatics in drug development.							3	1	2		2	3				
CO5 Understand, algorithm for time dependence; leapfrog algorithm, Verlet algorithm, Boltzmar						2	1	1		2	3						
velocity, duration of the MD run etc.								,	-	-		2	3				
3 Strong contribution, 2 Average contribution, 1 Low contribution																	
12. Brief description of self-learning / E-learning component																	
1. http://www.	t. https://www.youtube.com/watch?v=yX_nPzmTpi8																
Z. IIII 3 httr	https://www.youtube.com/watch?v=Y3utQZIPJ-4 https://www.jubilantbiosys.com/integrated-drug-discovery-services																
4. http	<ol> <li>nttps://www.jupilantbiosys.com/integrated-drug-discovery-services</li> <li>https://www.mt.com/in/en/home/applications/L1 AutoChem Applications/Process-Safetv.html</li> </ol>																
13. Boo	oks recommend	ded:															
1. Cha	apman, Fortran	95/2003	for Scientists and Wngir	ieers, l	McGraw-Hill Int	ternational Edition	n, New	York (2	2006).								
2. V.R	Rajaraman, Con	nputer P	rogramming in Fortran 9	) and 9	95, PHI Learning	g Pvt. Ltd, New D	elhi (19	97). <sup>.</sup>	-								
3. W.	H. Press, S. A. T	eukolsky	y, W. H. Vetterling, B. P. I	lanner	ry, Fortran Num	nerical Recipes V	olume 2	2 (Fortra	an 90), Ca	ambridg	e Univers	sity Pres	s (1996)				
4. R.L	Schwartz, T. C	hristians	sen, L. Wall, Learning Per	Secor	nd Edition, O'Re	eilly Media (1997	). 5. Foy	, Maste	ering Perl	First Ec	lition, O'l	Reilly Me	edia (200	J7)			
э.																	

. Name of the Department: Chemistry													
2.CourseName	SEMINAR		L		т			Р					
3.CourseCode	CH520				0		0 0						
4.TypeofCourse(use ti	ck mark)			Cor	e(√)	[	DE( )		F	C( )			
5.Pre-requisite (if any)	B.Sc. with Chemistry	6.Frequency(use tick marks)	Even ( v)	Oc	ld ()	Either	Sem ( )		Every Sem( )				
7.TotalNumberofLectu	7.TotalNumberofLectures,Tutorials,Practicals												
Lectures=30		Tutorials=10		Practic	al=Nil								
8. COURSE OBJECTIVES:	The primary objectives o	f this course are to develop studer	nts' communicatio	n and di	scussion	skills, in	crease vo	ocabular	y knowle	edge, lea	rn about		
communication style, de	ommunication style, develop learner autonomy, & build confidence to use English for oral presentation. Also to develop the ability to seek clarification and defend the												
ideas of others effectively.													
9. COURSE OUTCOMES (CO):													
After the successful course completion, learners will develop following attributes:													
COURSE OUTCOME ATTRIBUTE													
(CO)		•											
CO1	To develop and improve t												
CO2	To develop discussion and	l leadership abilities											
CO3 Skills for the development of demonstration abilities													
11. CO-PO mapping	11. CO-PO mapping												
COs	COs Attributes							PO5	PO6	PO7	PO8		
CO1 To develop and i	1	1	2	3	2	2	3	2					
CO2 To develop discussion and leadership abilities						1	2	2	2	2	3		
CO3 Skills for the development of demonstration abilities						3	1	2	2	1	2		
	3 Strong contribution, 2 Average contribution, 1 Low contribution												

1. Nam	. Name of the Department: Chemistry														
2.Cou	2.Course Name PROJECT TRAINING & EVALUATION								т		Р				
3.Course Code CH521							0		0		0				
4.Type of Course(use tick mark)							e(√)	[	DE( )		FC( )				
5.Pre-	-requisite (if any	) B.Sc. with Chemistry	6.Frequency	(use tick marks)	Even ( V)	Oc	ld ()	Either	Sem ( )		EverySem( )				
7.Tota	al Number of Leo	ber of Lectures, Tutorials, Practicals Tutorials=10 Practical=Nil													
Lectur	res=30			Tutorials=10		Practic	al=Nil								
8. COUI	. COURSE OBJECTIVES: To provide the industrial exposure and enhance technical skills of students.														
9. COUI	). COURSE OUTCOMES (CO):														
After the successful course completion, learners will develop following attributes:															
COURSE OUTCOME ATTRIBUTES					c										
(CO)						J <u> </u>									
	CO1	Hands on training													
	CO2	Integrate class room theo	ory with industri	al practice.											
	CO3	Understanding professio	nal ethics of ind	ustry.											
11. CO-	PO mapping														
COs Attributes								PO3	PO4	PO5	PO6	P07	PO8		
CO1 Hands on training							3	3	2	2	3	2	3		
CO2 Integrate class room theory with industrial practice.							2	З	2	2	2	2	3		
CO3	Understanding p	professional ethics of indu	stry.			3	3	3	2	3	2	1	3		
			3 Strong cont	ribution, 2 Average	contribution , 1 L	ow cont	ribution								