ACADEMIC CURRICULA

UNDERGRADUATE DEGREE PROGRAMME

Bachelor of Science

(B.Sc. Chemistry)

Three Years

Learning Outcomes Based Curriculum Framework(LOCF)

Academic Year

2020 - 2021

SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

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(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur- 603203, Chengalpattu District, Tamil Nadu, India

TABLE OF CONTENT

SEMESTER I

SEMESTER II

SEMESTER III

SEMESTER IV

SEMESTER V

SEMESTER VI

1. Department Vision Statement	
Stmt - 1	*To provide students with the fundamental concepts of chemical sciences.*
Stmt - 2	*To impart the ability of problems solving, critical thinking and analytical reasoning.*
Stmt - 3	*To prepare the students to pursue higher studies, required to work independently in research or in other industrial environments and to develop sustainable innovative solutions for the nation.*

2. Department Mission Statement	
Stmt - 1	*To provide a detailed knowledge of the terms, concepts, methodologies, principles and experimental techniques involved in various fields of chemistry.*
Stmt - 2	*To identify and solve chemical problems and explore new areas of research.*
Stmt - 3	*Implementing global standards and nurturing the students through innovation and quality education.*
Stmt - 4	*Nurturing the Chemistry Professionals to effectively contribute to the society with integrity and commitment.*
Stmt - 5	*Developing the student on the ethical side and making them an environment friendly chemist*

3. Program Education Objectives (PEO)	
PEO - 1	*To provide the students an in-depth understanding of the basic concepts of chemical sciences.*
PEO - 2	*To develop student skill in problems solving, critical thinking and analytical reasoning.*
PEO - 3	*To pursue higher studies, research and analysis in various disciplines of chemistry.*
PEO - 4	*To attain entrepreneurship andself-empowerment in the area of chemical sciences.*
PEO - 5	*To Provide a contemporary grounding in professional responsibility and ability to find solutions in a global, economic, environmental and societal context.*
4. Program Specific Outcomes (PSO)	
PSO - 1	*To provide a detailed knowledge of the terms, concepts, methodologies, principles and experimental techniques involved in various fields of chemistry.*
PSO - 2	*To identify and solve chemical problems and explore new areas of research.*
PSO - 3	*To prepare the students with a working knowledge of experimental techniques and instrumentation required to work independently in research or in other industrial environments.*

5. Consistency of PEO's with Mission of the Department					
	Mission Stmt. - 1	Mission Stmt. - 2	Mission Stmt. - 3	Mission Stmt. - 4	Mission Stmt. - 5
PEO - 1	H	M	H	L	M
PEO - 2	H	H	H	M	M
PEO - 3	H	M	H	H	H
PEO - 4	H	L	H	M	H
PEO - 5	H	M	H	H	H

H – High Correlation, M – Medium Correlation, L – Low Correlation

6. Consistency of PEO's with Program Learning Outcomes (PLO)

	Program Learning Outcomes (PLO)														
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
PEO - 1	H	H	H	H	H	H	H	H	M	H	H	H	H	H	H
PEO - 2	H	M	H	H	H	H	H	H	H	H	L	H	H	H	H
PEO - 3	H	H	H	L	H	H	H	H	H	H	H	M	H	H	H
PEO - 4	H	H	H	H	H	M	H	H	H	H	H	H	L	H	H
PEO - 5	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

7. Programme Structure

1. Professional Core Courses

(12 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UCY20101J	Inorganic Chemistry - I:Atomic Structure and Chemical Bonding	4	0	4	6
UCY20102T	Physical Chemistry - I:States of Matter and Ionic Equilibrium	5	1	0	6
UCY20201J	Organic Chemistry - I:Basic Concepts and Hydrocarbons	4	0	4	6
UCY20202T	Inorganic Chemistry - II: s- and p-Block Elements	5	1	0	6
UCY20301T	Physical Chemistry - II:Chemical Thermodynamics and its Applications	5	1	0	6
UCY20302J	Inorganic Chemistry - III: Coordination Chemistry	4	0	4	6
UCY20401J	Organic Chemistry - II:Halogenated Compounds and Oxygen Containing Functional Groups	4	0	4	6
UCY20402J	Physical Chemistry - III:Phase Equilibria and Electrochemical Cells	4	0	4	6
UCY20501J	Inorganic Chemistry - IV: Organometallic and Bioinorganic Chemistry	4	0	4	6
UCY20502T	Organic Chemistry - III: Nitrogen Containing Functional Group, Polyaromatic and Heterocyclic Chemistry	5	1	0	6
UCY20503J	Physical Chemistry - IV: Conductance and Chemical Kinetics	4	0	4	6
UCY20601T	Organic Chemistry - IV: Biomolecules	5	1	0	6
	Total Learning Credits				**72**

2. Discipline Specific Elective Courses (D)

(4 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UCY20D01T	Polymer Chemistry				
UCY20D02T	Analytical Chemistry	5	1	0	6
UCY20D03T	Industrial Chemistry				
UCY20D04T	Molecular Modeling and Drug Design	5	1	0	6
UCY20D05J	Instrumental Methods of Chemical Analysis				
UCY20D06J	Introduction to Nano Chemistry and Applications	4	0	4	6
UCY20D07L	Project Work	0	0	12	6
	Total Learning Credits				**24**

3. Generic Elective Courses (G)

(5 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
ULT20G01J	Tamil-I				
ULH20G01J	Hindi-I	2	0	2	3
ULF20G01J	French -I				
ULT20G02J	Tamil-II				
ULH20G02J	Hindi-II	2	0	2	3
ULF20G02J	French -II				
UMA20A01T	Allied Mathematics- I	3	0	0	3
UCY20A01T	Biochemistry-I				
UMA20A02T	Allied Mathematics - II	3	0	0	3
UCY20A02T	Biochemistry - II				
UPY20A01J	Allied Physics	4	0	4	6
	Total Learning Credits				**18**

4. Skill Enhancement Courses (S)
(6 courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UCY20S01T	IT Skills for Chemists	2	0	0	2
UCY20S02T	Fuel Chemistry				
UCY20S03T	Green Chemistry	2	0	0	2
UCY20S04T	Pharmaceutical Chemistry				
UCY20S05T	Research Methodology	2	0	0	2
UCY20S06T	Chemistry in Everyday Life				
UMI20S01L	My India Project	0	0	0	1
UCD20S01L	Soft Skills	0	0	2	1
UCD20S02L	Quantitative Aptitude and Reasoning	0	0	2	1
	Total Learning Credits				9

5. Ability Enhancement Courses (A)
(2 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
ULE20AE1T	English	4	0	0	4
UES20AE1T	Environmental Studies	3	0	0	3
	Total Learning Credits				7

6. Life Skill Courses (Jeevan Kaushal-JK)
(4 Courses)

Course Code	Course Title	Hours/ Week L	T	P	C
UJK20201L	Communication Skills	0	0	4	2
UJK20301T	Universal Human Values	2	0	0	2
UJK20401T	Professional Skills	2	0	0	2
UJK20501T	Leadership and Management skills	2	0	0	2
	Total Learning Credits				8

7. Extension activity (NS/NC/NO/YG)
(1 Course)

Course Code	Course Title	Hours/ Week L	T	P	C
UNS20201L	NSS	0	0	0	0
UNC20201L	NCC				
UNO20201L	NSO				
UYG20201L	YOGA				
	Total Learning Credits				0

AS SRMIST STRONGLY ENCOURAGES THE USE OF SWAYAM (Study Web of Active Learning by Young and Aspiring Minds) PLATFORM, THE STUDENTS ARE ENCOURAGED TO CHOOSE ATLEAST ONE CORE/ ELECTIVE COURSE FROM SWAYAM ON THE RECOMMENDATION OF THE FACULTY ADVISOR AND THE CREDITS WILL BE TRANSFERRED

8. Implementation Plan

Semester – I

Code	Course Title	Hours/ Week L	T	P	C
ULT20G01J	Tamil-I	2	0	2	3
ULH20G01J	Hindi-I				
ULF20G01J	French – I				
ULE20AE1T	English	4	0	0	4
UCY20101J	Inorganic Chemistry - I:Atomic Structure and Chemical Bonding	4	0	4	6
UCY20102T	Physical Chemistry - I:States of Matter and Ionic Equilibrium	5	1	0	6
UMA20A01T	Allied Mathematics-I	3	0	0	3
UCY20A01T	Biochemistry-I				
UCY20S01T	IT Skills for Chemists	2	0	0	2
UCY20S02T	Fuel Chemistry				
UCD20S01L	Soft Skills	0	0	2	1
	Total Learning Credits				25
	Total number of hours /week				29

Semester – II

Code	Course Title	Hours/ Week L	T	P	C
ULT20G02J	Tamil-II	2	0	2	3
ULH20G02J	Hindi-II				
ULF20G02J	French - II				
UCY20201J	Organic Chemistry - I:Basic Concepts and Hydrocarbons	4	0	4	6
UCY20202T	Inorganic Chemistry -II:s- and p-Block Elements	5	1	0	6
UMA20A02T	Allied Mathematics-II	3	0	0	3
UCY20A02T	Biochemistry-II				
UCD20S02L	Quantitative Aptitude and Reasoning	0	0	2	1
UJK20201L	Communication Skills	0	0	4	2
UNS20201L	NSS	0	0	0	0
UNC20201L	NCC				
UNO20201L	NSO				
UYG20201L	YOGA				
	Total Learning Credits				21
	Total number of hours /week				27

Semester – III					
Code	Course Title	Hours/ Week			C
		L	T	P	
UCY20301T	Physical Chemistry - II:Chemical Thermodynamics and its Applications	5	1	0	6
UCY20302J	Inorganic Chemistry - III:Coordination Chemistry	4	0	4	6
UPY20A01J	Allied Physics	4	0	4	6
UJK20301T	Universal Human Values	2	0	0	2
Total Learning Credits					20
Total number of hours /week					24

Semester - IV					
Code	Course Title	Hours/ Week			C
		L	T	P	
UCY20401J	Organic Chemistry - II:Halogenated Compounds and Oxygen Containing Functional Groups	4	0	4	6
UCY20402J	Physical Chemistry - III:Phase Equilibria and Electrochemical Cells	4	0	4	6
UCY20D01T	Polymer Chemistry	5	1	0	6
UCY20D02T	Analytical Chemistry				
UCY20D03T	Industrial Chemistry	5	1	0	6
UCY20D04T	Molecular Modeling and Drug Design				
UMI20S01L	My India Project	0	0	0	1
UJK20401T	Professional skills	2	0	0	2
Total Learning Credits					27
Total number of hours /week					30

Semester –V					
Code	Course Title	Hours/ Week			C
		L	T	P	
UCY20501J	Inorganic Chemistry - IV: Organometallic and Bioinorganic Chemistry	4	0	4	6
UCY20502T	Organic Chemistry - III:Nitrogen Containing Functional Group, Polyaromatic and Heterocyclic Chemistry	5	1	0	6
UCY20503J	Physical Chemistry - IV: Conductance and Chemical Kinetics	4	0	4	6
UCY20S03T	Green Chemistry	2	0	0	2
UCY20S04T	Pharmaceutical Chemistry				
UES20AE1T	Environmental Studies	3	0	0	3
UJK20501T	Leadership and Management skills	2	0	0	2
Total Learning Credits					25
Total number of hours /week					29

Semester - VI					
Code	Course Title	Hours/ Week			C
		L	T	P	
UCY20601T	Organic Chemistry - IV: Biomolecules	5	1	0	6
UCY20D05J	Instrumental Methods of Chemical analysis	4	0	4	6
UCY20D06J	Introduction to Nano Chemistry and Applications				
UCY20D07L	Project Work	0	0	12	6
UCY20S05T	Research Methodology	2	0	0	2
UCY20S06T	Chemistry in Everyday Life				
Total Learning Credits					20
Total number of hours /week					28

9. Program Articulation Matrix

Course Code	Course Name	Programme Learning Outcomes														
		Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
UCY20101J	*Inorganic Chemistry - I:Atomic Structure and Chemical Bonding*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20102T	*Physical Chemistry - I:States of Matter and Ionic Equilibrium*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20201J	*Organic Chemistry - I:Basic Concepts and Hydrocarbons*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20301T	*Physical Chemistry - II:Chemical Thermodynamics and its Applications*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20202T	*Inorganic Chemistry - II: s- and p-Block Elements*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20401J	*Organic Chemistry - II:Halogenated Compounds and Oxygen Containing Functional Groups*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20302J	*Inorganic Chemistry - III: Coordination Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20502T	*Organic Chemistry - III:Nitrogen Containing Functional Group, Polyaromatic and Heterocyclic Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20402J	*Physical Chemistry - III:Phase Equilibria and Electrochemical Cells*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20501J	*Inorganic Chemistry - IV: Organometallic and Bioinorganic Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20601T	*Organic Chemistry - IV: Biomolecules*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20503J	*Physical Chemistry - IV: Conductance and Chemical Kinetics*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20D01T	*Polymer Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20D02T	*Analytical Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20D03T	*Industrial Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20D04T	*Molecular Modeling and Drug Design*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20D05J	*Instrumental Methods of Chemical Analysis*	H	H	H	H	H	H	H	H	H	H	L	H	M	M	M
UCY20D06J	*Introduction to Nano Chemistry and Applications*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20D07L	*Project Work*	M	H	M	M	H	H	H	H	H	H	H	H	M	H	H
ULT20G01J	*Tamil- I*	*H*	*H*	*H*	*M*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*
ULH20G01J	*Hindi-I*	*H*	*H*	*H*	*M*	*H*	*H*	*M*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*
ULF20G01J	*French – I*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
ULT20G02J	*Tamil- II*	*H*	*H*	*H*	*M*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*
ULH20G02J	*Hindi-II*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*M*	*H*	*H*
ULF20G02J	*French – II*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*M*	*H*	*H*
UMA20A01T	*Allied Mathematics - I*	H	M	M	M	M	H	L	H	H	L	L	L	M	L	L
UMA20A02T	*Allied Mathematics - II*	H	M	M	M	M	H	L	H	H	L	L	L	M	L	L
UCY20A01T	*Biochemistry-I*	H	M	M	M	M	H	L	H	H	L	L	L	M	L	L
UCY20A02T	*Biochemistry - II*	H	M	M	M	M	H	L	H	H	L	L	L	M	L	L
UPY20A01J	*Allied Physics*	H	M	M	M	M	H	L	H	H	L	L	H	M	L	L
UCY20S01T	*IT Skills for Chemists*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20S02T	*Fuel Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20S03T	*Green Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20S04T	*Pharmaceutical Chemistry*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20S05T	*Research Methodology*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UCY20S06T	*Chemistry in Everyday Life*	H	H	L	M	H	H	M	M	M	M	L	H	M	H	H
UMI20S01L	*My India Project*	M	M	H	M	M	M	L	H	M	H	H	M	M	H	H
UCD20S01L	*Soft Skills*	H	L	H	H	L	M	L	L	L	L	H	M	M	H	L
UCD20S02L	*Quantitative Aptitude and Reasoning*	H	L	H	H	L	M	L	L	L	L	H	M	M	H	L
ULE20AE1T	*English*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
UES20AE1T	*Environmental Studies*	H	L	H	H	L	M	L	L	L	L	H	M	M	H	L
UJK20301T	*Universal Human Values*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
UJK20201L	*Communication Skills*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*
UJK20401T	*Professional Skills*	H	L	H	H	L	M	L	L	L	L	H	M	M	H	L
UJK20501T	*Leadership Skills*	H	L	H	H	L	M	L	L	L	L	H	M	M	H	L
	Program average	H	H	L	M	H	H	M	M	M	M	M	H	M	H	H

H – High Correlation, M – Medium Correlation, L – Low Correlation

Structure of UG Courses in Chemistry

Distribution of different Courses in each semester with their credits for B.Sc. (General) Chemistry with PCM

Semester	Compulsory Core Courses (CC) each with 06 credit (Total no. of Papers 12)	Discipline Specific Elective(DSE) With 06 credit (Total no. of Papers 4)	Ability Enhancement Compulsory Courses (AECC) With 04 credit (Total no. of Papers 2)	Life skills (JeevanKaushal)	Skill Enhancement Course (SEC) With 02 credit - 4 papers With 0 credit – 2 papers (Total no. of Papers 6)	Generic Elective (GEC) With 06 credit (T + P) & 03 credit (T) (Total no. of Papers 5)	Extension activity	Total Credits
Sem I	CC-1 CC-2 (12)		AECC-1 (4)(*English)*		SEC-1(2) SEC-2 (1) (Soft skills)	GE-1 (Language-I) (3)GE-2 (Maths-I /Biochemistry-I) (3)		25
Sem II	CC-3 CC-4 (12)			JK- 1(2)*(Communication skills)*	SEC-3(1) *(Quantitative aptitude and reasoning)*	GE-3 (Language-II) (3) GE-4 (Maths-II/ Biochemistry-II)(3)	NCC/ NSO/ NSS YOGA (0)	21
Sem III	CC-5 CC-5 (12)	-		JK-2(2)*(Universal human values)*		GE-5 (Physics) (4+2)		20
Sem IV	CC-7 CC-8 (12)	DSE-1 (6)DSE-2 (6)		JK- 3(2) *(Leadership skills)*	SEC-4(1) (My India project)			27
Sem V	CC-9 CC-10 CC-11 (18)		AECC-2 (3)(EVS)	JK – 4 (2) *(Professional skills)*	SEC-5(2)			25
Sem VI	CC-12 (6)	DSE-3(6) DSE - 4(6)			SEC-6(2)			20
Total Credits	**72**	**24**	**7**	**8**	**9**	**18**	**0**	**138**

SEMESTER I

Course Code	ULT20G01J	Course Name	Tamil-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Tamil*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
CLR-1 :	*To enable them to learn the nuances of modern poetry in Tamil*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	To explore New historicism through the works of art written in Tamil to enlighten the students to understand the changes in the modern society			
CLR-3 :	Inculcate Ways of life, moralities and ethical factors as an essential part of learning Tamil literature			
CLR-4 :	Develop strategies of comprehension of texts of different origin			
CLR-5 :	Strengthen the language of the students both in oral and written			
CLR-6 :	Express their sentiments, emotions and opinions, reacting to information, situations			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	*Extend and expand their savoir-faire through the acquisition of skills to cater the needs of the modern era.*	*2*	*75*	*60*	*H*	*H*	*H*	*-*	*H*	*H*	*M*	*H*	*H*	*-*	*H*	*H*	*H*	*H*	*H*
CLO-2 :	Enable the students to appreciate their mother tongue and to Enhance their thinking capacity	*2*	*80*	*70*	*H*	*H*	*-*	*H*	*-*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-3 :	Make them learn the basic rules of Language and make them communicate better	*2*	*70*	*65*	*H*	*H*	*H*	*M*	*-*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-4 :	Develop strategies of comprehension of texts based on different culture and life styles	*2*	*70*	*70*	*H*	*-*	*H*	*H*	*H*	*-*	*M*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-5 :	Strengthen spoken and written skills of the student	*2*	*80*	*70*	*-*	*H*	*-*	*M*	*-*	*H*	*H*	*-*	*-*	*H*	*H*	*-*	*H*	*H*	*H*
CLO-6 :	*Will be able to clear government examinations*	*2*	*75*	*70*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*

Duration (hour)		12	12	12	12	12
S-1	SLO-1	□ □	□ □	□ □	□ □	□ □
	SLO-2	□ □	□ □	□ □	□ □	□ □
S-2	SLO-1	□ □	□ □	□ □	□ □	□ □
	SLO-2	□ □	□ □	□ □	□ □	□ □
S-3	SLO-1	□ □	□ □	□ □	□ □	□ □
	SLO-2	□ □	□ □	□ □	□ □	□ □

(484)

Duration (hour)		12	12	12	12	12
S-4	SLO-1					
	SLO-2					
S-5	SLO-1					
	SLO-2					
S-6	SLO-1					
	SLO-2					
S-7	SLO-1	20		(77)		
	SLO-2					
S-8	SLO-1					
	SLO-2					
S-9	SLO-1			(9)		
	SLO-2					
S-10	SLO-1					
	SLO-2					
S-11	SLO-1					
	SLO-2					
S-12	SLO-1					

Duration (hour)		12	12	12	12	12
	SLO-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible], [illegible]

Learning Resources	
	1. [illegible], [illegible] - [illegible], [illegible] . . [illegible], [illegible], 603203, 2020 2. [illegible], [illegible], [illegible], [illegible], 2018 3. [illegible], [illegible], [illegible], 2013 4. [illegible] - http://www.tamilvu.org/ 5. [illegible] -https://www.projectmadurai.org/

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	30%	30%	30%	30%	30%	30%	30%	30%	30%	-
Level 2	Apply Analyze	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
Level 3	Evaluate Create	30%	30%	20%	20%	20%	20%	20%	20%	20%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Dr. R..Srinivasan Associate Professor, Department of Tamil, Presidency College, Chennai,	*1. B.Jaiganesh, Assistant Professor & Head, FSH, SRMIST*
		2. T.R.Hebzibah Beulah Suganthi, Assistant Professor, FSH, SRMIST
		3.S.Saraswathy, Assistant Professor, FSH, SRMIST

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Course Code	ULH20G01J	Course Name	Hindi-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*HINDI*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*To be able to converse well in the Hindi Language*			
CLR-2 :	*To read and write and clarity*			
CLR-3 :	*To be willing listeners and translators –where need be*			
CLR-4 :	*To acquire the values/thought contents of the writers and practice in it in life.*			
CLR-5 :	*To find motivation through the various forms of literature and learn to overcome any challenges of life.*			
CLR-6 :	*To discover the importance of the language in making education as a means of growth in life and not mere literacy.*			

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

					Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	*To appreciate the Hindi language in its various forms.*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To understand the philosophy of life and living through stories.*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*To help the students learn and develop the fundamentals of life, through One-Act plays.*	*2*	*70*	*65*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To share the richness of thought and content presented in the Hindi language, into other languages so that the readers would stand to gain.*	*2*	*70*	*70*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
CLO-5 :	*To guide the students in the learning of the technical aspect of the Hindi language, this would help them in the field of administration.*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*To encourage the students to communicate with the public, on a large scale with the medium of Main stream and Documentary films.*	*2*	*75*	*70*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Kahani kya Hai	Ekanki aur Natak kya hai	Patrkarita ka arambh	Film Samiksha	Takniki Shabdavali
	SLO-2	Jivan ka anubhav	Vidhyarthiyon dono ke antar ko smajhkar apne dwara use prastut kar sakta hai	Vidhyarthiyon ka apne samaj ke prti jagrukta	Film ka prabhav ko smajhna	Vaignik tarike se bhashaon ka avishkaar karna
S-2	SLO-1	Kahani ke Tatva	EKANKI KA ARTH	Aazdi aur Patrkarita ka daiytava	SAMIKSHA KYA HAI	ARTH
	SLO-2	Vishleshan karne ki Kshmta	Vidhyarthi ke bhitar vishkleshan ki kshamta jagrit	Vidhyarthiyon ko patrkarita ka itihas smajkar samaj nirman ke liye sahyog dena	Tarkik vishleshan kshmta paida karta hai	Vidhyarthi uske arth dwara hi uske mahtav smjhenge
S-3	SLO-1	Vo Tera Ghar Ye Mera Ghar Parivar me Buzargon ke Mahtav ko Samjhana	PARIBHASHA	PATRKARITA KA MAHTAVA	SAMIKSHA KE PRAKAR	PARIBHASHA
	SLO-2	Bhartiya Sanskriti Se Vidhyarthiyon ko Jodna	Vidvano ke mat se parichay	Patrkarita se bhut se sawal ka smadhan ho jata hai	Vidhyarthiyon ka un prkaro ka adhyaan karna jisse vidhyarthi us samiksha ko	Vibhinn vidwano dwara di gai paribhasha se us baat ko smjhenge vidhyathi

Duration (hour)		12	12	12	12	12
					tayaar kar payenge	
S-4	SLO-1	MithaiwalaPyar Bantne se dukh kam hota hai	SWAROOP	PTRAKARITA KA ARTH	SAMIKSHA KA UDDESHYA	SHABDAVALI KI AVSHYAKTA
	SLO-2	Manavata ka Path	Vidhyarthiyon me iski samajh se lekhan kshmata badegi	Vibhinn vidhvono ko padhne se vidhyarthiyon ki tarkik kshmta badhti hai ,	Vidhyarthi ke andar smaj ke prati Kartavya bodh paida hoga	Vaignikon ka awiskar kitna mahtavpurn
S-5	SLO-1	Bechadri PalChatro me Utsah Vardhan Karna	PATHYA VACHAN	PTRAKARITA KI PARIBHASHA	FILM KA SAMAJIK MAHTAVA	BHASHA VAIGYANIK
	SLO-2	Beta-beti ek saman ke mahtav ko smjhana.	Vidhyarthiyon ka path kaushal bdhega	K vidhvaono ki ukti ek smadhan bhi hota hai	Samajik uttar daiytav ko smjhana	Bhasha vaignikon ki jankari
S-6	SLO-1	Nadi aur JeevanParyavaran ke mahtav se awagat karana.	PRASTUTI	PRAMUKH SAMACHAR PATR	FILM KA VISHLESHAN	KARYALYIN SHABD
	SLO-2	Manav Jeevan me nadi ki upyogita aur Mahtav.	Natak khelne par bahut si takniki bate samajhenge	Vidhyarthiyon ki jankari badhegi	Vidhyarthi tarkik vishleshan sikhega	Shabd kaise tayar kiye jate hain vidhyorthiyon ko jankari
S-7	SLO-1	Pachees chauka Ded SauJamindari Pratha se awagat karana	MAHTVA	TV.PATRKARITA	DRISTIKON NIRMAN	ANGREZI SE HINDI ANUVAD
	SLO-2	Asprishya Vicharao ke Prati Sakaratamak Bnana.	Natak ka mahtav ko smajhkr samaj ke hito ke sath judna.	TV patrkar ke daiytav ko smajkar vidhyarthi ise apne rozgar se jod sakta hai	Vidhyarthi ka drishtikon nirmit hoga	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna
S-8	SLO-1	Kahani ka Uddeshya	PRASHAN-ABHYAS	PHOTO PATRKARITA	DOCUMENTRY FILM	HINDI SE ANGREZI ANUVAD
	SLO-2	Vidhyarthiyon ko Samaj se Jode rakhna	Vidhyarthiyon ka lekhan kshmata Badhna	Vidhyarthiyon me photo patrkarita ke mahtav ka smajh paida hona	Vidhyarthi samajik dharatal ki kathinai ko smajhkar desh se judega	Hindi adhikari aur anuvadak ke pad ke liye tayaar karna.
S-9	SLO-1	Kahani Lekhan	UDDESHYA	PRASTUTIKARAN	MAIN STREAM FILM	EK DIN EK SHABD
	SLO-2	Vidhyarthi Ko likhne ki aur Prerit karna	Vidhyarthi ko smaj upyog hito ki jankari dena	Vifhyarthi apni baat rakhne ki kshmta vikstit karta hai	Vidhyarthion ko jivan ke anchue pahluon se bhi sakshaktkar	Vidhyarthiyon ko rozgaar se jodna
S-10	SLO-1	Seminar	PARICHARCHA	BHASHA-SHAILI	FILM KE DARSHAK	ATI MAHTVAPURN SHABD
	SLO-2	Vidhyarthiyon dwara Prastuti karan	Vidhyarthi me vak-kaushal bdhana	Vidhyarthi ko apni report me bhasha-shaili ko sikh kar ek badhiya reporter ban sakta hai	Vidhyarthiyon ka samajik gyan	Shabdon ke mahtav ko smajhkar use yaad karna
S-11	SLO-1	Prashan Abhyas	BHASHA SHAILI	PATRKARITA KE NIYAM	FILM AUR BAZAAR	SAMANYA SHABD AUR PARIBHASHIK SHABDAVALI ME ANTAR
	SLO-2	Vidhyarthiyon me Lekhn Kaushal ki kshmata Viksit karna.	Vidhyarthiyon ko bhasha ka mahtav smjhna	Vidhyarthi ise sikh kar ek nyay priya patrkar ban sakta hai	Vidhyarthiyon ko rozgaar se jodna	Vidhyarthiyon ko vaighniko dwara tayaar ki gai bhasha ki samaj
S-12	SLO-1	Path-Punravarti	EKANKI AUR RANGMANCH	PATRKAR KA DAIYTVA	FILM DARSHAK KA MAHTAVA	PARIBHASHIK SHABDAVALI KA MAHTAV
	SLO-2	Pariksha ke liye Saksham	Vidhyarthi isse rangmanch ke mahtav ko smajhenge	Vidhyarthiyon ko patrkar ka daityva sikhkar smaj ke uttar daityva ko nibhana hai	Vidhyarthiyon ko darshak ki ruchiyon se awagat karvana	Rozgaar se vidhyarthiyon ko jodnaw

Learning Resources	*The Prescribe Text Book Compiled and Edited by Department of Hindi* *www.gadyakosh.comwww.shabdkosh.com*

Learning Assessment											
	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	30%	30%	30%	30%	30%	30%	30%	30%	30%	-
Level 2	Apply Analyze	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
Level 3	Evaluate Create	30%	30%	20%	20%	20%	20%	20%	20%	20%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Prof.(Dr.) S.Narayan Raju, Head, Department of Hindi,CUTN, Tamilnadu	*1. Dr.S Preeti. Associate Professor & Head, SRMIST*
		2. Dr. Md.S. Islam Assistant Professor, SRMIST
		3 Dr. S. Razia Begum, Assistant Professor, SRM IST

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Course Code	ULF20G01J	Course Name	French-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*French*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

CLR-1 :	*Extend and expand their savoir-faire through the acquisition of current scenario*
CLR-2 :	Enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French
CLR-3 :	Make them learn the basic rules of French Grammar.
CLR-4 :	Develop strategies of comprehension of texts of different origin
CLR-5 :	Strengthen the language of the students both in oral and written
CLR-6 :	Express their sentiments, emotions and opinions, reacting to information, situations

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	*To acquire knowledge about French language*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*2*	*80*	*70*	-	*H*	-	*H*	-	*H*	-	-	-	-	*M*	-	-	-	-
CLO-3 :	*To develop content using the features in French language*	*2*	*85*	*75*	*H*	-	-	*H*	-	*H*	-	-	-	-	*M*	-	-	-	-
CLO-4 :	*To interpret the French language into other language*	*2*	*70*	*80*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
CLO-5 :	*To improve the communication, intercultural elements in French language*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	*H*	-	-	-	-
CLO-6 :					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	**SLO-1**	**Bonjour, ça va ?**	**Salut ! Je m'appelle Agnès**	**Qui est –ce ?**	**Dans mon sac, j'ai…**	**Il est comment ?**
	SLO-2	**Salut**	**Paul, Valérie, Manish**	**Les exemples**	**Da ns ton sac**	**Les objectifs**
S-2	**SLO-1**	Les pays	Les pronoms personnels sujets	Les professions	La formation du féminin (3)	L'aspect physique
	SLO-2	Les nationalités	Je, Tu, Il/Elle Nous, vous, Ils/Elles	Les exemples	Les féminins	Le corps
S-3	**SLO-1**	Les animaux domestiques	Les verbes être et avoir	Quelques objets	La phrase interrogative	Le caractère
	SLO-2	Les animaux	Les verbes auxiliaires	Objets	Les interrogatives	Les exemples
S-4	**SLO-1**	Les jours de la semaine	Les articles définis et indéfinis	La fiche d'identité	*qu'est – ce que.. ?*	Les prépositions de lieu (1)
	SLO-2	Les mois de l'année	Les exemples	La carte d'identité	*Les exemples*	Dans, sur, sous etc..,
S-5	**SLO-1**	Les nombres de 0 à 69	La formation du féminine (1)	La liaison	*Qu'est – ce que C'est*	Les nombre à partir de 70
	SLO-2	Les nombres	Les féminins	Les activités	*Les objets*	Les exemples

Duration (hour)		12	12	12	12	12
S-6	SLO-1	La famille (1)	La formation du pluriel (1)	L'élision	*Qui est – ce ?*	**Allo ?**
	SLO-2	Ses parents	Les exemples	Les activités	*Les personnes*	**Portable**
S-7	SLO-1	L'accent	Les adjectifs possessifs	Intonation descendre	*la phrase négative*	La formation du féminin(3)
	SLO-2	L'accent tonique	Les exemples	Les descendre	*La négation*	Les exemples
S-8	SLO-1	Les articles définis	Entrer en contact : salut	Intonation montante	*C'est*	Les articles contractés
	SLO-2	Les articles indéfinis	Entrer en contact : demander	Les montantes	*Il est*	Les articles partitifs
S-9	SLO-1	Bonjour, - Salut !	Dire comment ça va	Dans mon sac	*Les verbes du premier group*	Les pronoms personnels toniques
	SLO-2	Ca va	Comment allez-vous ?	Des objets	*Les exemples*	Les pronoms
S-10	SLO-1	Je m'appelle Agnès	Se présenter	Les Mots	Les verbes*aller*	Les adverbes interrogatifs
	SLO-2	Quel est votre nom	Présenter quelqu'un	Les expressions	Le verbe venir	Les interrogatifs
S-11	SLO-1	Les Mots	*Demander*	Demander poliment	Demander et répondre poliment	Les verbes du deuxième group
	SLO-2	Les Expressions	*Demander le temps*	Répondre poliment	Les exemples	Les exemples
S-12	SLO-1	Entrer en contact	Demander la date	Demander des informations personnelles	Demander des informations personnelles	Décrire l'aspect physique
	SLO-2	Se présenter.	Dire la date	Les exemples	Les activités	Décrire le caractère

Learning Resources	***Theory:*** ***1.*** "**Génération-AI"** Méthode de français, Marie-Noëlle COCTON, P.DAUDA, L.GIACHINO, C.BARACCO, Les éditions Didier, Paris, 2018. ***2. Cahier d'activités avec deux discs compacts.***

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	30%	30%	30%	30%	20%	20%	20%	20%	30%	-
Level 2	Apply Analyze	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
Level 3	Evaluate Create	30%	30%	20%	20%	30%	30%	30%	30%	20%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. C.Thirumurugan Associate Professor, Department of French, Pondicherry University	*1. Kumaravel K. Assistant Professor & Head, SRMIST*
		2. Ponrajadurai M Assistant Professor, SRMIST

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Course Code	ULE20AE1T	Course Name	English	Course Category	A	Ability Enhancement Course	L	T	P	C
							4	0	0	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*English*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	CommunicationSkills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-1 :	*Extend and expand the integrity in an individual which shall never allow him/her to compromise upon a noble way of living*																		
CLR-2 :	Enable the students to overcome the fear of speaking a foreign language and enable them to think through a foreign language.																		
CLR-3 :	Make them communicate an unbiassed way of thinking in a better manner																		
CLR-4 :	Develop strategies of comprehension of texts based on different culture and life styles																		
CLR-5 :	Strengthen spoken and written skills of the student in English																		
CLR-6 :	Help them express their sentiments, emotions and opinions, and reactions to information and situations in a civilized, cultured and humane manner.																		
CLO-1 :	*To acquire knowledge of becoming better beings through the tools of Language and Literature*	*2*	*75*	*60*	*H*	*H*	*H*	*-*	*-*	*H*	*-*	*H*	*-*	*H*	*H*	*H*	*-*	*-*	*-*
CLO-2 :	*To acquire a strong knowledge on concept, culture, civilization through English Literature*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*-*	*-*
CLO-3 :	*To develop own content and to be able to translate using the features in English Language*	*2*	*70*	*65*	*H*	*-*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*-*	*H*	*H*	*-*	*-*	*-*
CLO-4 :	*To interpret the contents in the texts presented in English Language*	*2*	*70*	*70*	*H*	*-*	*H*	*H*	*H*	*H*	*-*	*H*	*-*	*-*	*H*	*-*	*-*	*-*	*-*
CLO-5 :	*To present an improved and healthier communication and intercultural elements acquired through English Literature*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*H*	*-*	*-*	*H*	*-*	*-*	*-*	*-*
CLO-6 :	*To participate in any level of conversation and discussion presented in English with both proficiency in the language and positive caliber in the content of speech*	*2*	*75*	*70*	*H*	*H*	*-*	*H*	*M*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*

Duration (hour)		12	12	12	12	12
S-1	**SLO-1**	*Introduction to the art of poetry writing will be done*	*Post-colonial impacts in India as observed in their language and culture will be discussed.*	*Story through images is explained to the students*	*The definition and purpose of monologue is explained*	Homophones and Homonyms are to be explained in the class along with examples of usage.
	SLO-2	*The rationale behind this unit will be discussed.*	*The students will be encouraged to impart their views*	*The students are asked to create their own stories from those images*	*the sample monologues are to be provided to the learners*	How where and when these as vocabulary can be used is to be explained

Duration (hour)		12	12	12	12	12
S-2	SLO-1	*Feminism through Kamaladas' poem' In Kindergarten' is explained*	*Mathraboothan and the mother tongue influence in English – a discussion*	*Every day the students are made to bring their own cartoons to tell stories related to social issues and political issues.*	*The learners are made to create their own monologue contents.*	*Cross word puzzles are to be given to the students to make them understand the differences and usage of homophones and homonyms*
	SLO-2	*feminist critique's stand through poets like Meena Kandasamy is discussed*	*Students from different regions are asked to talk. The peculiarity in their pronunciation is to be identified by them*	*How to identify irony and sarcasm is taught*	*The contents are assessed and the lacuna is informed*	*The students are evaluated by making them use homophones and homonyms on their own*
S-3	SLO-1	*The writer Meena Kandasamy is invited to read her poems on women.*	*Enjoywithinlimits, says Mr Mathruboothamistaught and discussed*	*International Political memes to be created in the class*	*Discuss the contents created by the students and reiterate the idea that a monologue should mimic a story and has to have a proper beginning middle and an end.*	*How exactly to decide a proper word at a given situation is to be practically explained in the class.*
	SLO-2	*Questions on her perspectives are to be posed by the students*	*Everymistakefound in the textisanalysed*	*Memes on popular issues to be created in the class*	*The created monologues are to be assessed by the students themselves*	*Mundane situations are to be given to the students to check their ability to use those words*
S-4	SLO-1	*Gender inequality is discussed through A K Ramanujam and his poetry*	*The structure of sentence in English and the distorsion of the sentence isverified*	*Autobiography and biography differences are explained*	*To ask the students to bringnewspaper to class and makethem select a column and readitloudly.*	*To give all the parts of speech not according to the grammar book order but according to a method which would easily make one understand correlation of one with the other. For instance – Noun, Pronoun, Adjective, Verb, Adverb… will have to be the order*
	SLO-2	*Different legal situations where both the genders suffer is explained in the class*	*Diffèrent sentences are given and tested*	*Certain Classic autobiographies and biographies are presented*	*No meaningis to beexplained. Just the flow is to bechecked.*	*The students are made to use as many adjectives as possible for describing their friends*
S-5	SLO-1	*Kalki the poetisinvited to conduct a guets lecture on herownpoem.*	*Nobel? What Nobel, asks MrMathrubootham is discussed*	*How to give voice to an inanimate object.*	*Another reading loud session of the same passages are to be conducted along with dictionary checking for meanings are to be done.*	*The parts of speech must beused in different sentences*
	SLO-2	*Questions on her perspectives are to be posed by the students*	*The attitudes of people in a ludicrous manner is discussed*	*Different objects are given to the students and they are asked to give autobiographical notes to them*	*The new meanings that the students get must be compared with the given word and the distance between the meanings are to be explained*	*the teacherought to use the board to draw a situation to make one understandeachpart's usage.*
S-6	SLO-1	*Seminar to generate discussion to enhance gender sensitivity is conducted*	*The Text is analyzed in detail*	*Practically test the students in class by giving them different concrete objects.*	*To make them compare and realize how they had overcome their fear for English*	*Along with parts of speech particularly when Verb is being taught Tenses ought to be taught with same methodology mentioned above.*
	SLO-2	*Case studies are to be incorporated by the students in*	*More insights into Indian English is given*	*Ask the students to evaluate each other's autobiography on concrete*	*The comprehensive techniques are taught*	*The students are asked to create a lighter vein situation and asked to use*

Duration (hour)		12	12	12	12	12
		their seminar		*objects*		*all the tenses*
S-7	**SLO-1**	Human interest columns in news papers - tragedies on women men and transgender documented is read aloud and discussed in the class room.	*Neutral accent is taught along with right pronunciation*	*Caption writing is taught*	*To develop the ability to pick up a conversation istaugh*	*The rules of Tenses are taught with live examples in the classes.*
	SLO-2	. how much are the students able to relate with or able to feel emotionally for those situations is to be checked and analysed	*Test is to be conducted to check how far a student is able to understand neutral accent*	*The purpose of the caption writing is to be instilled*	*to engage in conversations and be able to interupt and end conversation appropriatelywilllbetaught*	*Ability to use all the rules in tenses is taught.*
S-8	**SLO-1**	*Case studies to be given to the students to document their reactions*	*Mr Mathruboothamisfullysupporting all new technologies – discussion*	*Different examples for captions are given*	*Different situations to be given to the students to engage in a conversation.*	*The basic way to pick an error is by already knowing the rules of grammar thoroughly.*
	SLO-2	*Find out if there is any student finding it hard to emote or is insensitive toward the moment*	*Humor and sarcasmisskimmedfrom the text*	*The studenst are asked to create captions similar to the ones shown in the class*	*The students are asked to find errors in each others' monologue*	*Hence all the rules are to be brushed up*
S-9	**SLO-1**	*Students are to made to createtheirownenactable content on the prevailinggenderinequalities*	*How to write a statement and question is to be taught with reference to the text.*	*The students are made to give captions different news articles, products and situations*	*To test how much one is able to use ironyhumor and sarcasm in one's conversation*	*Excercises on all sorts of possible errors are given to the students and asked to rectify.*
	SLO-2	*The students are asked to improvise on dialogue on theirown*	*The way sentences are constructed according to the regional impact is discussed*	*The best is appreciated for its qualities of being best*	*Natural usage of punisexplained*	*Mathrabootham's passages are given to the studentsagain to check the errors.*
S-10	**SLO-1**	*Feminism vs Gender inequality a test for the students to chart out the existing gulf*	*Pizza maavu : Welcome to Mr Mathruboothamfoodrecipiewebsiteisdiscussed*	*Public Speakingexamplessince Julius Caesar to Martin Luther isgiven*	*To teachdifferentkinds of reading. - skimming scanning and intensive reading extensive reading is taught*	*Definesynonym and antonym. Ask the sudents to identifysynonyms and antonyms in text.*
	SLO-2	*False allegations and Legal situations sometimes created by women to corner men only degrades the freedom struggle of women – discuss*	*The students are made to explain the textthemselves*	*The techniques used by different leaders sinceagesisdiscussed*	*Teh students are practicallyasked to use thosemethodology to understand a text*	*Demonstartetheriunderstanding of synonyms and antonyms in active learning. Introduce thesaurus reference.*
S-11	**SLO-1**	*A detailed discussion on the 4 poets is done in the class through comparative method*	*Identify the errors and make students to rewrite first two texts*	*The Ted X talks are played in the class, different political leader's canvasing is presented*	*The students are made to read the passages loudly*	*Demeonstrateunderstanding of words by relatingthem to their opposites (antonyms)*
	SLO-2	*While comparison the students are able to get a deeper analytical*	*Check if they are able to retain the humor in the text after correcting the sentences*	*What makes a talk impressive is identified and discussed*	*The students are asked questions from the passages to check their retention*	*Demonstrateunderstanding of wordswithsimilar but not*

Duration (hour)		12	12	12	12	12
		way of thinking and are able to present an all encompassed points			*capacity*	*identicalmeanings (synonyms)*
S-12	**SLO-1**	*The comprehension and retention and application of all the acquired knowledge of the student is checked by initiating an informal discussion in the class.*	*Identify the errors and make the students to rewrite the last two texts*	*The students are givendifferent topics to give impromptu*	*The learner is made to select phrases and words from the given passages and is asked to use it in own sentences*	*With the studentsbrainstormshortlist of commonlyusedwords*
	SLO-2	*The overall development in the student's EQ pertaining to gender oriented issues will be sensible and objective.*	*Check if they are able to retain the humor in the text after correcting the sentences. Explain the result to them*	*The best talk isrecorded and made available for other'srefferences*	*The ability to converse with humor sarcasm or deep thoughts and with the capacity to emote the desired emotion in the other is checked*	*Askthem to rapidlygivesynonyms and antonyms to thosewords*

Learning Resources	***Theory:*** 1. Horizon- English Text Book – Compiled and Edited by the Faculty of English Department, FSH, SRMIST, 2020 **2. *English Gramar in Use by Raymond Murphy***

Learning Assessment											
	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember Understand	30%	-	30%	-	30%	-	30%	-	30%	-
Level 2	Apply Analyze	30%	-	30%	-	30%	-	30%	-	30%	-
Level 3	Evaluate Create	40%	-	40%	-	40%	-	40%	-	40%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
	1. Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	*1. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST*
		2. Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

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Course Code	UCY20101J	Course Name	Inorganic Chemistry-I: Atomic Structure and Chemical Bonding	Course Category	C	Core course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

Learning

Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-1 :	*Exploit the periodic properties of elements for bulk property manipulation towards scientific advancement*																		
CLR-2 :	*Employ various theories towards the identification of structures and geometries of molecules*																		
CLR-3 :	*Address concepts related to lattice energy*																		
CLR-4 :	*Get knowledge on the metals, semiconductors and insulators and their conductivity behaviors*																		
CLR-5 :	*Employ the fundamental concepts in different types of chemical bonds.*																		
CLR-6 :	*Utilize the basic chemistry principles applied in various scientific problems and identify appropriate solutions*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*Utilize the knowledge in quantum mechanics and periodic properties*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Perceive the importance of structures and geometries of molecules using Radius Ratio Rules, VSEPRand MO theory*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Understand the concept of lattice energy using Born-Landé and Kapustinskii expression*	*2*	*70*	*65*	*H*	-	-		-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*rationalize the conductivity of metals, semiconductors and insulators based on the Band theory*	*2*	*70*	*70*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	-	-	*H*	*M*	-
CLO-5 :	*understand the importance and application of chemical bonds, weak chemical forces and their effects*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	*M*	*H*	*M*
CLO-6 :	*Utilize concepts in chemistry for scientific advancement based on atomic and molecular level modification*	*2*	*75*	*70*	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*	-

Duration (hour)		24	24	24	24	24
S-1	**SLO-1**	**Introduction to Atomic Structure**	Shapes of s and p orbitals	Electronegativity	Solvation energy.	I_3-andBrF_2^+
	SLO-2	**Introduction to Atomic Structure**	Shapes of d orbitals	Electronegativity	Solvation energy.	PCl_6^-
S-2	**SLO-1**	Recapitulation of Bohr's theory	Pauli's Exclusion Principle, Hund's rule of maximum multiplicity	Pauling's/ Allred Rochow's scales	**Introduction to** Covalent bond: Lewis structure	**ICl_4^-**
	SLO-2	limitations	Aufbau principle and its limitations	Pauling's/ Allred Rochow's scales	Valence Bond theory (Heitler-London approach)	**SO_4^{2-}**
S-3	**SLO-1**	atomic spectrum of hydrogen atom	Periodicity of Elements (with reference to s & p block and the trends shown)	Variation of electronegativity with bond order	Energetics of hybridization	Multiple bonding (s and π bond approach) and bond lengths.
	SLO-2	atomic spectrum of hydrogen atom	Effective nuclear charge	Variation of electronegativity with bond order	equivalent and non-equivalent hybrid orbitals	Multiple bonding (s and π bond approach) and bond lengths.
S-4	**SLO-1**	Wave mechanics: de Broglie equation	shielding or screening effect	partial charge	Bent's rule	Covalent character in ionic compounds

Duration (hour)		24	24	24	24	24
	SLO-2	Wave mechanics: de Broglie equation	shielding or screening effect	partial charge	Resonance and resonance energy	polarizing power and polarizability
S-5 toS-8	SLO-1	Lab Introduction	Acid-Base Titrations: Principles Estimation of sodium carbonate using standardized HCl	Estimation of free alkali present in different soaps/detergents	Estimation of Fe(II) with $K_2Cr_2O_7$ using internal indicator (diphenylamine, N-phenylanthranilic acid)	Experiment - Repeat – 2
	SLO-2					
S-9	SLO-1	Heisenberg's Uncertainty Principle	Slater rules	Hybridization	Introduction of Molecular orbitalTheory	Fajan's rules and consequences ofPolarization
	SLO-2	significance	Slater rules	Hybridization	Introduction of Molecular orbitalTheory	Fajan's rules and consequences ofPolarization
S-10	SLO-1	Schrödinger's wave equation	Variation of effective nuclearcharge in periodic table	group electronegativity.	Molecular orbital diagrams of diatomic and simple polyatomic molecules	Ionic character in covalent compounds
	SLO-2	Schrödinger's wave equation	Variation of effective nuclearcharge in periodic table	group electronegativity.	N_2, O_2 and their ions	Bond moment and dipole moment
S-11	SLO-1	Significance of ψ and $ψ^2$.	Atomic and ionic radii	**Introduction to**Ionic bond: General characteristics,	C_2 and its ions	Percentage ionic character fromdipole moment and electronegativity difference.
	SLO-2	Significance of ψ and $ψ^2$.	Atomic and ionic radii	types of ions, size effects, radius ratio rule and its limitations	$B_2$and its ions	Percentage ionic character fromdipole moment and electronegativity difference.
S-12	SLO-1	Quantum numbers and	Ionization enthalpy	Packing of ions in crystals	$F_2$and its ions	**Introduction to** Metallic Bond
	SLO-2	their significance	Ionization enthalpy	Packing of ions in crystals	CO and its ions	Qualitative idea of valence bond and band theories.
S-13 To S-16	SLO-1	Titrimetric Analysis: Calibration and use of apparatus	Estimation of carbonate and hydroxide present together in a mixture	Oxidation-Reduction Titrimetry : Principles Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution	Estimation of Fe(II) with $K_2Cr_2O_7$ using external indicator	Experiment - Repeat – 3
	SLO-2					
S-17	SLO-1	Normalized and orthogonal wave functions	Successive ionization enthalpies	Born-Landé equation with derivation	NO and its ions	Semiconductors and insulators
	SLO-2	Normalized and orthogonal wave functions	Successive ionization enthalpies	Born-Landé equation with derivation	HCl (idea of s-p mixing and orbital interaction to be given)	defects in solids.
S-18	SLO-1	Sign of wave functions	factors affecting ionization enthalpy	importance of Kapustinskii expression for lattice energy	Introduction to VSEPR Theory	Weak Chemical Forces: Van der Waals forces,
	SLO-2	Sign of wave functions	factors affecting ionization enthalpy	importance of Kapustinskii expression for lattice energy	Introduction to VSEPR Theory	ion-dipole forces, dipole-dipole interactions
S-19	SLO-1	Radial and angular wave functions forhydrogen atom	Ionization enthalpy trends in groups and periods	Madelung constant	Shapes of the following simplemolecules and ions containing lone pairs and bond pairs of electrons:	induced dipole interaction
	SLO-2	Radial and angular wave functions forhydrogen atom	Ionization enthalpy trends in groups and periods	Madelung constant	H_2O, NH_3 and PCl_3	Hydrogen bonding (theories of hydrogen bonding, valence bond treatment)
S-20	SLO-1	Radial and angular distribution curves	Electron gain enthalpy and	Born-Haber cycle and	PCl_5, and SF_6,	Effects of weak chemical forces, melting and boiling points,
	SLO-2	Radial and angular distribution curves	Trends in groups and periods.	Application	ClF_3	solubility, energetics of dissolution process
S-	SLO-1	Preparation of solutions of	Estimation of carbonate and	Estimation of oxalic acid and sodium	Experiment - Repeat – 1	Demonstration Practical Session

Duration (hour)		24	24	24	24	24
21toS-24	SLO-2	titrants of different Molarity/Normality.	bicarbonate present together in a mixture.	oxalate in a given mixture.		

Learning Resources	**Theory:** **1. Lee, J.D., Concise Inorganic Chemistry, Fifth Edn., Wiley India.** **2. Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K., Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education 2009.** **3. Douglas, B.E., McDaniel, D.H., Alexander, J.J., Concepts and Models of Inorganic Chemistry, 3rd Edn., John Wiley & Sons, Inc. 1993.** **4. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, and F.A. Armstrong, Shriver and Atkins' Inorganic Chemistry, 5th Edn,©2010, W. H. Freeman and Company, 41 Madison Avenue, New York, NY 10010 www.whfreeman.com.** **5. Miessler, Gary L., Fischer Paul J., Tarr, Donald A., Inorganic Chemistry, Fifth edition, Pearson, 2014.**	**Practicals:** **1. Jeffery, G.H., Bassett, J., Mendham, J., Denney, R.C.,Vogel's Textbook of Quantitative Chemical Analysis, 5th Edn., Longman Scientific & Technical, England, (John Wiley and Sons Inc, 605 Third Avenue, NewYork NY 10158)**

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr. SudarshanMahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Prof. M. Arthanareeswari, SRMIST
2. Dr. ShanmukhaprasadGopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in	2. Dr. S. Shanmugan, SRMIST

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Course Code	UCY20102T	Course Name	Physical Chemistry - I : States of Matter and Ionic Equilibrium	Course Category	C	Core course	L	T	P	C
							5	1	0	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
CLR-1 :	Understand states of matter and interchange of states, intermolecular interactions.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Understand the gaseous state in terms of ideal gas behavior.			
CLR-3:	Understand the matter at liquid state with its surface tension and viscosity.			
CLR-4:	Understand the concept of solid state and the symmetry in crystal system.			
CLR-5:	Understand state of equilibrium and the ionization factors.			
CLR-6:	Llearn the concept of pH, buffers, acids and bases indicators.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Explain the difference between solid, liquid and gases in terms of intermolecular interactions.	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Explain the van der Waal's equation and its derivation with the ideal gas behavior, at constant temperature, pressure and volume.	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Explain the concept of vapor pressure and the determination of refractive index.	2	70	70	H	-	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	Explain the ***Bravais lattices and***Bragg's law- it's determination.	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	-	H	M
CLO-5 :	Explain the degree of ionization, pH and electrolyte behavior.	2	75	65	-	-	H	-	-	-	-	-	-	-	-	-	-	H	M
CLO-6 :	Explain buffers and use them in different experiments.	2	75	65	H	-	-	-	-	-	-	-	-	-	-	-	-	H	M

Duration (hour)		18	18	18	18	18
S-1	SLO-1	*Gaseous state*	*Virial coefficients,*	*Refraction-*	*Analysis of powder diffraction patterns of CsCl*	***Buffer mixture of weak acid and its salts***
	SLO-2	*Laws of gaseous state-*	*Calculation of Boyle temperature.*	*Refractive index-determination*	*Analysis of powder diffraction patterns of KCl.*	***Calculation of pH of buffer mixtures-***
S-2	SLO-1	*Gas constant R in different units-*	*Isotherms of real gases*	*Specific and molar refraction*	*Crystal types- Molecular crystal,*	*Henderson equation*
	SLO-2	*Deviation from ideal behavior.*	*and their comparison with van der Waals isotherms,*	*Molar volume and chemical constitution*	*covalent, metallic and ionic*	***Buffer mixture of a weak base and its salt***
S-3	SLO-1	*Van der Waals equation for real gases*	*continuity of states,*	*Introduction to Solid state:*	*Imperfection in crystals-point defects*	*Hydrolysis of water- salts of strong acid and strong base*
	SLO-2	*Van der Waals equation for real gases- its derivation*	*Critical state,*	*Nature of the solid state,*	*Schottky and Frenkel defects*	*salts of weak acid and strong base - strong acid and weak base- weak acid and weak base*
S-4	SLO-1	*and its application in explaining real gas behavior*	*Critical pressure*	*Difference between crystalline*	*Line defects,*	*Hydrolysis constant*

Duration (hour)		18	18	18	18	18
	SLO-2	*its application in explaining real gas behavior*	*Determination of critical temperature and pressure*	*And amorphous solids*	*Edge dislocations*	*Relation between K_h, Ka and K_w*
S-5	SLO-1	*Critical phenomenon,*	*relation between critical constants and van der Waals constants,*	*law of constancy of interfacial angles*	*Introduction to ionic equilibria-*	*Degree of hydrolysis- pH of the hydrolyzed salt solutions*
	SLO-2	*PV isotherm of real gases*	*law of corresponding states.*	*7Symmetry in crystal systems-*	*Strong electrolyte*	*Determination of degree of hydrolysis- Indirect method*
S-6	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Electrical conductance method*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Freezing point depression*
S-7	SLO-1	*PV isotherm of real gases* ***including their temperature dependence***	*Liquefaction of gases*	*Plane of symmetry-axis of symmetry and*	*Moderate and weak electrolyte*	*Distribution law*
	SLO-2	*PV isotherm of real gases* ***including their pressure dependence,***	*Joule-Thomson effect*	*Center of symmetry*	*Degree of Ionization,*	*Calculation of hydrolysis constant*
S-8	SLO-1	*Critical temperature*	*Adiabatic expansion-*	*Elements of symmetry,*	*Factors affecting degree of Ionization*	*Concept of solubility product-relation between Ksp and*
	SLO-2	*Critical volume*	*Involving mechanical work*	*Rectangular and diagonal plane of symmetry,*	*Ionization constant*	*molar solubility of sparingly soluble salts*
S-9	SLO-1	*Maxwell distribution law —*	*Introduction to Liquid state:*	*Axis of 2,3,4 fold symmetry*	*Ionization of weak acid and bases*	*Applications of solubility product principle-*
	SLO-2	*Molecular velocities-*	*Physical properties of liquids-*	*Points and*	*Arrhenius and*	*Determination of solubilities of sparingly soluble salts,*
S-10	SLO-1	*root mean square, average and most probable velocities.*	*Vapor pressure and*	*space groups*	*Bronsted-Lowry concept*	*Predicting precipitation reactions*
	SLO-2	*collision number and mean free path*	*Vapor pressure measurements*	*Space lattices and unit cells*	*Conjugate acids and bases*	***Precipitation of soluble salts***
S-11	SLO-1	*Collision diameter (σ).*	*Heat of vaporization-Trouton's rule*	*Bravais lattices*	*Relative strengths of acids-base pairs*	*Tutorial Session*
	SLO-2	*relation between mean free path and coefficient of viscosity (η),*	*Surface tension-*	*Seven crystal systems*	*Influence of solvents on acid and base strengths*	*Tutorial Session*
S-12	SLO-1	*Tutorial Session*	*Effect of surface tension-Pressure and*	*Law of rational indices,*	*Lewis concept,*	*Ionic equilibria involving complex ions*
	SLO-2	*Tutorial Session*	*Temperature-Effect of addition of various solutes on surface tension.*	*Miller indices,*	*Dissociation of weak acids and bases*	*Theory of acid-base indicators*
S-13	SLO-1	*calculation of σ from η;*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*law of equipartition of energy,*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S-14	SLO-1	*degrees of freedom*	*Measurement of surface tension*	*Lattice energy of ionic crystal*	*Ionic product of water*	*Action of phenolphthalein and*
	SLO-2	*and molecular basis of heat capacities.*	*Interfacial tension and surface active agents*	*Lattice energy of ionic crystal*	*pH scale and*	*Methyl orange.*
S-15	SLO-1	*Behavior of real gases:*	*Viscosity-*	*X-ray diffraction,*	*other pH logarithmic expressions*	*Acid-base titrations and*
	SLO-2	*Deviations from ideal gas behavior,*	*Non-Newtonian liquids*	*Bragg's law and*	*Common-ion effect.*	*Selection of indicators.*

Duration (hour)		18	18	18	18	18
S-16	SLO-1	*compressibility factor, Z,*	*Measurement of viscosity*	*Its derivation.*	*Mixture of weak acids and salts*	*Titrations of Strong acid vs. strong base,*
	SLO-2	*and its variation with pressure and temperature for different gases.*	*Effects of viscosity-Temperature, pressure-Reynolds number*	*Experimental methods-*	*Buffer solutions-buffer capacity,*	*Weak acid vs. strong base*
S-17	SLO-1	*Causes of deviation from ideal behavior.*	*Temperature variation of viscosity of liquids*	*a simple account of rotating crystal method and powder pattern method*	*Buffer index.*	***Titration of weak base with strong acids.***
	SLO-2	*Equation of states for real gases;*	*and comparison with that of gases.*	*Analysis of powder diffraction patterns of NaCl,*	*Salt hydrolysis-salts of strong acids*	***Limitations of indicators***
S-18	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*

Learning Resources	**Theory:** 1. **Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 10th Ed ,2014.** 2. **Castellan, G. W. Physical Chemistry 4th Ed. Narosa 2004.** 3. **Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP 2009.** 4. **Thomas Engel & Philip Reid Physical Chemistry Pearson Education 3rd Ed, 2013.**

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40%	-	35%	-	30%	-	30%	-	30%	-
Level 2	Apply Analyze	40%	-	40%	-	40%	-	40%	-	40%	-
Level 3	Evaluate Create	20%	-	25%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Dr. S.Ashok Kumar , SRMIST
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in	2. Dr. J. Arockia Selvi, SRMIST

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Course Code	UMA20A01T	Course Name	Allied Mathematics-I	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	MATHEMATICS	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Understand the concept of sets, relations and functions	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	Gain knowledge on the basics of logic																		
CLR-3 :	Obtain the knowledge on polynomial equations																		
CLR-4 :	gain knowledge on Matrices and its applications																		
CLR-5 :	comprehend the working principle of various calculus techniques																		
CLR-6 :	Understand various Mathematical evaluation procedure																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Acquire the knowledge on sets and functions	3	80	85	M	H	-	-		-	-	-	-	-	-	H	-	-	-
CLO-2 :	Gain the ability to identify science and engineering problems logically	1	75	80	M	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Understand the basic ideas about polynomial equations	3	85	80	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Appreciate the concepts of Matrices in real life situations	3	80	75	M	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Apply the knowledge of different calculus techniques	1	75	85	M	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	obtain the knowledge on Mathematical evaluation method	3	80	85	M	-	-	-	-	-	-	-	-	-	-	H	-	-	-

Duration (Hour)		Module 1 (9)	Module 2 (9)	Module 3 (9)	Module 4 (9)	Module 5 (9)
S-1	SLO-1	Sets - sets definition and representation of sets	Statements	Polynomial equations	Symmetric matrices,	Introduction to calculus
	SLO-2	**Examples for sets and representations**	**Examples for statements**	**Examples for** Polynomial equations	**Skew symmetric matrices**	**Differential calculus -Introduction**
S-2	SLO-1	Types of sets, operation on sets, Venn diagram	connectives, conjunction	Irrational roots	Hermitian, skew Hermitian matrices	**Maxima and minima-Introduction**
	SLO-2	**Examples for types of sets and operations on sets**	**Examples for** connectives, conjunction	**Problems on irrational roots**	**Examples for different types of matrices**	Simple problems on maxima and minima of functions of single variable
S-3	SLO-1	Relation - Types of Relation	Disjunction, negation	complex roots(up to third order equations only)	Orthogonal, Unitary matrices	**More problems on maxima and minima**
	SLO-2	**Examples for types of relation**	Examples for Disjunction, negation	**Problems on equations with complex roots**	**Examples for** Orthogonal, Unitary matrices	**More problems on maxima and minima**
S-4	SLO-1	Equivalence Relation	**Tautology, Contradiction**	Reciprocal equations	Cayley Hamilton Theorem	**More problems on maxima and minima**

Duration (Hour)		Module 1 (9)	Module 2 (9)	Module 3 (9)	Module 4 (9)	Module 5 (9)
	SLO-2	**Examples and problems on equivalence relation**	**Problems on** tautology, contradiction	**Problems on reciprocal equation**	**Problems on** Cayley Hamilton Theorem	Radius of curvature – Introduction
S-5	SLO-1	Function - Introduction	logical equivalence	Approximation of roots of a polynomial equation	**Problems on** Cayley Hamilton Theorem	**Problems on** Radius of curvature- Cartesian co – ordinate
	SLO-2	Types of functions	**Examples for** logical equivalence	Newton's Method-Introduction	Eigen values– Eigen vectors	**Problems on** Radius of curvature
S-6	SLO-1	**Problems for different functions**	tautological implications	**Newton's method- Finding positive roots**	**Problems on** Eigen values– Eigen vectors	**More problèmes on radius of curvature**
	SLO-2	Composite of two functions	**Examples for** tautological implications	**More problems Newton's method- Finding positive roots**	**Problems on** Eigen values– Eigen vectors	Partial differentiation
S-7	SLO-1	**Examples for composite functions**	arguments , Validity of arguments	**Problems on Newton's method- Finding reciprocal of a given number**	**Problems on** Eigen values– Eigen vectors	Problems on partial differentiation
	SLO-2	Composite of three functions	Normal forms	**Problems on Newton's method- Finding Square root of a given number**	**Problems on** Eigen values– Eigen vectors	More problems on partial diferentiation
S-8	SLO-1	**Examples for composite of three functions**	Principal disjunctive normal form	Horner's method- Introduction	Cramer's rule-Introduction	Euler's theorem- Introduction
	SLO-2	Problems on functions	**Problems for pdnf**	Horner's method Finding positive roots	Solving system of linear equations- Crammer's rule	Problems on Euler's theorem
S-9	SLO-1	Problems on composite of two functions	Principle conjunctive normal form	Problems on Horner's method- finding roots between given values	Problems on Crammer's rule	More Problems on Euler's theorem
	SLO-2	Problems on composite of three functions	Problems for pcnf	More Problems on Horner's method	More Problems on Crammer's ruLe	More Problems on Euler's theorem

Learning Resources	1. T. Veerarajan, Discrete Mathematics, 7th Edition, Tata-Mcgraw hill, New Delhi, 2006. 2. A. Singaravelu, ALLIED MATHEMATICS, 3rd Edition, Meenakshi Agency, Chennai, 2011. 3. P. R. Vittal, Allied Mathematics, 4th Edition Reprint, Margham Publications, Chennai, 2013. 4. S.G. Venkatachalapathy, Allied Mathematics, 1st Edition Reprint, Margham Publications, Chennai, 2007.

Learning Assessment											
	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40 %	-	30 %	-	30 %	-	30 %	-	30 %	-
Level 2	Apply Analyze	40 %	-	40 %	-	40 %	-	40 %	-	40 %	-
Level 3	Evaluate Create	20 %	-	30 %	-	30 %	-	30 %	-	30 %	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, **IIT Madras,** sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMISTProf. K.S. Ganapathy Subramanian, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Dr. N. Balaji, SRMISTDr. P. Sampath, SRMIST

Course Code	UCY20A01T	Course Name	Biochemistry-I	Course Category	G	Generic Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	***Chemistry***	**Data Book / Codes/Standards**		***Nil***	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

CLR-1 :	Enumerate the molecular motif of a living cell, structural and functional hierarchy of biomolecules
CLR-2 :	Gain knowledge about chemistry of amino acids, peptides and methods to synthesise them
CLR-3 :	Learn about proteins, their structural features and techniques used for purifying them.
CLR-4:	Discern about different types of lipids and their importance in metabolism
CLR-5 :	Learn the importance on the various aspects of metabolism and interrelationship of metabolic events

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	**Learning**			**Program Learning Outcomes (PLO)**													
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Students will able to have basic knowledge about the chemistry of metabolism happening in the living cell	2	70	65	H	-	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	Students will gain insight about amino acids and techniques used to synthesize peptides	2	80	70	H	-	-	H	H	-	-	-	-	-	-	-	-	-	-
CLO- 3:	Ability to understand the influence of amino acid sequence on the protein structure	2	70	70	H	-	-	H	H	-	-	-	-	-	-	-	H	-	-
CLO- 4:	Explain the role of different types of lipids in cellular metabolism	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	-	H	M
CLO- 5:	Understand the chemical concepts involved in the synthesis, degradation separation and purification techniques of biomolecules and apply them appropriately.	2	75	65	-	-	H	-	-	-	-	-	-	-	-	-	-	H	M

Duration (hour)		**9**	**9**	**9**	**9**	**9**
S-1	**SLO-1**	**Living Cell -** Plant cell.	Amino acids – classification	**Proteins** - classification	**Lipids -** Classification	**Metabolism of amino acids and lipids -** The urea cycle
	SLO-2	**Living Cell** – Plant cell.	Amino acids – classification	**Proteins** - classification	**Lipids -** Classification	**Metabolism of amino acids and lipids -** The urea cycle
S-2	**SLO-1**	**Living Cell** - Animal cell.	Amino acids – classification	**Proteins** - classification	neutral lipids, phospho lipids and glycolipids	**Metabolism of amino acids and lipids -** The urea cycle
	SLO-2	**Living Cell** - Animal cell.	Amino acids – classification	**Proteins** - classification	neutral lipids, phospho lipids and glycolipids	**Metabolism of amino acids and lipids -** The urea cycle
S-3	**SLO-1**	Cell membrane	synthesis of amino acids	**Proteins** - properties	neutral lipids, phospho lipids and glycolipids	**Metabolism of amino acids and lipids -** The urea cycle
	SLO-2	Cell membrane	synthesis of amino acids	**Proteins** - properties	neutral lipids, phospho lipids and glycolipids	**Metabolism of amino acids and lipids -** The urea cycle
S-4	**SLO-1**	Cell Organelles	Identification of amino acids	**Proteins** - properties	Importance- synthesis and degradation	Cholesterol biosynthesis
	SLO-2	Cell Organelles	Identification of amino acids	**Proteins** - properties	Importance- synthesis and degradation	Cholesterol biosynthesis
S-5	**SLO-1**	functions of major cellular components	Identification of amino acids	Determination of amino acid sequence	Importance- synthesis and degradation	Cholesterol biosynthesis
	SLO-2	functions of major cellular components	Identification of amino acids	Determination of amino acid sequence	Importance- synthesis and degradation	Cholesterol biosynthesis

Duration (hour)		9	9	9	9	9
S-6	SLO-1	functions of sub cellular components	Peptide bond- stereochemistry	Determination of amino acid sequence	Importance- synthesis and degradation	Cholesterol biosynthesis
	SLO-2	functions of sub cellular components	Peptide bond- stereochemistry	Determination of amino acid sequence	Fatty acids	Cholesterol biosynthesis
S-7	SLO-1	Metabolism	synthesis of peptides by solution and solid phase techniques	Denaturation and renaturation of protein molecules	saturated fatty acids	Biosynthesis of lipids - synthesis of fatty acids
	SLO-2	Metabolism	synthesis of peptides by solution and solid phase techniques	Denaturation and renaturation of protein molecules	saturated fatty acids	Biosynthesis of lipids - synthesis of fatty acids
S-8	SLO-1	Anabolism and their relation to metabolism.	synthesis of peptides by solution and solid phase techniques	Separation and purification of proteins - dialysis	unsaturated fatty acids	Biosynthesis of lipids - synthesis of fatty acids
	SLO-2	Anabolism and their relation to metabolism.	synthesis of peptides by solution and solid phase techniques	gel filtration	unsaturated fatty acids	Biosynthesis of lipids - synthesis of fatty acids
S-9	SLO-1	catabolism and their relation to metabolism	synthesis of peptides by solution and solid phase techniques	Electrophoresis	EFA.	Biosynthesis of lipids - synthesis of fatty acids
	SLO-2	catabolism and their relation to metabolism	synthesis of peptides by solution and solid phase techniques	Electrophoresis	EFA	Biosynthesis of lipids - synthesis of fatty acids

Learning Resources	
1. David L. Nelson and Michael M. Cox Lehninger, *Principles of Biochemistry*, Worth Publishers, 4th edition,New York, 2005. 2. L. Veerakumari, *Biochemistry*, MJP publishers, Chennai, 2004.	3. J. L. Jain, *Biochemistry*, Sultan Chand and Co, 1999. 4. U.Sathyanarayana, Biochemistry, Elsevier, 5th edition,2010.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. M.R. Ganesh , SRMIST*

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Course Code	UCY20S01T	Course Name	IT Skills for Chemists	Course Category	S	Skill Enhancement Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*To make the students of chemistry familiar with the working of computer, programming Language and QBASIC*			
CLR-2 :	*To use software as a tool to understand chemistry*			
CLR-3 :	*To solve chemistry basedProblems using computer languages*			
CLR-4:	*To impart knowledge about the statistical treatment using computer language*			
CLR-5:	*To develop the skill of computer programming*			
CLR-6:	*To create simple programs using computer knowledge*			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Develop algorithm to solve problems and write corresponding programs in BASIC*	*2*	*70*	*65*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	*H*	*H*	-
CLO-2 :	*Write BASIC programs for performing calculations involved in laboratory experiments and research work.*	*2*	*80*	*70*	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Use various spreadsheet software to perform calculations and plot graphs.*	*2*	*75*	*60*	-	*H*	-		-	-	-	-	-	-	-	-	-	*H*	*M*
CLO-4 :	*Execute various computer programs using various operations*																	*H*	*M*
CLO-5 :	*Perform* BASIC/FORTRAN programs for curve fitting																*H*	*H*	*H*
CLO-6:	*Create programs using computer languages*				*H*													*H*	

Duration (hour)		6	6	6	6	6
S-1	**SLO-1**	Fundamentals- mathematical functions	Types ofuncertainties	Roots ofquadratic equations analytically	numerical differentiation	Hierarchy ofoperations
	SLO-2	Polynomial expressions	Combining uncertainties	Example:pH of a weak acid	change in pressure for small change in volume of a van der Waals gas	Inbuilt functions
S-2	**SLO-1**	Llogarithms	Statistical treatment	Roots ofquadratic equations iteratively	Numerical integration-	Elements of the BASIC language
	SLO-2	The exponentialfunction	Mean, standard deviation	*Examples*	Trapezoidal and Simpson's rule	BASIC keywords and commands
S-3	**SLO-1**	Units of a measurement	Relative error	Numerical methods offinding roots	entropy changefrom heat capacity data	Logical and relative operators
	SLO-2	Inter-conversion of units	Data reduction and the propagation of errors	Newton-Raphson method	enthalpy changefrom heat capacity data	Strings and graphics
S-4	**SLO-1**	Constants and variables	Graphical data reduction	binary –bisection method	Computer programming-	Compiled versus interpreted languages
	SLO-2	Equation of astraight line	Numerical data reduction	Apply on pH of a weak acid	Constants and variables	Debugging.

Duration (hour)		6	6	6	6	6
S-5	SLO-1	Plotting graphs	Numerical curve fitting-	Apply on volume of a van der Waals gas	Bits ands bytes	Simple programs using these concepts
	SLO-2	Uncertainty in experimental techniques	The method of least squares (regression)	Apply on equilibrium constant expressions	Binary formats	Matrix addition and multiplication
S-6	SLO-1	Displaying uncertainties	Algebraic operations on realscalar variables	Differential calculus-	ASCII formats	BASIC/FORTRAN programs for curve fitting
	SLO-2	Uncertainty in measurement	Manipulation of van der Waals equation in different forms	The tangent line and the derivative of a function	Arithmetic expressions	Simple programs using these concepts

Learning Resources	1. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books, 2008. 2. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier 2005.	3. Yates, P. Chemical calculations. 2nd Ed. CRC Press 2007. 4. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman Chapters 3-5, 2007

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Dr. T.Pushpa Malini , SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories,shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. S.Rajeswari , SRMIST*

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Course Code	UCY20S02T	Course Name	Fuel Chemistry	Course Category	S	Skill Enhancement Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Demonstrate broad knowledge of Fuel chemistry			
CLR-2 :	Impart the basic knowledge about the types and characteristics of fuels			
CLR-3 :	*Impart the knowledge about composition and uses of fuels*			
CLR-4	Develop skills in the analysis of coal and coal based chemicals			
CLR-5	Develop competence in the analysis of various physico-chemical properties of fuels			
CLR-6	*limpart knowledge about* Petroleum and Petrochemical products			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Students will gain insight about renewable and non-renewable energy resourses	2	70	65	H	-	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*Understand various categories of fuels and their characteristics*	2	80	70	H	-	-	H	H	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Attain knowledge about composition and uses of fuels*	2	80	70	H	-	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-4	*Demonstrate the gasifaction and liquefaction of coal*	2	75	60	-	H	-		-	-	-	-	-	-	-	-	-	-	-
CLO-5	*Explain the classification and applications of petroleum and petrochemical products*	2	75	60	H	-	-	M	-	H	-	-	-	-	-	-	H	H	-
CLO-6	*Perceive the importance of fuels in future*	2	75	60	-	-	-	-	-	H	-	-	-	-	-	-	-	H	-

Duration (hour)		6	6	6	6	6
S-1	**SLO-1**	Review of energy sources- renewable	Manufactured Solid Fuels and their Characteristics	Blast Furnace Gas	carbonization of coal	Petroleum and Petrochemical Industry: Composition of crude petroleum
	SLO-2	non-renewable	Charcoal	Water Gas	Fractionation of coal tar	Classification of crude Petroleum
S-2	**SLO-1**	Classification of fuels- Solid fuels	Briquettes	Producer Gas	Uses of coal tar based chemicals	Paraffinic Base Type Crude Petroleum
	SLO-2	Liquid fuels	Bagasses	Oil Gas	Uses of coal tar based chemicals	Asphalitc Base Type Crude Petroleum
S-3	**SLO-1**	Gaseous fuels	Manufactured Liquid Fuels and their Characteristics	Composition of gaseous Fuels	Requisites of a good metallurgical coke	Mixed Base Type Crude Petroleum
	SLO-2	Natural and Synthetic fuels	Gasoline or Petrol	Uses of gaseous Fuels	Requisites of a good metallurgical coke	Petroleum products
S-4	**SLO-1**	calorific value of fuels-Introduction	Diesel Fuel	Uses of coal in various industries – Fuel	Coal gasification- Hydrogasification	Applications of various Petroleum products
	SLO-2	calorific value of fuels-Explanation	Kerosene Oil	Uses of coal in various industries -Non Fuel	Catalytic gasification	Cracking - Thermal cracking

Duration (hour)		6	6	6	6	6
S-5	SLO-1	Calorific value of wood	Heavy Oil	Composition of coal	Coal liquefaction – General idea	catalytic cracking
	SLO-2	Characteristics of Flame	Gaseous Fuels and their Characteristics	Characteristics of coal	Coal liquefaction – Process explanation	Petrochemicals ; Vinyl acetate
S-6	SLO-1	Combustion Characteristics	Natural Gas	Analysis of Coal- Proximate Analysis of Coal	Solvent Refining-	Propylene oxide, Isoprene
	SLO-2	Ignition Temperature	Coal Gas	The Ultimate Analysis of Coal	Solvent Refining methods	Butadiene, Toluene and its derivatives Xylene

Learning Resources	1. Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK,1990 2. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK, 1990 3. Richard A. Dave, IP, Modern Petroleum Technology,Vol 1, Upstream,Ed. 6th ed., John Wiley & Sons. Ltd, 2000	4. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi, 2015 5. B.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut, 2000

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Dr. T.Pushpa Malini , SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. S.Rajeswari , SRMIST*

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Course Code	UCD20S01L	Course Name	Soft Skills	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards		-	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Expose students to right attitudinal and behavioral aspects and to build the same through activities	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Develop and nurture interpersonal skills of the students through individual and group activities.			
CLR-3 :	Increaseefficiency and leadership skills and to improve team results.			
CLR-4 :	Acquire time management skills and develop creative skills			
CLR-5 :	Understand intercultural communication and etiquettes required in a professional environment			
CLR-6 :	Instill confidence in students and develop skills necessary to face the challenges of competitive exams and placements			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	Re-engineer their attitude and understand its influence on behavior	3	80	70	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-2 :	Acquire inter personal skills and be an effective goal oriented team player	3	80	70	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-3 :	Understand the importance of time management and creativity	3	85	75	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-4 :	Build confidence during any presentation	3	85	75	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-5 :	Develop interpretation skills and intercultural communication	3	85	75	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H
CLO-6 :	Help the students succeed in competitive exams and placements	3	80	70	M	M	M	-	M	H	M	-	-	H	H	H	M	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	IKIGAI	Interpersonal Skills	Creating brands – activity (posters, flyers, business cards)	Value of Time	Intercultural communication – beliefs, customs and attitude of people in different countries (US, UK, Japan, West Asia, China, Russia)
	SLO-2	IKIGAI	Emotional Intelligence	Creating brands – activity (posters, flyers, business cards)	Diagnosing Time Management	Social and cultural etiquettes
S-2	SLO-1	Attitude	Importance of Team Work	Causes of Stress and Its Impact	Weekly Planner, To do list, Prioritizing work	Communication etiquettes
	SLO-2	Factors influencing Attitude	Team Building Activity	How to Manage Stress and Distress?	Time management activity	Telephone etiquettes
S-3	SLO-1	SWOT Analysis	Leadership skills	Understanding the Circle of Control	Creativity – think out of the box	Dinning etiquettes
	SLO-2	Individual SWOT Analysis – activity	Leadership skills based Activity	Stress Busters	Creativity Activity	Grooming etiquettes

Duration (hour)		6	6	6	6	6
S-4	SLO-1	*Extempore Practice Session*	*Networking skills*	*Conflicts in Human Relations – reasons*	*Creativity Assessment Activity*	*Ice breaking*
	SLO-2	*Extempore Practice Session*	*Networking skills based Activity*	*Approaches to conflict resolution*	*Creativity Assessment Activity*	*Designing ice breaker games*
S-5	SLO-1	*Extempore Practice Session*	*Negotiation skills*	*Conflict resolution – case studies*	*Brainstorming, use of groups and individual brainstorming techniques to promote idea generation*	*Ice breaker activity*
	SLO-2	*Extempore Practice Session*	*Negotiation skills based Activity*	*Conflict resolution – case studies*	*Brainstorming session activities*	*Ice breaker activity*
S-6	SLO-1	*Extempore Practice Session*	*Entrepreneurial Skills*	*Importance and necessity of Decision Making*	*Brainstorming session*	*Introduction to resume building*
	SLO-2	*Extempore Practice Session*	*Entrepreneurial knowledge, Focus, Investment, Risk tolerance, Resilience, Negotiation, Ethics, Networking*	*Process of Decision Making, Practical Way of Decision Making, Weighing Positives and Negatives*	*Brainstorming session*	*Introduction to resume building*

Learning Resources	
1. *Jeff Butterfield, Soft Skills for Everyone,CENGAGE, India,2015* 2. *Dr. K. Alex, Soft Skills, S.Chand Publishing & Company, India, 2014* 3. *Covey Sean, Seven habits of highly effective teens, Simon & Schuster, New York, 2014*	4. *Carnegie Dale, How to win friends and influence people, Simon and Schuster, New York, 2016* 5. *Thomas A Harris, I am ok, you are ok, Arrow, London, 2012* 6. *Daniel Coleman , Emotional Intelligence , Bloomsbury, India, 2016*

Learning Assessment

Level	Bloom'sLevel of Thinking	Continuous Learning Assessment (100% weightage)			
		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (30%) #	CLA-4 (30%)##
		Practice	Practice	Practice	Practice
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

CLA-1, CLA-2and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ajay Zener, Director, Career Launcher	-	*1. Mr Priyanand, Assistant Professor, CDC, E&T, SRMIST* *2. Ms Sindhu Thomas, Head in charge, CDC, FSH, SRMIST* *3. Ms Mahalakshmi, Assistant Professor, CDC, FSH, SRMIST*

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SEMESTER II

Course Code	ULT20G02J	Course Name	Tamil-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Tamil*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLR-1 :	*To generate in students a sensitivity to gender marginalization and Eco sensitivity.*																		
CLR-2 :	*An evolved consciousness in the minds to accommodate all is developed*																		
CLR-3 :	*The ability to accept all and to co- exist is initiated*																		
CLR-4 :	*To create community connectivity and interdependence is initiated*																		
CLR-5 :	*To instill language skills*																		
CLR-6 :	*To give them all the historical insights*																		
CLO-1 :	*To acquire knowledge about Tamil Language*	*2*	*75*	*60*	*H*	*H*	*H*	*-*	*-*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of Tamil*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*H*	*H*	*H*	*-*	*-*	*H*	*H*	*H*	*H*	*H*	*H*
CLO-3 :	*To develop content using the features in Tamil language*	*2*	*70*	*65*	*H*	*-*	*-*	*H*	*-*	*H*	*H*	*H*	*-*	*H*	*H*	*H*	*H*	*H*	*H*
CLO-4 :	*To use Tamil Language and Literature to enhance their creativity*	*2*	*70*	*70*	*H*	*-*	*H*	*M*	*H*	*-*	*-*	*-*	*H*	*H*	*H*	*H*	*H*	*H*	*H*
CLO-5 :	*To improve communication and creative expression in Tamil language*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*H*	*H*	*-*	*-*	*H*	*H*	*H*	*H*	*H*	*H*
CLO-6 :	To enable the students to speak and write in chaste Tamil	*2*	*75*	*70*	*H*	*H*	*H*	*H-*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*

Duration (hour)		12	12	12	12	12
S-1	SLO-1	□ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
	SLO-2	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
S-2	SLO-1	□ □	□ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
	SLO-2	□ □	□ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
S-3	SLO-1	□ □	□ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
	SLO-2	□ □	□ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

Duration (hour)		12	12	12	12	12
S-4	SLO-1	(130)		–		–
	SLO-2		(104)	–		–
S-5	SLO-1					-
	SLO-2					
S-6	SLO-1	(44)				–
	SLO-2		(221)			
S-7	SLO-1					
	SLO-2					
S-8	SLO-1	(149)				
	SLO-2					,
S-9	SLO-1					
	SLO-2					–
S-10	SLO-1	(235)	(14)			
	SLO-2			(5)		
S-11	SLO-1				–	
	SLO-2				–	
S-12	SLO-1		(14)		–	
	SLO-2					

Learning Resources	1. , - , , **603203, 2020.** 2. , , , 2017 3. , , (9 . 16), , 2005

	4. □□□□□□□□□□□□□□□□□□□ -http://www.tamilvu.org/ 5. □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□ -https://www.projectmadurai.org/

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	30%	30%	30%	30%	30%	30%	30%	30%	30%	-
Level 2	Apply Analyze	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
Level 3	Evaluate Create	30%	30%	20%	20%	20%	20%	20%	20%	20%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. R..Srinivasan, Associate Professor, Department of Tamil, Presidency College, Chennai.	*1. B.Jaiganesh, Assistant Professor & Head, FSH, SRMIST*
		2. T.R.Hebzibah Beulah Suganthi, Assistant Professor, FSH, SRMIST
		3.S.Saraswathy, Assistant Professor, FSH, SRMIST

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Course Code	ULH20G02J	Course Name	Hindi-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*HINDI*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
CLR-1 :	*To be able to converse well in the Hindi Language*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*To read and write and clarity*			
CLR-3 :	*To be willing listeners and translators –where need be*			
CLR-4 :	*To acquire the values/thought contents of the writers and practice in it in life.*			
CLR-5 :	*To find motivation through the various forms of literature and learn to overcome any challenges of life.*			
CLR-6 :	*To discover the importance of the language in making education as a means of growth in life and not mere literacy.*			

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

		Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	*To acquire knowledge about Medieval and Modern Poetry.*	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To consider the relevance of the present trends in Hindi and their contemporary relevance.*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*To help develop better understanding of the Hindi language by studying the stories with reference to current reality.*	2	70	65	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*To understand the usage of the present Advertising trends and its creative angles with the varied skills of Hindi Language.*	2	70	70	H	-	H	H	H	-	-	-	-	-	H	-	-	-	-
CLO-5 :	*To make translation of good literature and any relevant document from the Hindi Language to English and Vice-versa.*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*To help the learner to tackle Administrative terminologies, help them use Idioms and Phrases in their daily life, with ease.*	2	75	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	**SLO-1**	Kavye ke guno se awagat karana – Jaysi	Kahani Idkiyan	VIGYAPAN	ANUVAD	Takniki Shabdavali
	SLO-2	Ishk hakiki evam moksh bhava se awagat karana	Nari Shakti ki sarthakata	Srijnatamak kshmata jagrit karna	Vidhyarthiyon ko sikhaya jayega anuvad kitna upyogi hai	Vaignik tarike se bhashaon ka avishkaar karna
S-2	**SLO-1**	Surdas – Vatsalya ras se awagat karana	Kahani gunda Prem ki prakashtha se awagat karvana	VIGYAPAN KYA HAI	ARTH	ARTH
	SLO-2	Bhakti Bhavna se vidhyarthiyon ko jodna	Prtantr bharat ki samajik vyavstha se awagat karvana	Shabdavali evam chitratamakta se awagat karvana	Vidhyarthiyon dwara arth smajkar samaj ke liye mahtavpurn karya kar payenge	Vidhyarthi uske arth dwara hi uske mahtav smjhenge
S-3	**SLO-1**	Tulsidas-Manav mulyon ki prabal bhavna jagrit karna	KAHANI KE TATVA	VIGYAPAN KI BHASHA	PARIBHASHA	PARIBHASHA
	SLO-2	Dharmik Parvarti se awagat karana	Kahani ke tatva ki mahatta se awagat	Bhasha ki abhivyakti ke pryog ko	Vibhinn vidwano dwara di gai	Vibhinn vidwano dwara di gai

Duration (hour)		12	12	12	12	12
			karvana	smjhana	paribhasha se us baat ko smjhenge vidhyathi	aribhasha se us baat ko smjhenge idhyathi
S-4	SLO-1	Tiruvaluvaar – naitik mulyon ko jagrit karna	KAHANI KE AAYAM	VIGYAPAN KA PRBHAV	MAHATVA	SHABDAVALI KI AVSHYAKTA
	SLO-2	Vidhyarthiyon ko nitivaan bnana	Vidhyarthiyon ko kahani ke vidhinn ayam se awagat karvana	Shravaya-drishya samgri ke prbhav ki upyogita	Samijik jan-jeevan ke liye anuvad ke mahtav ko smjhana.	Vaignikon ka awiskar kitna mahtavpurn
S-5	SLO-1	Desh prem ki bhavna bharna	LEKHAK PARICHAY	VIGYAPAN AUR BAZAR	UDDESHYA	BHASHA VAIGYANIK
	SLO-2	Krantikari vicharon se Awagat karana	Lekhako ke jivan se awagat karvana	Vidhyarthioyon ko vigyapan se bazar me kaise sthapit kiya ja skata hai batana	Vidhyarthi anuvad ke uddeshya ko smajhkar samaj upyogi karya krne me apni sarthak bhumika nibhayenge	Bhasha vaignikon ki jankari
S-6	SLO-1	Badal Raag- Desh prem ki bhavna bhrna	KAHANI PATH	VIGYAPAN AUR ROZGAR	HINDI-ENGLISH	KARYALYIN SHABD
	SLO-2	Krantikari vicharo se awagat karana	Vidhyarthiyon ko kahani path ke dwara unka vak kausal majbut karna	Vidhyarthi savam ka ad-ajency bhi bna paye	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna	Shabd kaise tayar kiye jate hain idhyorthiyon ko jankari
S-7	SLO-1	Pret ka Byaan -Bhukhmari evam akaal se awagat karana	KAHANI KA SARANSH	VIGYAPAN KI NIYAM	ENGLISH-HINDI	ANGREZI SE HINDI ANUVAD
	SLO-2	Samajik samanta banaye rkhne ki pravarti jagana	Lekhan kshmata ka vikas hona	Vigyapan ka ek hi niyam bhasha ka kashav jo vidhyarthiyon me viksit kiya jayega	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna	Hindi adhikarai aur anuvadak ke pad ke liye tayaar karna
S-8	SLO-1	Lahro se dark a nauka paar nhi hoti – chatro ko sahashi bnana	KAHANI KA UDDESHYA	VIGYAPAN KA MAHTVA	ANUVAD KI UPYOGITA	HINDI SE ANGREZI ANUVAD
	SLO-2	Karmaththa purn bhavna ko jagrit karna	Kahani ke uddeshy unke jiwan ke mahtav ko smjhne me sahayk banna	Vartman me uski prasangikta vidhyarthiyon ko smjhana	Vidhyarthiyon ko vibhin karyalayon me hindi adhikari pad ki jankari prapt	Hindi adhikari aur anuvadak ke pad ke liye tayaar karna.
S-9	SLO-1	Javani –rashtr prem ki bhavna jagrit karna	KAHANI KA VISHELESHAN	PRINT VIGYAPAN	ANUVADk KI BHUMIKA	EK DIN EK SHABD
	SLO-2	Vir ras evam virta ki pravati se awagat karana	Vishleshan kshmata viksit hota	Vidhyarthi iski bhasha sikhenge	Vidhyarthiyon ko anuvadak ki bhumika ka mahtav smajh aayega jiske adhar par vo kaam karenge	Vidhyarthiyon ko rozgaar se jodna
S-10	SLO-1	Dhool- saman vyavhar ki pravarti jagana	KAHANI PARICHARCHA	RADIO, TV.VIGYAPAN	SAHITYIK ANUVAD	PRYOJANMULAK SHABD KA MAHTAVA
	SLO-2	Satah se jude rahne ke prerna dena.	Vaad-vivad se vidhyarthiyon me apni baat ko rkhne ki yogyata banna	Vidhyarthiyon ko abhyas karvaya jayega	Vibhinn bhashaon ke sahitya ka anuvad kaise kiya jane ki chunouti ko samjajh payenge	Vidhyarthiyon ko vaighniko dwara tayaar ki gai bhasha ki samaj
S-11	SLO-1	KAVYA BIBM	KAHANI ANDOLAN	Ad agency	ANUVAD KE NIYAM	VIBHINN KSHETRO ME PRYOJANMULAK SHABDO KA MAHATAV
	SLO-2	Vidhyarthiyon ko naye-naye bibm ki jankari prapt hona	Vibhinn kahani andolan se bhi awagat karana	Ad agency aur swarozgaar se jodna	Anuvad ke niyamo ko vidhyarthi smajh payenge	Hindi adhikari pad par karyarat
S-12	SLO-1	SAMUHIK PARICHARCHA	KAHANI KA BADLTA SWAROOP	VIGYAPAN KA SWARUP	SHABDO KA MAHATAV	VAIGYANIK SHABDAVALI KI AVSHYAKATA
	SLO-2	Vidhyarthiyon ki bolne ki kaushal kshamta ko bdhana	Smay ke sath unke swarup ke bdlav ka bhi vidyarthi me samajh paida hona	Vidhyarthiyon ko vigyapan lekha ki barikayon ki samajh utpann hona	Shabda anuvad ke mahtva ko vidhyarthi smajhenge	Vidhyarthiyon ko shabdo ki vaignikta se jodna

Learning Resources	***The Prescribe Text Book Compiled and Edited by Department of Hindi*** *www.kavitakosh.org* *www.shabdkosh.com*

Learning Assessment											
	Bloom's Level of Thinking	**Continuous Learning Assessment (50% weightage)**								**Final Examination (50% weightage)**	
		CLA – 1 (10%)		**CLA – 2 (10%)**		**CLA – 3 (20%)**		**CLA – 4 (10%)#**			
		Theory	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**	**Theory**	**Practice**
Level 1	Remember	30%	30%	30%	30%	20%	20%	20%	20%	30%	-
	Understand										
Level 2	Apply	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
	Analyze										
Level 3	Evaluate	30%	30%	20%	20%	30%	30%	30%	30%	20%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Prof.(Dr.) S.Narayan Raju, Head, Department of Hindi,CUTN, Tamilnadu	*1. Dr.S Preeti. Associate Professor & Head, SRMIST*
		2. Dr. Md.S. Islam Assistant Professor, SRMIST
		3 Dr. S. Razia Begum, Assistant Professor, SRM IST

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Course Code	ULF20G02J	Course Name	French-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*French*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Strengthen the language of the students both in oral and written			
CLR-2 :	Express their sentiments, emotions and opinions, reacting to information, situations			
CLR-3 :	Make them learn the basic rules of French Grammar.			
CLR-4 :	Develop strategies of comprehension of texts of different origin			
CLR-5 :	Enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French			
CLR-6 :	*Extend and expand their savoir-faire through the acquisition of current scenario*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	*To acquire knowledge about French language*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	*M*	-	-	-	-
CLO-3 :	*To develop content using the features in French language*	*2*	*70*	*65*	*H*	-	-	*H*	-	-	-	-	-	-	*H*	-	-	-	-
CLO-4 :	*To interpret the French language into other language*	*2*	*70*	*70*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
CLO-5 :	*To improve the communication, intercultural elements in French language*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	*H*	-	-	-	-
CLO-6 :	To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French	*2*	*75*	*70*	*H*	-	*M-*	*H*	*H*	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	**SLO-1**	Les loisirs	La routine	Où faire ses courses ?	Découvrez et dégustez	Tout le monde s'amuse
	SLO-2	Les activités	Les exemples	Les courses	Dégustez	Le monde
S-2	**SLO-1**	Les activités quotidiennes	Les adjectifs interrogatifs	Les aliments	Les articles partitifs	Les sorties
	SLO-2	Les quotidiennes	Les trois formes	Les exemples	Du, De la, De l', Des	Les exemples
S-3	**SLO-1**	Les matières	Les nombres ordinaux	Les quantités	Le pronom en (la quantité)	Situer dans le temps
	SLO-2	Les exemples	Les nombres	Les exemples	Le bon quantité	Les activités
S-4	**SLO-1**	Le temps	L'heure	Les commerces	Très ?	Les vêtements
	SLO-2	L'heure	Quelle heure est-il ?	Les activités	Beaucoup ?	Les accessoires
S-5	**SLO-1**	Les fréquences	Le pronom personnel COD	Les commerçants	La phrase négative (2)	Les ados au quotidien
	SLO-2	Les activités	Les exemples	Les exemples	Les négations	La vie quotidienne

Duration (hour)		12	12	12	12	12
S-6	SLO-1	Les sons [u]	Les pronominaux	Demander le prix	C'est /Il est	Les adjectifs démonstratifs
	SLO-2	Les sons [y]	Se promener, se coucher etc…,	Dire le prix	Les activités	Ce, Cet, Cette, Ces
S-7	SLO-1	Les loisirs	Les verbes du premier groupe	Les services	L'impératif	La formation du féminin
	SLO-2	Les exemples	Parler, Demander, Poser	Les exemples	Les exemples	Les exemples
S-8	SLO-1	La routine	groupe en –e_er,é_er,-eler,-eter	Les moyens de paiement	Les verbes devoir, pouvoir	Le pronom indéfini on
	SLO-2	Les activités	Appeler, Jeter etc..,	La carte de crédits	Les verbes savoir, vouloir	Les activités
S-9	SLO-1	Les Mots	Le verbe prendre	les sons [ã]	Il faut	Le futur proche
	SLO-2	Les expressions	Les exemples	Les sons [an]	Le verbe impersonnel	S+Aller+Infinitif du verbe
S-10	SLO-1	Exprimer ses gouts	Parler de ses gouts	Découvrez !	Au restaurant : Commander et commenter	Le passe composé
	SLO-2	Les exemples	Des gouter	Dégustez !	Les restaurant	Les exemples
S-11	SLO-1	Exprimer ses préférences	Parler de ses préférences	Au restaurant : commander	Inviter à une invitation	Les verbes voir et sortir
	SLO-2	Les activités	Les exemples	Au restaurant : commenter	Répondre à une invitation	Décrire une tenue
S-12	SLO-1	Décrire sa journée	Décrire sa journée	Inviter à une invitation	Les Mots	écrire un message amical
	SLO-2	Les exemples	Les activités	Répondre à une invitation	Les expressions	Lire un message

Learning Resources	***Theory:*** 1. "**Génération-AI"** Méthode de français, Marie-Noëlle COCTON, P.DAUDA, L.GIACHINO, C.BARACCO, Les éditions Didier, Paris, 2018. ***2.Cahier d'activités avec deux discs compacts.***

Learning Assesment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	30%	30%	30%	30%	20%	20%	20%	20%	30%	-
Level 2	Apply Analyze	40%	40%	50%	50%	50%	50%	50%	50%	50%	-
Level 3	Evaluate Create	30%	30%	20%	20%	30%	30%	30%	30%	20%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. C.Thirumurugan Associate Professor, Department of French, Pondicherry University	*1. Kumaravel K. Assistant Professor & Head, SRMIST*
		2. Ponrajadurai M Assistant Professor, SRMIST

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Course Code	UCY20201J	Course Name	Organic Chemistry – I: Basic Concepts and Hydrocarbons	Course Category	C	Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning
CLR-1 :	*Organic Chemistry I is designed in a manner that it forms a cardinal part of the learning of organic chemistry for the subsequent semesters*	1
CLR-2 :	*The course is infused with the recapitulation of fundamentals of organic chemistry and the introduction of a new concept of visualizing the organic molecules in a three-dimensional space*	2
CLR-3 :	*To establish the applications of these concepts, the functional groups- alkanes, alkenes and alkynes are introduced*	3
CLR-4 :	*To establish the applications of these concepts, the functional groups aromatic hydrocarbons are introduced*	
CLR-5:	*The constitution of the course strongly aids in the paramount learning of the concepts and their applications*	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.*	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	*Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	*Learn and identify many organic reaction mechanisms including Free Radical Substitution,Electrophilic Addition and Electrophilic Aromatic Substitution.*	2	70	65	H	-	-		-	-	-	-	-	-	-	-	H	M	-
CLO-4 :	*Correlate and describe the stereochemical properties of organic compounds and reactions*	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	M	H
CLO-5 :	*Understand and explain the reactivity of alkenes and alkynes*	2	80	75	H														

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Recapitulation of Basics of Organic Chemistry :Hybridisation: Shapes of molecules	Chirality in molecules with one and two stereocentres	Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes): General methods of preparation- Wurtz and Wurtz Fittig reaction	**Cyclohexane confirmation with energy diagram**	**Aromatic Hydrocarbons** :Concept of Aromaticity: Huckel's rule aromatic character of arenes with examples
	SLO-2	Hybridisation: Shapes of molecules	Chirality in molecules with one and two stereocentres	General methods of preparation- Wurtz and Wurtz Fittig reaction	**Cyclohexane confirmation with energy diagram**	Concept of Aromaticity: Huckel's rule aromatic character of arenes with examples
S-2	SLO-1	Electronic Displacements and their applications: Inductive & Electromeric	Chirality in molecules with no stereocentre (Allenes, biphenyls); meso configuration	General methods of preparation-Corey House synthesis	Axial and equatorial positions	Concept of Aromaticity: Huckel's rule aromatic character of cyclic carbocations with suitable examples
	SLO-2	Resonance, Mesomeric effects and Hyperconjugation	Chirality in molecules with no stereocentre (Allenes, biphenyls); meso configuration	General methods of preparation-Corey House synthesis	Axial and equatorial positions	Concept of Aromaticity: Huckel's rule aromatic character of cyclic carbocations with suitable examples

Duration (hour)		24	24	24	24	24
S-3	SLO-1	Concept of dipole moment, Acidity and Basicity and related pKa values	Racemic modification	Physical and chemical properties of alkanes	Conformations of monosubstituted alkanes	Concept of Aromaticity: Huckel's rule aromatic character of a carbanions with suitable examples
	SLO-2	Concept of dipole moment, Acidity and Basicity and related pKa values	Racemic modification	Physical and chemical properties of alkanes	Conformations of monosubstituted alkanes	Concept of Aromaticity: Huckel's rule aromatic character of a carbanions with suitable examples
S-4	SLO-1	Homolytic and heterolytic fissions with suitable examples, types, shape and relative stability of Carbocations, Carbanions, Free radicals and Carbenes	Resolution of Racemic Modification	Isomerism and its effect on properties of molecule	Carbon-Carbon pi Bonds (Alkenes and Alkynes): Structure and isomerism	Concept of Aromaticity: Huckel's rule aromatic character of heterocyclic compounds with suitable examples
	SLO-2	Homolytic and heterolytic fissions with suitable examples, types, shape and relative stability of Carbocations, Carbanions, Free radicals and Carbenes	Resolution of Racemic Modification	Isomerism and its effect on properties of molecule	Structure and isomerism	Concept of Aromaticity: Huckel's rule aromatic character of heterocyclic compounds with suitable examples
S-5 to S-8	SLO-1	Lab Introduction	Purification of organic compounds by crystallization using the following solvents: a. .Water b. Alcohol	Effect of impurities on the melting point – mixed melting point of two unknown organic compounds	Calibration of Thermometer	Experiment-Repeat-2
	SLO-2					
S-9	SLO-1	Homolytic and heterolytic fissions with suitable examples, types, shape and relative stability of Carbocations, Carbanions, Free radicals and Carbenes	Relative configuration: D/L designations	Free radical substitutions; Halogenation	General methods of preparation, physical and chemical properties	Electrophilic aromatic substitution: halogenation with mechanism
	SLO-2	Weaker forces like van der Waal's forces and Hydrogen bonding	Relative configuration: D/L designations	Free radical substitutions; Halogenation	General methods of preparation, physical and chemical properties	Electrophilic aromatic substitution: halogenation with mechanism
S-10	SLO-1	Electrophiles and Nucleophiles and introduction to types of organic reactions: Addition, Elimination and Substitution reactions	Relative configuration: D/L designations	Concept of relative reactivity v/s selectivity	Mechanism of E1 reactions	Nitration with mechanism
	SLO-2	Electrophiles and Nucleophiles and introduction to types of organic reactions: Addition, Elimination and Substitution reactions	Relative configuration: D/L designations	Concept of relative reactivity v/s selectivity	Mechanism of E2 reactions	Nitration with mechanism
S-11	SLO-1	Stereochemistry: Optical Activity and Optical Isomerism	Absolute configuration: R/S designations	Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane)	Mechanism E1cb reactions	Sulphonation with mechanism
	SLO-2	Optical Activity and Optical Isomerism	Absolute configuration: R/S designations	Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane)	Saytzeff and Hoffmann eliminations	Sulphonation with mechanism

Duration (hour)		24	24	24	24	24
S-12	SLO-1	Asymmetry, Chirality, Enantiomers, Diastereomers	Absolute configuration: R/S designations	Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of propane)	Electrophilic Additions, mechanism with suitable examples, (Markownikoff /Antimarkownikoff addition)	Friedel Crafts alkylation/ acylation with their mechanism
	SLO-2	Asymmetry, Chirality, Enantiomers, Diastereomers	Absolute configuration: R/S designations	Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of propane)	Electrophilic Additions, mechanism with suitable examples, (Markownikoff /Antimarkownikoff addition)	Friedel Crafts alkylation/ acylation with their mechanism
S-13 To S-16	SLO-1	Organic Preparation:Bromination of acetanilide/ aniline/phenol	Purification of organic compounds by crystallization using the following solvents:a. Alcohol-Water	Chromatography (a) Separation of a mixture of two amino acids by ascending and radial paper chromatography (b) Separation of a mixture of two sugars by ascending paper chromatography (c) Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)	Detection of extra elements	Experiment-Repeat-3
	SLO-2					
S-17	SLO-1	Specific rotation; Configuration	Geometrical isomerism: cis-trans	Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of butane)	Syn and anti-addition; addition of H_2, X_2, methylene	Directing effects of groups in electrophilic substitution: Activating groups
	SLO-2	Specific rotation; Configuration	Geometrical isomerism: cis-trans	Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of butane)	Oxymercuration-demercuration, hydroboration-oxidation	Directing effects of groups in electrophilic substitution: Activating groups
S-18	SLO-1	Projection Formulae: Newmann, Sawhorse, Fischer	Geometrical isomerism: syn-anti	General molecular formulae of cycloalkanes	Hydroxylation, Diels Alder reaction	Directing effects of groups in electrophilic substitution: Deactivating groups
	SLO-2	Projection Formulae: Newmann, Sawhorse, Fischer	Geometrical isomerism: syn-anti	General molecular formulae of cycloalkanes	1,2-and 1,4-addition reactions in conjugated dienes	Directing effects of groups in electrophilic substitution: Deactivating groups
S-19	SLO-1	Projection Formulae: Newmann, Sawhorse, Fischer	E/Z notations with CIP rules	Relative stability of cycloalkanes	Mechanism of allylic and benzylic bromination in propene, 1-butene, toluene, ethyl benzene	Different groups effects on benzene
	SLO-2	Projection Formulae: Newmann, Sawhorse, Fischer	E/Z notations with CIP rules	Relative stability of cycloalkanes	Mechanism of allylic and benzylic bromination in propene, 1-butene, toluene, ethyl benzene	Halides competing effects
S-20	SLO-1	Projection Formulae: interconversion	E/Z notations with CIP rules	Baeyer Strain Theory	Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes	Directing effect on multiple substituents

Duration (hour)		24	24	24	24	24
	SLO-2	Projection Formulae: interconversion	E/Z notations with CIP rules	Baeyer Strain Theory	Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes	Directing effect on multiple substituents
S-21 to S-24	SLO-1 SLO-2	Organic Preparation: Nitration of nitrobenzene/toluene	Determination of the melting points of prepared organic compounds (Kjeldahl method and electrically heated melting point apparatus)	Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)	Experiment-Repeat-1	Demonstration Practical Session

Learning Resources	**Theory:** 1. **Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).** 2. **Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).** 3. **Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).** 4. **Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.** 5. **Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.**	**Practicals:** 1. **Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson 2012.** 2. **Ahluwalia, V.K. &Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press , 2000.** 3. **Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press, 2000.**

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Prof. M. Arthanareeswari, SRMIST
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in	2. Dr. Gopal Chandru Senadi, SRMIST

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Course Code	UCY20202T	Course Name	Inorganic Chemistry - II: s- and p-Block Elements	Course Category	C	Core course	L	T	P	C
							5	1	0	6

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	**Data Book / Codes/Standards**	*Nil*		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		Level of Thinking (Bloom)	*Expected Proficiency (%)*	*Expected Attainment (%)*
CLR-1 :	*Exploit the general principals of Metallurgy and s-, p-block elements*			
CLR-2 :	*Explains the principles of oxidation and reduction as applied to the extraction procedures*			
CLR-3 :	*Get knowledge on metals and alloy behaviour, and understand why alloys are preferred over metal alone*			
CLR-4 :	*Address thermodynamic concepts like Gibbs energy and entropy to the extraction of metals*			
CLR-5 :	*Employ the patterns and trends exhibited by s and p block elements and their compounds with emphasis on synthesis, structure, bonding and uses*			
CLR-6 :	*Utilize the basic chemistry principles applied in various biological problems and identify appropriate solutions*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	*Level of Thinking (Bloom)*	*Expected Proficiency (%)*	*Expected Attainment (%)*	*Fundamental Knowledge*	*Problem Analysis*	*Design & Development*	*Analysis, Design, Research*	*Modern Tool Usage*	*Society & Culture*	*Environment & Sustainability*	*Ethics*	*Individual & Team Work*	*Communication*	*Project Mgt. & Finance*	*Life Long Learning*	*PSO - 1*	*PSO - 2*	*PSO – 3*
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	*Utilize the principles of metallurgy for extraction of pure metals*	*2*	*70*	*65*	*H*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*
CLO-2 :	*Exploit the basic and practical applications in metals and alloy to their manufacturing processes*	*2*	*80*	*70*	*H*	*H*	*-*	*H*		*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*
CLO-3 :	*Gaining the knowledge in thermodynamic concepts like that of Gibbs energy and entropy to the extraction of metals*	*2*	*75*	*60*	*-*	*-*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*
CLO-4 :	*Perceive the importance of periodicity of the elements*	*2*	*70*	*70*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*M*	*-*
CLO-5 :	*Understand the unusual and rare oxidation states of carbides and nitrides*	*2*	*80*	*70*	*-*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*H-*	*-*
CLO-6 :	*Interpret the vital role of Sodium, Potassium, Calcium and magnesium in biological systems and the use of caesium in devising photoelectric cells*	*2*	*75*	*65*	*-*	*-*	*-*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*H*

Duration (hour)		18	18	18	18	18
S-1	**SLO-1**	General Principles of Metallurgy	*Common features such as ease of formation of alkaline earth metal compounds*	*beryllium nitrate*	*hydrides of Group 14*	*halides of phosphorus*
	SLO-2	General Principles of Metallurgy	*Common features such as ease of formation of alkaline earth metal compounds*	*beryllium nitrate*	*hydrides of Group 14*	*halides of phosphorus*
S-2	**SLO-1**	Chief modes of occurrence of metals based on standard electrode potentials.	*thermal stability and*	*EDTA complexes of calcium*	*hydrides of Group 15 (EH_3 where E = N, P)*	Preparation of Borazine
	SLO-2	Chief modes of occurrence of metals based on standard electrode potentials.	*solubility of the following alkali and alkaline earth metal compounds:*	*EDTA complexes of calcium*	*hydrides of Group 15 (EH_3 where E = N, P)*	properties of Borazine
S-3	**SLO-1**	Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent	*hydrides*	*EDTA complexes of magnesium*	*hydrides of Group 15 (EH_3 where E = As, Sb)*	*structure of Borazine*

Duration (hour)		18	18	18	18	18
	SLO-2	*Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent*	*hydrides*	*EDTA complexes of magnesium*	*hydrides of Group 15 (EH_3 where E = As, Sb)*	*uses of Borazine*
S-4	SLO-1	*Electrolytic Reduction*	*oxides*	*Solutions of alkali metals in liquid ammonia*	*hydrides of Group 15 (EH_3 where E = Bi)*	*Preparation of Silicates*
	SLO-2	*Electrolytic Reduction*	*oxides*	*Solutions of alkali metals in liquid ammonia*	*hydrides of Group 15 (EH_3 where E = Bi)*	*Preparation of Silicates*
S-5	SLO-1	*Hydrometallurgy with reference to cyanide process for silver and gold.*	*peroxides*	*Properties of alkali metals in liquid ammonia*	*hydrides of Group 16*	*structure of Silicates*
	SLO-2	*Hydrometallurgy with reference to cyanide process for silver and gold.*	*peroxides*	*Properties of alkali metals in liquid ammonia*	*hydrides of Group 16*	*structure of Silicates*
S-6	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S-7	SLO-1	*Methods of purification of metals*	*superoxides*	*Chemistry of p Block Elements: Electronic configuration, atomic and ionic size*	*hydrides of Group 17*	*Preparation and properties of silicones*
	SLO-2	*Methods of purification of metals*	*superoxides*	*metallic/non-metalliccharacter, melting point*	*hydrides of Group 17*	*structure and uses of silicones*
S-8	SLO-1	*Electrolytic process*	*carbonates*	*ionization enthalpy*	*hydrides of Group 17*	*Preparation of Phosphonitrilic halides $\{(PNCl_2)_n$ where n = 3 and 4}*
	SLO-2	*Electrolytic process*	*carbonates*	*electron gain enthalpy*	*oxides of phosphorus*	*properties of Phosphonitrilic halides $\{(PNCl_2)_n$ where n = 3 and 4}*
S-9	SLO-1	*van Arkel-de Boer process*	*nitrates*	*electronegativity*	*oxides of phosphorus*	*Structure of Phosphonitrilic halides $\{(PNCl_2)_n$ where n = 3 and 4}*
	SLO-2	*Zone refining*	*nitrates*	*Catenation*	*oxides of phosphorus*	*uses of of Phosphonitrilic halides $\{(PNCl_2)_n$ where n = 3 and 4}*
S-10	SLO-1	*Chemistry of s-Block Elements: General characteristics*	*sulphates*	*Allotropy of C*	*oxides of sulphur*	*Preparation of Interhalogen compounds*
	SLO-2	*melting point and flame colour*	*sulphates*	*Allotropy of C*	*oxides of sulphur*	*Preparation of Interhalogen compounds*
S-11	SLO-1	*reducing nature*	*sulphites*	*Allotropy of P*	*oxides of chlorine*	*properties of Interhalogen compounds*
	SLO-2	*diagonal relationships*	*sulphites*	*Allotropy of P*	*oxides of chlorine*	*properties of Interhalogen compounds*
S-12	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S-13	SLO-1	*Anomalous behavior of first member of each group*	*Complex formation tendency of s-block elements*	*Allotropy of S*	*oxoacids of phosphorus*	*structure of Interhalogen compounds*
	SLO-2	*Anomalous behavior of first member of each group*	*Complex formation tendency of s-block elements*	*Allotropy of S*	*oxoacids of phosphorus*	*uses of Interhalogen compounds*
S-14	SLO-1	*Reactions of alkali metals with oxygen and hydrogen*	*structure of the following complexes: crown ethers of Group I*	*inert pair effect*	*oxoacids of phosphorus*	*Preparation and properties of pseudohalogen compounds*
	SLO-2	*Reactions of alkali metals with oxygen and hydrogen*	*structure of the following complexes: crown ethers of Group I*	*Diagonal relationship between B and Si and anomalous behaviour of first member of each group.*	*oxoacids of chlorine*	*structure and uses of pseudohalogen compounds*
S-15	SLO-1	*Reactions of alkali metals with nitrogen*	*structure of cryptates*	*Structure, bonding and properties: acidic/basic nature, stability*	*oxoacids of chlorine*	*Preparation and properties of Clathrate compounds of noble gases*

Duration (hour)		18	18	18	18	18
	SLO-2	*Reactions of alkali metals with nitrogen*	*structure of cryptates*	*ionic/covalent nature, oxidation/reduction,*	*oxoacids of chlorine*	*structure and uses ofClathrate compounds of noble gases*
S-16	SLO-1	*Reactions of alkaline earth metals with water.*	*cryptates of Group I*	*hydrolysis, action of heat of Hydrides*	*peroxoacids of sulphur*	*Preparation and properties of xenon fluorides.*
	SLO-2	*Reactions of alkaline earth metals with water.*	*cryptates of Group I*	*hydrolysis, action of heat of Hydrides*	*peroxoacids of sulphur*	*Preparation and properties of xenon fluorides.*
S-17	SLO-1	*Common features such as ease of formation of alkali metal compounds*	*basic beryllium acetate*	*hydrides of Group 13*	*halides of silicon*	*structure and uses of xenon fluorides, MO treatment of XeF_2.*
	SLO-2	*Common features such as ease of formation of alkali metal compounds*	*basic beryllium acetate*	*hydrides of Group 13*	*halides of silicon*	*structure and uses of xenon fluorides, MO treatment of XeF_2.*
S-18	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*

Learning Resources

Theory:

1. ***Douglas, B.E; Mc Daniel, D.H. & Alexander J. J. Concepts and Models of Inorganic Chemistry, New York: John Wiley, 1994.***
2. ***Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 3 rd Ed.(adapted), Pearson, 2009***
3. ***Shriver, D.F., Atkins P.W and Langford, C.H., Inorganic Chemistry 2 nd Ed., Oxford University Press, 1994***
4. ***Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.***
5. ***Lee, J.D., Concise Inorganic Chemistry, Pearson Education, 2010.***

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (5%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. S. Shanmugan, SRMIST*

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Course Code	UMA20A02T	Course Name	Allied Mathematics - II	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	UMA20A01T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

CLR-1 :	To understand the basics of integration.
CLR-2 :	To learn the fundamental concept of Trigonometry.
CLR-3 :	Understand to solve ordinary differential equations.
CLR-4 :	To understand concepts of Laplace Transform and its properties.
CLR-5 :	To learn the concepts of inverse Laplace Transform.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Scientific Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	Students will able to apply the concepts of integral calculus, in finding area, surfaces, volume of the solid.	3	85	80	H	H	L	-	-	-	-	-	M	L	-	H	-	-	-
CLO-2 :	Students will able to be familiar with Trigonometry.	3	85	80	M	H	-	M	M	-	-	-	M	-	-	H	-	-	-
CLO-3 :	Students will understand the concept of second order differential equations with constant coefficient and applying in mechanics and dynamics.	3	85	80	H	H	-		-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Students are able to understand the concept of Laplace transformation and applying in Science and Engineering	3	85	80	H	H	H	M	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	Students are able to understand the concept of Inverse Laplace transformation and applying in Science and Engineering.	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Integral calculus-Basic integral formulae.	Expansion of $\sin n\theta, \cos n\theta$ in powers of $\sin\theta$ and $\cos\theta$, where n being a positive integer.	Introduction to second order differential equations with constant coefficients.	Introduction to Laplace Transforms	Introduction t Inverse Laplace Transforms
	SLO-2	Problems related to integral formulae.	Expansion of $\tan n\theta$.	Finding the order and degree of the differential equations.	Standard results of Laplace transforms	Standard results of Inverse Laplace transforms
S-2	SLO-1	Integrals of the type $\int \frac{dx}{ax^2+bx+c}$	Problems based on $\sin n\theta$	Solution of the differential equation – Complementary function and particular function.	Derivation of the standard results of Laplace transforms.	Simple problems based on results.
	SLO-2	Problems related to the above integral type.	Problems based on $\sin n\theta$	Problems based on $(aD^2+bD+c)y=0$	Derivation of the standard results of Laplace transforms.	Simple problems based on results.

Duration (hour)		9	9	9	9	9
S-3	SLO-1	Integrals of the type $\int \frac{px+q}{ax^2+bx+c}dx$	Additional problems based on $\sin n\theta$	Additional problems on $(aD^2+bD+c)y=0$	Simple problems based on results.	Simple problems based on results.
	SLO-2	Problems related to the above integral type.	Problems based on $\cos n\theta$	Problems based on $(aD^2+bD+c)y=e^{ax}$	Simple problems based on results.	Simple problems based on results.
S-4	SLO-1	Integrals of the type $\int \frac{dx}{\sqrt{ax^2+bx+c}}$	Problems based on $\cos n\theta$	Additional problems on $(aD^2+bD+c)y=e^{ax}$	Properties of Laplace Transforms.	Simple problems based on results.
	SLO-2	Problems related to the above integral type.	Additional problems based on $\cos n\theta$	Problems based on $(aD^2+bD+c)y=\sin ax$	Properties of Laplace Transforms.	Inverse Laplace transforms of $sF(s)$
S-5	SLO-1	Integrals of the type $\int \frac{px+q}{\sqrt{ax^2+bx+c}}dx$	Problems based on $\cos n\theta$ and $\tan n\theta$	Problems based on $(aD^2+bD+c)y=\sin ax$	Problems related to the properties of Laplace transforms.	Problems based on $L^{-1}[sF(s)]$
	SLO-2	Problems related to the above integral type.	Expansion of $\sin^n\theta$ and $\cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$ where n being a positive integer.	Additional problems based on $(aD^2+bD+c)y=\sin ax$	Problems related to the properties of Laplace transforms.	Additional problems on $L^{-1}[sF(s)]$
S-6	SLO-1	Integration by Partial fraction method (Simple algebraic functions only)	Problems based on $\sin^n\theta$ interms of $\sin\theta$.	Additional problems based on $(aD^2+bD+c)y=\sin ax$	Additional problems related to the first shifting property.	Inverse Laplace transforms of $\frac{F(s)}{s}$
	SLO-2	Problems related to the partial fraction method.	Problems based on $\sin^n\theta$ interms of $\cos\theta$.	Problems based on $(aD^2+bD+c)y=\cos ax$	Laplace transform of $tf(t)$	Problems based on $L^{-1}\left[\frac{F(s)}{s}\right]$
S-7	SLO-1	Additional problems related to the partial fraction method.	Problems based on $\sin^n\theta$ interms of $\cos\theta$.	Additional problems based on $(aD^2+bD+c)y=\cos ax$	Problems on Laplace transform of $tf(t)$	Additional problems based on $L^{-1}\left[\frac{F(s)}{s}\right]$
	SLO-2	Bernoulli's formula and related problems.	Problems based on $\cos^n\theta$ interms of $\cos\theta$.	Additional problems based on $(aD^2+bD+c)y=\cos ax$	Problems on Laplace transform of $\frac{f(t)}{t}$	Inverse Laplace transforms -partial fraction method
S-8	SLO-1	Reduction formula for $\int \sin^n x\,dx$	Problems based on $\cos^n\theta$ interms of $\cos\theta$.	Problems based on $(aD^2+bD+c)y=x^n$	Additional problems on Laplace transform of $\frac{f(t)}{t}$	Partial fraction method-Related problems.
	SLO-2	Evaluation of $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$	Problems based on $\sin^n\theta\ \cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$	Additional problems on $(aD^2+bD+c)y=x^n$	Problems on Laplace transform of $te^{at}f(t)$	Additional problems on partial fraction method.

Duration (hour)		9	9	9	9	9
S-9	SLO-1	Reduction formula for $\int \cos^n x\,dx$	Problems based on $\sin^n\theta\ \cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$	Additional problems on $(aD^2+bD+c)y=x^n$	Additional problems on Laplace transform of $te^{at}f(t)$	Additional problems on partial fraction method.
	SLO-2	Evaluation of $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$	Problems based on $\sin^n\theta\ \cos^n\theta$ interms of multiples of $\sin\theta$ and $\cos\theta$	Additional problems on $(aD^2+bD+c)y=x^n$	Additional problems on Laplace transform of $te^{at}f(t)$	Additional problems on partial fraction method.

Learning Resources	
	1. Singaravelu. A, Allied Mathematics, 6th Revised Edition, Meenakshi Agency, 2014. 2. Vittal. P.R, Allied Mathematics, 4th Edition Reprint, Margham Publications, 2013. 3. Venkatachalapathy, S.G, Allied Mathematics, 1st Edition Reprint, Margham Publications, 2007. 4. T.K. Manickavasagam Pillai and S. Narayanan, Ancillary Mathematics, Reprint, S.Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
	5. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. Singapore, 10th edition, 2012. 6. T. Veerajan, "Engineering Mathematics I", Tata McGraw Hill Publishing Co., New Delhi, 5th edition, 2006. 7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 42nd Edition, 2012.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40 %	-	30 %	-	30 %	-	30 %	-	30 %	-
Level 2	Apply Analyze	40 %	-	40 %	-	40 %	-	40 %	-	40 %	-
Level 3	Evaluate Create	20 %	-	30 %	-	30 %	-	30 %	-	30 %	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. V. Maheshwaran, Cognizant Technology Solutions maheshwaranv@yahoo.com	Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in	Dr. A. Govindarajan, SRMIST Dr. N. Parvathi, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	Mr. M. Balaganesan, SRMIST Dr. T. Nirmala, SRMIST Mrs.T.N.Saibhavani, SRMIST

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Course Code	UCY20A02T	Course Name	Biochemistry - II	Course Category	G	Generic Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		Level of Thinking (Bloom)	*Expected Proficiency (%)*	*Expected Attainment (%)*
CLR-1 :	*To develop an understanding about the role of carbohydrates in cellular metabolism*			
CLR-2 :	*To learn about the structural chemistry of carbohydrates*			
CLR-3 :	*To comprehend the various aspects of enzyme reactions and enzyme inhibition*			
CLR-4 :	*To gain basic knowledge about the function of DNA and RNA*			
CLR-5 :	*To understand the process involved in the major biochemical metabolic pathways*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	*Level of Thinking (Bloom)*	*Expected Proficiency (%)*	*Expected Attainment (%)*	*Fundamental Knowledge*	*Problem Analysis*	*Design & Development*	*Analysis, Design, Research*	*Modern Tool Usage*	*Society & Culture*	*Environment & Sustainability*	*Ethics*	*Individual & Team Work*	*Communication*	*Project Mgt. & Finance*	*Life Long Learning*	*PSO - 1*	*PSO - 2*	*PSO – 3*
CLO-1 :	*Students will gain insight into the structure of Carbohydrates and its influence on cell metabolism*	*2*	*70*	*65*	*H*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
CLO-2 :	*Elucidate the mechanism involved in the enzyme mediated reactions*	*2*	*80*	*70*	*H*	*-*	*-*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
CLO- 3:	*Recognize the influence of molecular interactions on the structure of DNA and RNA*	*2*	*70*	*65*	*H*	*-*	*-*		*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*M*	*-*
CLO- 4:	*Ability to understand the concept of cloning and its application.*	*2*	*70*	*70*	*H*	*-*	*H*	*H*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*H*	*-*
CLO- 5:	*Information about crucial biosynthetic pathways and their role in metabolism*	*2*	*80*	*70*	*-*	*H*	*-*	*H*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*H*	*-*	*-*

Duration (hour)		9	9	9	9	9
S-1	**SLO-1**	Classification of carbohydrates	Disaccharides – reducing and non-reducing sugars	Nomenclature- classification and properties	Nucleosides and nucleotides - purine and pyrimidine bases	Glycolysis
	SLO-2	Classification of carbohydrates	Disaccharides – reducing and non-reducing sugars	Nomenclature- classification and properties	Nucleosides and nucleotides - purine and pyrimidine bases	Glycolysis
S-2	**SLO-1**	Monosaccharides – aldoses	Disaccharides – reducing and non-reducing sugars	Nomenclature- classification and properties	Nucleosides and nucleotides - purine and pyrimidine bases	Glycolysis
	SLO-2	Monosaccharides – aldoses	Disaccharides – reducing and non-reducing sugars	Nomenclature- classification and properties	Nucleosides and nucleotides - purine and pyrimidine bases	Glycolysis
S-3	**SLO-1**	Monosaccharides – ketoses	Carbohydrates of the cell membrane – starch	Nomenclature- classification and properties	Nucleosides and nucleotides - purine and pyrimidine bases	Glycolysis
	SLO-2	Monosaccharides – ketoses	Carbohydrates of the cell membrane – starch	Nomenclature- classification and properties	Nucleosides and nucleotides - purine and pyrimidine bases	Glycolysis
S-4	**SLO-1**	Monosaccharides - stereoisomerism, epimers, mutarotation.	Carbohydrates of the cell membrane – starch	Mechanism of enzyme action - Lock and Key model, Induced fit models.	classification and function of RNA	TCA cycle.
	SLO-2	Monosaccharides - stereoisomerism, epimers, mutarotation.	Carbohydrates of the cell membrane – starch	Mechanism of enzyme action - Lock and Key model, Induced fit models.	classification and function of RNA	TCA cycle
S-5	**SLO-1**	Monosaccharides - stereoisomerism,	Carbohydrates of the cell membrane –	Mechanism of enzyme action - Lock and	classification and function of RNA	TCA cycle

Duration (hour)		9	9	9	9	9
		epimers, mutarotation.	Cellulose	Key model, Induced fit models.		
	SLO-2	Monosaccharides - stereoisomerism, epimers, mutarotation.	Carbohydrates of the cell membrane – Cellulose	Mechanism of enzyme action - Lock and Key model, Induced fit models.	classification and function of RNA	TCA cycle
S-6	SLO-1	Glucose – structure, Furanose and pyranose forms of glucose and fructose	Carbohydrates of the cell membrane – Cellulose	Mechanism of enzyme action - Lock and Key model, Induced fit models.	classification and function of RNA	TCA cycle
	SLO-2	Glucose – structure, Furanose and pyranose forms of glucose and fructose	Carbohydrates of the cell membrane – Cellulose	Mechanism of enzyme action - Lock and Key model, Induced fit models.	classification and function of RNA	TCA cycle
S-7	SLO-1	Glucose – structure, Furanose and pyranose forms of glucose and fructose	Carbohydrates of the cell membrane – Glycogen.	Mechanism of inhibition (competitive, non and uncompetitive and allosteric).	Biosynthesis of DNA- replication.	Biosynthesis and degradation of purines and pyrimidines
	SLO-2	Glucose – structure, Furanose and pyranose forms of glucose and fructose	Carbohydrates of the cell membrane – Glycogen.	Mechanism of inhibition (competitive, non and uncompetitive and allosteric).	Biosynthesis of DNA- replication.	Biosynthesis and degradation of purines and pyrimidines
S-8	SLO-1	Haworth projection formulae for glucose	Carbohydrates of the cell membrane – Glycogen.	Mechanism of inhibition (competitive, non and uncompetitive and allosteric).	Biosynthesis of DNA- replication.	Biosynthesis and degradation of purines and pyrimidines
	SLO-2	Haworth projection formulae for glucose	Carbohydrates of the cell membrane – Glycogen.	Mechanism of inhibition (competitive, non and uncompetitive and allosteric).	Biosynthesis of DNA- replication.	Biosynthesis and degradation of purines and pyrimidines
S-9	SLO-1	Haworth projection formulae for glucose	Carbohydrates of the cell membrane – Glycogen.	Mechanism of inhibition (competitive, non and uncompetitive and allosteric).	Cloning	Biosynthesis and degradation of purines and pyrimidines
	SLO-2	Haworth projection formulae for glucose	Carbohydrates of the cell membrane – Glycogen.	Mechanism of inhibition (competitive, non and uncompetitive and allosteric).	Cloning	Biosynthesis and degradation of purines and pyrimidines

Learning Resources		
1. David L. Nelson and Michael M. Cox Lehninger, *Principles of Biochemistry*, Worth Publishers, 4th edition,New York, 2005. 2. L. Veerakumari, *Biochemistry*, MJP publishers, Chennai, 2004.	3. J. L. Jain, *Biochemistry*, Sultan Chand and Co, 1999. 4. U.Sathyanarayana, Biochemistry, Elsevier, 5th edition,2010.	

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
Level 2	Apply Analyze	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
Level 3	Evaluate Create	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. M.R.Ganesh SRMIST*

Course Code	UCD20S02L	Course Name	Quantitative Aptitude and Reasoning	Course Category	S	Skill Enhancement Course	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	-		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLR-1 :	Demonstrate various principles involved in solving mathematical concepts																		
CLR-2 :	Develop interest and awareness in students regarding profit/ loss, interest calculations and average																		
CLR-3 :	Critically evaluate basic mathematical concepts related to mixtures and alligations,permutation and combination, time and work																		
CLR-4 :	Provide students with skills necessary to generate and interpret data and concepts related to time, speed and distance and blood relation.																		
CLR-5 :	Enable students to understand reasoningskills																		
CLR-6 :	Create awareness in students regarding the various concepts in quantitative aptitude and reasoning skills and also its importance in various competitive exams																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Understand, analyze and solve questions based on numbers, logarithms.	3	80	70	H	H	M	H	L	M	-	H	-	H	-	H	M	-	H
CLO-2 :	Create, solve, interpret and apply basic mathematical models which are applicable in our day to day life	3	80	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-3 :	Understand the concepts of mixtures and alligations, permutation and combinations, probability, time and work and to approach questions in a simpler and innovative method	3	85	70	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-4 :	Understand the concept in time ,speed and distance	3	85	80	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-5 :	Ability to solve the problems on reasoning	3	85	75	M	H	M	H	-	M	-	H	-	H	-	H	M	-	H
CLO-6 :	Able to face different competitive exams	3	80	70	M	H	M	H	-	M	-	H	-	M	-	H	M	-	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Classification of numbers	Profit and Loss-Introduction	Mixtures and Alligations-Introduction	Time, Speed and Distance-Problems onTrains	Direction Sense-Introduction
	SLO-2	Test of divisibility	Profit and Loss- Basic Problems	Mixtures and Alligations-Problems	Time, Speed and Distance-Boats&Streams	Direction Sense-Problems
S-2	SLO-1	Unit digit	Statistics-Introduction	Permutation –Introduction& Basics	Data Interpretation – Bar chart	Number Series
	SLO-2	Tailed zeroes	Statistics-Mean,Median,Mode	Combination-Introduction& Basics	Data Interpretation – Pie chart	Word Series
S-3	SLO-1	HCF, LCM	Simple Interest-Introduction,Formulas &Problems	Probability-Introduction &Basics	Data Interpretation – Table	Seating Arrangements - Linear
	SLO-2	HCF, LCM - Solving problems	Compound Interest-Introduction,Formulas &Problems	Probability-Problems	Data Interpretation – Line graph	Seating Arrangements - Circular
S-4	SLO-1	Logarithm –Introduction of log rules	Word problems on Line equations-Introduction	Time and work-Introduction	Data sufficiency-Introduction and Basics	Puzzles-Concepts

Duration (hour)		6	6	6	6	6
	SLO-2	Logarithm –Applications of log rules	Word problems on Line equations-Basic problems	Time and work-Men and Work	Data sufficiency-Problems	Puzzles-Problems
S-5	SLO-1	Percentage -Introduction	Averages-Introduction& Basics	Time and work-Pipes &Cisterns(Introduction)	Blood relation-Introduction	Clocks-Concepts Discussion
	SLO-2	Percentage- Basic problems	Averages-Tricky Problems	Time and work-Pipes &Cisterns(Problems)	Blood relation-Problems	Clocks-Problems
S-6	SLO-1	Percentage-Increasing & Decreasing functions	Ratio and Proportions-Introduction	Time, Speed and Distance-Introduction	Coding – Decoding-Introduction	Calendars-Introduction of basic concept
	SLO-2	Percentage- Miscellaneous problems	Ratio and Proportions-Basics & problems	Time, Speed and Distance-Basic problems	Coding – Decoding-Different types	Calendars-Problems

Learning Resources	1. AbhijitGuha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 5th Edition 2. Dr. Agarwal.R.S, Quantitative Aptitude for Competitive Examinations, S. Chand and Company Limited, 2018 Edition 3. Archana Ram, PlaceMentor: Tests of Aptitude for Placement Readiness, Oxford University Press, Oxford, 2018	4. Edgar Thrope, Test Of Reasoning for Competitive Examinations, Tata McGraw Hill, 6th Edition 5. Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for competitive examinations, Pearson, 3rd Edition *6. P A Anand, Quantitative Aptitude for competitive examinations, Wiley publications, e book, 2019*

Learning Assessment

Level	Bloom'sLevel of Thinking	Continuous Learning Assessment (100% weightage)			
		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (30%) #	CLA-4 (30%) ##
		Practice	Practice	Practice	Practice
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	*40%*	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ajay Zener, Director, Career Launcher	-	*1. Dr. P Madhusoodhanan, HoD, CDC, E&T, SRMIST*
		2. Dr. M Snehalatha, Assistant. Professor, CDC, E&T, SRMIST

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Course Code	UJK20201L	Course Name	Communication Skills	Course Category	JK	Life Skill Course	L	T	P	C
							0	0	4	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*To make the students learn the native speakers' accent.*			
CLR-2 :	*To educate them about word stress of English*			
CLR-3 :	*The enable them to participate in group discussion and debates*			
CLR-4 :	To improve their participation and participation skills			
CLR-5 :	To improve the listening and speaking abilities in English			
CLR-6 :	*LSRW skills all together is developed in every student*			

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

		Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	*Understand the native speakers' exact pronunciation*	2	75	60	H	H	H	H	-	-	-	H	H	H	H	H	-	-	-
CLO-2 :	*Master the sound systems of English*	2	80	70	H	H	H	-	-	-	-	H	H	H	H	H	-	-	-
CLO-3 :	*Have a better Word stress, Rhythm and Intonation*	2	70	65	H	H	H	-	H	H	-	-	H	H	H	H	-	-	-
CLO-4 :	*Develop Neutral Accent*	2	70	70	H	H	H	-	H	-	-	-	-	-	H	H	-	-	-
CLO-5 :	*Participate in any conversation with any native speaker*	2	80	70	H	H	-	H	-	H	-	H	H	H	H	H	-	-	-
CLO-6 :	*Clear any standardized tests conducted to measure the English language ability like IELTS and TOEFL*	2	75	70	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Introduction to Digital language lab - helps in the listening skills by providing an interactive environment to the students	*Learners are enabled to record their speech and listen to it in order to correct their lacuna*	*Reading software is used to facilitate reading exercises for the students*	*To enable the students to familiarize with word processor blogging*	Students are enabled to learn and pronounce stressed and unstressed words
	SLO- 2	The students will be able to converse fluently	*One will know himself where he/ she has gone wrong*	*Flow in reading will be improved*	*online publishing. Will be learnt by the students*	The practice will lead them to acquire neutral accent and understand foreign accent
S-2	SLO-1	*Students are exposed to functionallanguage*	*Fluency and Pronunciation to be evaluated*	*The usage of phonetics will be mandated.*	Enable the students in learning situational language	Common topics in IELTS speaking test and TOFEL will be provided to assess the students.
	SLO- 2	*This exposurewill help thempick up fluency*	*Their standard will measured*	*reading will be done in the class*	Create imaginary situations and students are allowed to engage in conversations	Assessments will be provided for self scrutiny
S-3 –	SLO-1	*Lab 1 In the wall of Pink Floyed to be played for the students*	*Lab 4 Students are given a situation, they need to write a respond for it by writing a*	*Lab 7 Introduction to the conversation of a native speaker/ interview of a*	*Lab 10* learners are asked to describe some visual information(	*Lab 13students will listen to a passage and they need to give a*

Duration (hour)		12	12	12	12	12
S-4			*letter requesting information or explaining the situation*	*native speaker*	table/charts/nature) in their own word	*suitable title*
	SLO- 2	*The students will be able to understand the isolation of a wall. It helps them to enhance their pronunciation*	*This will lead to understand the English letter conventions*	*Learners will prove the fluency by listening*	*They need to have a well organized thought of it using language accurately in a academic style.*	Assessment on their language competency and vocabulary
S-5	SLO-1	*They get familiarized with pronunciation styles*	*Learners to record and repeat new wordsagain and again*	*New words are to be referred in the reading passages and checked with the help of dictionaries*	*Familiarize the students with e-journals , e-guidance, e-magazines, e-Books, e-Library*	Listening topics in the IELTS listening test and TOFEL will be provided
	SLO- 2	*American and British styles are differentiated*	*Untill right prononciation isaquiredis not allowed to go to the Next session*	*Those new words are to be used in different contexts and sentences*	*Help students to access them as much as possible*	Assessment on their listening capacity is to be provided
S-6	SLO-1	*Listening to news bulletins and songswillbeenabled to help them to understand use of vocabulary*	*Learnerscanspeak English and compare the notes and exchange ideas*	*Comprehensive skills are enhanced and checked the level*	Enable the students to versatile writing	Reading topics in the IELTS reading test and TOFEL will be provided to assess the students.
	SLO- 2	*Will beenabled ti imitae the exact accent and prononciation*	*From the exchangedideascomprehensive questions willbeasked by the otherstudents*	*The levels are informed to the students and lcuna is explained*	Diffrerence in writing and readingisexplained	Assesment on their capacity is explained
S-7 – S-8	SLO-1	*Lab 2TedX will be played for the student*	*Lab 5introduction to semi-formal/ neutral discursive essay will be taught.*	*Lab 8television news will be broadcasted to them*	*Lab 11learners are given with a set of images where they need to write a story from it*	*Lab 14 students will listen to the great monologues of the time*
	SLO- 2	*It will help them to improve their fluency*	*It will teach them to write coherently and cohesively.*	*It will help them to understand the usage of words and the fluency of speaker*	*It helps them to keen on observation as well as to know their creativity.*	They will learn the importance of pronunciation, stress and pause in a speech
S-9	SLO-1	*To enable to listen to authentic sounds of the target language*	*Give different topics to debate to enable them talk fluently*	*The right pronunciation is checked with an access to articles fiction verses and speeches*	*Focus on writing is done*	writing topics in the IELTS writing test and TOFEL will be provided to assess the students.
	SLO- 2	*To enable them imitate the different sounds and accents and make them repeat it*	*To check the pace of their speech*	*Minute details and differences are marked and rectified*	*Conversational skills are enhanced*	Writing skills are assessed and tested
S-10	SLO-1	To enable to practice different accents focusing on intonation and voice modulation	*Dialogue delivery be checked by asking them to prepare for their own e- learning materials*	*Read and repeat passages*	Help in professionalwriting	Model IELTS and TOFEL test will be conducted for the students
	SLO- 2	The differences between intonation stress and modulations are explained	*Make the students speak and record*	*Check the ability to repeat the exact pronounciation*	Check and asses theirwritings	Assessment will be provided to the learners
S 11 - S 12	SLO-1	*Lab3 After listening to TedX, students need to jot down set of question.*	*Lab 6 learners will be taught to write a review for a film after watching*	*Lab 9 conversation between two people in every day context will be played for the studetns*	*Lab 12 students will listen to the writers note on publishing a novel/ short story*	*Lab 15 they will listen to grammar usage in the form of visual image and song*
	SLO- 2	This will help them to identify the key information in listening text.	*Leaner will need to think for the apt word. Through this language competency will be evaluated*	*It Will help them to understand the target language*	It will helps them to enhance their creativity also the language compétence	They will the foreign language easily and it enhances their competency of it

Learning Resources	***Theory:*** 1. Horizon- English Text Book – Compiled and Edited by the faculty of English Departement, FSH, SRMIST, 2020 2. *English Grammar in Use by Raymond Murphy* 3. *Raymond Murphy, Intermediate English Grammar, Cambridge University Press, 2007* 4. *R.P. Bhatnagar, English for Competitive Examinations, Trinity Press, 3rd Edition,2016* *5. http://www.aptitudetests.org/verbal-reasoning-test* *6. https://www.assessmentday.co.uk/aptitudetests_verbal.htm*

Learning Assessment

Level	Bloom'sLevel of Thinking	Continuous Learning Assessment (100% weightage)							
		CLA – 1 (20%)		CLA – 2 (20%)		CLA – 3 (30%)		CLA – 4 (30%)#	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	30%	-	30%	-	30%	-	30%
	Understand								
Level 2	Apply	-	30%	-	30%	-	30%	-	30%
	Analyze								
Level 3	Evaluate	-	40%	-	40%	-	40%	-	40%
	Create								
	Total	100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	*1. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST*
		2. Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

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Course Code	UNS20201L/ UNC20201L UNO20201L/ UYG20201L	Course Name	NSS/NCC/NSO/YOGA	Course Category	*E*	*Extension Activity*	L	T	P	C
							0	0	0	0

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	NSS/NCC/NSO/YOGA	Data Book / Codes/Standards	*Nil*		

Assessment is Fully Internal

Learning Assessment	
Assessment Tools	**Marks**
Continuous Learning Assessment –I (CLA-I)	20 Marks
Continuous Learning Assessment –II (CLA-II)	30 Marks
Continuous Learning Assessment –III (CLA-III)	30 Marks
Continuous Learning Assessment –IV (CLA-IV)	20 Marks
Total Marks	100 Marks

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SEMESTER III

Course Code	UCY20301T	Course Name	Physical Chemistry - II :Chemical Thermodynamics and its Applications	Course Category	C	Core course	L	T	P	C
							5	1	0	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Learn the thermodynamics properties and its limitations.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	Understand the concepts of energy, heat, work, enthalpy, entropy, free energies and the relation between them.																		
CLR-3 :	Understand the Carnot cycle and adiabatic expansion and compression.																		
CLR-4 :	Learn the concept of entropy and it's change in reversible and irreversible process.																		
CLR-5 :	Apply these processes, extend the thermodynamic properties to the system of variable compositions and equilibrium.																		
CLR-5 :	Understand the colligative properties and Osmotic pressure.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Explain three laws of thermodynamics, concepts of state and path functions, extensive and intensive properties.	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Derive the expressions of ΔU, ΔH, ΔS, ΔG, ΔA for ideal gases under different conditions.	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	H	-
CLO-3 :	Explain the concept of partial molar properties.	2	70	65	H	-	-		-	-	-	-	-	-	-	-	H	M	-
CLO-4 :	Derive the expression of equilibrium constants.	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	H	-
CLO-5 :	Explain the thermodynamic basis of colligative properties	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-6	Explain the theory of semipermeable membrane.	2	80	70	H	H	-	H	-	-	-	-	-	-	-	-	H	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to chemical thermodynamics	Joule Thomson effect	Carnot theorem	Determination of absolute entropies	Le-Chatlier principle,
	SLO-2	and limitations of thermodynamics	Coefficient in real gas	Concept of entropy	Of solid, liquid and gas	Factors affecting Le-chatlier principle
S-2	SLO-1	System- open, closed and isolated	Zeroth law of	Entropy change at constant T	Entropy of real gas	Free energy mixing and spontaneity
	SLO-2	Macroscopic properties	thermodynamics	Calculation of entropy change during flow of heat from higher to lower T	Calculation of absolute entropy of molecules	Equilibrium between ideal and pure condensed gas
S-3	SLO-1	Phase, state of a system	Introduction to thermochemistry	Calculation of entropy change of an ideal gas with change in P and V	Entropy changes in	Introduction to solution
	SLO-2	Variable	Change enthalpy in a reaction, exothermic and endothermic reaction	Entropy change in Isothermal expansion of an Ideal gas	chemical reactions	colligative properties- dilute solutions
S-4	SLO-1	Thermodynamics equilibrium	Standard enthalpies of reaction, combustion and neutralization	Entropy change in reversible process- ideal gas	Boltzman entropy equation	Colligative property- lowering of vapour pressure
	SLO-2	Extensive and Intensive properties	Enthalpy of solutions	Entropy change in irreversible process-	Residual entropy	Raoults law

Duration (hour)		18	18	18	18	18
				ideal gas		
S-5	SLO-1	Thermodynamic process	Variation of enthalpy of a reaction with temperature	Entropy change accompanying change of phase	Partial molar property	Osmotic pressure- relation between osmotic pressure
	SLO-2	Isothermal, adiabatic and reversible and irreversible properties	Kirchoff equation	Isothermal, Isobaric and Isochoric process	Partial molar free energy	And lowering of vapor pressure
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	First law of thermodynamics	Bond energies-	Entropy of mixture of ideal gas	Gibbs-Duhem equation	Theory of semipermeable membrane
	SLO-2	Internal energy	enthalpy formation of the bond	Boltzmann equation	Dependence of thermodynamic parameter on composition	Sieve, solubility theory
S-8	SLO-1	State functions	Application of	Standard entropy and physical significance of entropy	Variation of chemical potential with T	adsorption
	SLO-2	Exact and inexact differentials	Bond energies	Free energy function	Variation of chemical potential with P	And capillary theory
S-9	SLO-1	Eulers reciprocal	Flame and	Helmholtz free energy equation	Chemical potential in case of system of ideal gas	Reverse osmosis
	SLO-2	Cyclic rule	Explosion temperature	Gibbs free energy equation	-derivation	With phenomenon
S-10	SLO-1	Enthalpy - vaporization	Hess law of	Variation of free energy with T,P and V	Clapeyron-Clausius equation	Elevation of boiling point
	SLO-2	fusion	constant heat summations	Criteria for reversible process	derivation	Boiling point elevation constant
S-11	SLO-1	Heat capacity- relationship between	Applications of	Criteria for irreversible process	Integrated Clapeyron-Clausius equation	Determination of molar mass from
	SLO-2	Cp and Cv in gaseous system	Hess law	Limitation of criteria of reversible and irreversible process	Application of Clapeyron-Clausius equation for liquid = vapour	boiling point of elevation
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Isothermal expansion	Second Law: Limitation of first law	Gibbs Helmholtz equation	Application of Clapeyron-Clauses equation for solid-liquid equilibria	Depression in freezing point
	SLO-2	Work done in reversible isothermal expansion	Need for second law	Fugacity and physical significance	Change in thermodynamic function of mixing of ideal gas	Cryoscopic constant
S-14	SLO-1	Work done in reversible isothermal compression	Second law of thermodynamics	activity and physical significance	Chemical equilibria:Criteria of thermodynamic equilibrium	Determination of molar mass from
	SLO-2	Work done in irreversible isothermal expansion	Spontaneous process	Activity coefficient	Law of mass action	Depression in freezing point
S-15	SLO-1	Adiabatic expansion	Cyclic process	Standard states	Vant Hoff reaction isotherm	Vant hoff factor
	SLO-2	Calculation of ΔU, ΔH and W	Carnot cycle	Inversion temperature	Chemical equilibria of ideal gas	osmotic effect
S-16	SLO-1	Final temperature in reversible	Isothermal and adiabatic expansion	Maxwell equation	Thermodynamic derivation of relation between Gibbs free energy of a reaction and reaction coefficient.	Association and
	SLO-2	adiabatic expansion relation between T&P, T&V	Isothermal and adiabatic compression	Relation between Joule-Thomson coefficient and other thermodynamic parameter	Equilibrium constants and their dependence on T	Degree of association
S-17	SLO-1	Irreversible adiabatic	Efficiency of heat engine	Third law of thermodynamics	Equilibrium constants and their dependence on P	Dissociation, and
	SLO-2	expansion	Free energy change -spontanity	Nernst heat theorem	Equilibrium constants and their dependence on concentration	Degree of dissociation of salts

Duration (hour)		18	18	18	18	18
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	Theory: 1. Peter, A. & Paula, J. de. Physical Chemistry 9th Ed., Oxford University Press 2011. 2. Castellan, G. W. Physical Chemistry 4th Ed., Narosa, 2004. 3. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall , 2012.	4. McQuarrie, D. A. & Simon, J. D. Molecular Thermodynamics Viva Books Pvt. Ltd.: NewDelhi, 2004. 5. Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. Commonly asked Questions in Thermodynamics. CRC Press: NY 2011. 6. Levine, I .N. Physical Chemistry 6th Ed., Tata Mc Graw Hill, 2010. 7. Metz, C.R. 2000 solved problems in chemistry, Schaum Series , 2006.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	40%	-	30%	-	30%	-	30%	-	30%	-
Level 2	Apply Analyze	40%	-	40%	-	40%	-	40%	-	40%	-
Level 3	Evaluate Create	20%	-	30%	-	30%	-	30%	-	30%	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Dr. S.Ashok Kumar , SRMIST
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in	2. Dr. J.Arockiaselvi , SRMIST

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Course Code	UCY20302J	Course Name	Inorganic Chemistry-III: Coordination Chemistry	Course Category	C	Core course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

Learning	Program Learning Outcomes (PLO)

		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-1 :	Exploit concepts related to coordination chemistry to manifold applications in diverse areas like qualitative and quantitative analysis	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Employ various coordination compounds as catalysts in industrial processes as medicines, paints and pigments																		
CLR-3 :	Address concepts related to magnetic properties and color of complexes																		
CLR-4 :	Get knowledge ond and f block elements and get an idea about horizontal similarity in a period in addition to vertical similarity in a group																		
CLR-5 :	Employ reaction mechanisms of coordination compounds to differentiate kinetic and thermodynamic stability																		
CLR-6 :	Utilize the basic coordination chemistry principles applied in various scientific problems and identify appropriate solutions																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	Understand the basic terms and use standard rules to name coordination compounds	2	70	65	H	-	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Discuss the various types of isomerism possible in in a metal complex.	2	80	70	H	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Predict the structure of metal complexes and understand the inner and outer orbital complexes	2	75	60	-	H	-	-	-	-	-	-	-	-	-	-	-	H	-
CLO-4 :	Gaining the knowledge of magnetic properties and colour of complexes	2	70	70	H	-	-	H	H	-	-	-	-	-	-	-	H	-	-
CLO-5 :	Understand the important properties of transition metals and use Latimer diagrams to predict and identify different types species	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	-	H	M
CLO-6 :	Understand reaction mechanisms of coordination compounds and differentiate between kinetic and thermodynamic stability	2	75	65	-	-	H	-	-	-	-	-	-	-	-	-	-	H	M

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Introduction to Coordination Chemistry	outer orbital complexes	Qualitative aspect of MO Theory for octahedral sigma donor and π- acceptor complexes	potassium ferrocyanide	transition state
	SLO-2	Introduction to Coordination Chemistry	Examples	Qualitative aspect of MO Theory for octahedral sigma donor and π- acceptor complexes	potassium ferrocyanide	transition state
S-2	SLO-1	Recapitulation of Werner's Coordination theory	Introduction to Crystal field theory	Qualitative aspect of MO Theory for π-donor complexes	potassium ferricyanide	intermediate
	SLO-2	Recapitulation of Werner's Coordination theory	Introduction to Crystal field theory	Qualitative aspect of MO Theory for π-donor complexes	potassium ferricyanide	intermediate
S-3	SLO-1	IUPAC nomenclature of coordination compounds	Crystal field theory-Octahedral coordination	Introduction to Transition Elements	Sodium nitroprusside	activated complex

Duration (hour)		24	24	24	24	24
	SLO-2	IUPAC nomenclature of coordination compounds	Crystal field theory- Octahedral coordination	General group trends with special reference to electronic configuration	Sodium nitroprusside	activated complex
S-4	SLO-1	IUPAC nomenclature of coordination compounds	Calculation of CFSE in weak and strong fields	Colour, variable valency	sodium cobaltinitrite	Introduction to substitution reactions in square Planar complexes
	SLO-2	IUPAC nomenclature of coordination compounds	measurement of Δo and concept of pairingenergies	Colour, variable valency	sodium cobaltinitrite	Introduction to substitution reactions in square Planar complexes
S-5 to S-8	SLO-1	Lab Introduction	Estimation of Iodine Content in iodized salt	Estimation of Calcium content in milk.	Inorganic preparations- Cuprous Chloride, Cu_2Cl_2	Experiment - Repeat - 2
	SLO-2					
S-9	SLO-1	Introduction toisomerism in coordination compounds.	factors affecting the magnitude of Δo	magnetic properties	Lanthanoids and Actinoids: A brief discussion of electronic configuration and	Different types of substitution reactions in square Planar complexes
	SLO-2	Introduction toisomerism in coordination compounds.	factors affecting the magnitude of Δo	magnetic properties	oxidation states	Different types of substitution reactions in square Planar complexes
S-10	SLO-1	Structural isomerism in coordination compounds with CN 4 and 6	Crystal field theory-tetrahedral coordination	catalytic properties	Lanthanoids and Actinoids: colour	Kinetics of substitution reactions in square Planar complexes
	SLO-2	Structural isomerism in coordination compoundswith CN 4 and 6	Crystal field theory-tetrahedral coordination	catalytic properties	Lanthanoids and Actinoids: colour	Kinetics of substitution reactions in square Planar complexes
S-11	SLO-1	stereo isomerism in coordination compounds with CN 4 and 6	Crystal field theory-tetragonal distortions from octahedral geometry	Transition Elements-ability to form complexes	Lanthanoids and Actinoids: spectralproperties	Mechanisms of substitution reactions in square Planar complexes
	SLO-2	stereo isomerism in coordination compoundswith CN 4 and 6	Crystal field theory-square planar geometry	Transition Elements-ability to form complexes	Lanthanoids and Actinoids: spectralproperties	Mechanisms of substitution reactions in square Planar complexes
S-12	SLO-1	A brief idea about chelate effect	Introduction toJahn-Teller theorem	Latimer diagrams of Mn and Fe inacidic and basic media	Lanthanoids and Actinoids: magnetic properties	Examples of substitution reactions in square Planar complexes
	SLO-2	A brief idea about chelate effect	Introduction toJahn-Teller theorem	Latimer diagrams of Mn and Fe inacidic and basic media	Lanthanoids and Actinoids: magnetic properties	Examples of substitution reactions in square Planar complexes
S-13 To S-16	SLO-1	Iodo / Iodimetric TitrationsEstimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution	Complexometric titrations using disodium salt of EDTAEstimation of Mg^{2+},Zn^{2+}	Principles involved in chromatographic separations may be included: Paper cinematographic separation of following metal ions: a) Ni (II) and Co (II)	Inorganic preparations- Aluminium potassium sulphate $KAl(SO_4)_2 .12H_2O$ (Potash alum) or Chrome alum.	Experiment - Repeat - 3
	SLO-2					
S-17	SLO-1	labile and inert complexes	Jahn-Teller theorem-Examples	Latimer diagrams of Cu in acidic and basic media	Lanthanoid contraction-causes	Introduction to Trans- effect
	SLO-2	labile and inert complexes	Jahn-Teller theorem-Examples	Latimer diagrams of Cu in acidic and basic media	Lanthanoid contraction- effects	Introduction to Trans- effect
S-18	SLO-1	Valence bond theory	Qualitative aspect of Ligand field Theory for octahedral sigma donor complexes	A brief discussion of differences between the first, second and third transition series.	Separation of lanthanoids by ion exchange method.	theories of trans effect
	SLO-2	Valence bond theory	Qualitative aspect of Ligand field Theory	A brief discussion of differences between	Separation of lanthanoids by ion	theories of trans effect

Duration (hour)		24	24	24	24	24
			for octahedral sigma donor complexes	the first, second and third transition series.	exchange method.	
S-19	SLO-1	Its application to complexes of coordination numbers 4 and 6.	Qualitative aspect of Ligand field Theory for octahedral complexes	Some important compounds of Cr, Mn, Fe and Co and their roles as laboratory reagents;	Introduction to inorganic reaction mechanisms.	Trans- effect:Examples
	SLO-2	Its application to complexes of coordination numbers 4 and 6.	Qualitative aspect of Ligand field Theory for octahedral complexes	potassium permanganate	Introduction to inorganic reaction mechanisms.	Trans- effect:Examples
S-20	SLO-1	inner orbital complexes	Qualitative aspect of Ligand field Theory for π- donor complexes	potassium permanganate	Concept of reaction pathways	Thermodynamic and Kinetic stability (using VBT)
	SLO-2	Examples	Qualitative aspect of Ligand field Theory for π- donor complexes	its application	Concept of reaction pathways	Thermodynamic and Kinetic stability (using VBT)
S-21 to S-24	SLO-1	Estimation of antimony in tartar-emetic iodimetrically	Estimation of Ca^{2+} by substitution method	Paper cinematographic separation of following metal ions: Cu(II) and Cd(II)	Experiment - Repeat - 1	Demonstration Practical Session
	SLO-2					

Learning Resources	Theory:	Practicals:
	1. Atkins, P.,Overton, T. Shriver and Atkins' inorganic chemistry 6th Ed. Oxford University Press, USA, 2010. 2. Pfennig, B. W. Principles of Inorganic chemistry. John Wiley & Sons, 2015. 3. Purcell, K.F & Kotz, J.C., Inorganic Chemistry W.B. Saunders Co, 1977. 4. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993. 5. Cotton, F.A. & Wilkinson, G., Advanced Inorganic Chemistry Wiley-VCH, 1999. 6. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967. 7. Greenwood, N.N. & Earnshaw A., Chemistry of the Elements, Butterworth-Heinemann, 1997. 8. Miessler, G. L. &. Tarr, Donald A. Inorganic Chemistry 3rd Ed.(adapted), Pearson, 2009 9. Barnes, C. E. Inorganic Chemistry 4th Ed. (Catherine E. Housecroft and Alan G. Sharpe). Journal of Chemical Education, 2003.	1. Vogel, A.I. A text book of Quantitative Analysis, ELBS 1986. 2. G. Marr and B.W. Rockett, Practical Inorganic Chemistry

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Prof. M. Arthanareeswari, SRMIST
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in	2. Dr. S. Shanmugan, SRMIST

Course Code	UPY20A01J	Course Name	Allied Physics	Course Category	G	Generic Elective Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Physics and Nanotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO - 1	PSO - 2	PSO - 3
CLR-1 :	Understand and solve problems on fundamentals of physics																		
CLR-2 :	Acquire knowledge on materials properties																		
CLR-3 :	Correlate the acquired knowledge and use it for various applications																		
CLR-4 :	Familiarize themselves with interaction of light and matter																		
CLR-5 :	Apply physics methods and principles to solve problems in the majors.																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	Understand the fundamentals of physics	2	80	75	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-2 :	Evaluate and learn the structural, optical, nuclear and electronic properties of solids	2	80	70	H	M	M	H	M	H	H	H	M	H	M	H	M	M	M
CLO-3 :	Emphasize the significance of green technology and its applications	2	75	70	H	M	H	H	H	H	H	M	H	H	H	H	H	H	H
CLO-4 :	Gain comprehensive knowledge and sound understanding of fundamentals of light and material properties	2	80	75	M	H	H	M	H	H	H	H	H	H	M	H	H	H	H
CLO-5 :	Recognize how and when physics methods and principles can help address problems in their major	2	80	75	H	H	H	H	H	M	H	H	M	H	M	H	H	H	H
CLO-6 :	Develop skills on practical, analytical problem solving in physics	2	80	70	H	H	H	H	H	M	H	H	M	H	M	H	H	H	H

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Sources of conventional energy	Space lattice basis	Kinetic theory of gases	Electric charge - conservation of charge	Time period - amplitude - phase
	SLO-2	Need for non - conventional energy resources	Unit Cell, lattice parameters	Basic postulates	Permittivity	Wave nature of light
S-2	SLO-1	Solar energy and solar cells andits applications	Two dimensional andthreedimensional Bravaislattices	Ideal gas laws	Coulomb's law	Huygens's principle
	SLO-2	calculating energy generation by a solar cell	The seven crystal systems	Numerical problem solving on Ideal gas laws	Numerical problem solving on ,Coulomb's law	Numerical problem solving on amplitude, phase
S-3	SLO-1	Bio mass energy	Cubic crystal system	Van Der Waal's equation of states	Electric field	Interference
	SLO-2	Generation and applications of bio mass energy	Crystal symmetry	Derivation of Van Der Waal'sequation of states	Electric potential	Young's double slit experiment
S-4	SLO-1	Wind energy generation and applications	Reciprocal lattice and its importance	Pressure of an ideal gas	Gauss's law	Coherence
	SLO-2	Numerical evaluation of wind energy generation	Density and atomic packing fraction	Derivation of Pressure of an ideal gas	Applications of Gauss's law	Interference from thin films
S-5to S-8	SLO-1	Introduction to the Lab experimentation	Calculation of lattice cell parameters by X-ray diffraction	Determination of specific heat capacity of the liquid by Newtons's law of cooling	Calibration of Voltmeter using potentiometer	Determination of dispersive power of a prism using spectrometer
	SLO-2					

Duration (hour)		24	24	24	24	24
S-9	SLO-1	Nuclear energy - Atomic structure	Numerical on Density and atomic packing fraction	Laws of thermodynamics	Numerical problem solving onGauss's law	Michelson's interferometer
	SLO-2	Alpha, beta and gamma radiation	Crystal directions and planes	Problem solving on laws of Thermodynamics	Conductors and dielectrics	Diffraction - Wave theory of light
S-10	SLO-1	Law of radioactive decay	Introduction to Miller indices	Entropy	Electric Current	Numerical problem on interference
	SLO-2	Example problems in radioactivity	Numerical on Miller indices	Calculating numerical on entropy change	Problem on dielectrics and conductors	Light and Optics
S-11	SLO-1	Decay constant	Interplanar distance	Change of entropy in reversible and irreversible processes	Ohm's law	Fermat's principle
	SLO-2	Half-life and mean life	Numerical on interplanar distance	Change of entropy in irreversible processes	Magnetic induction	Laws of reflection and refraction
S-12	SLO-1	Nuclear energy	Hexagonal closely packed (HCP)structure	Low temperature	Permeability and susceptibility	Total internal reflection
	SLO-2	Applications of nuclear energy	Derivation of HCP atomic packing fraction	Joule - Kelvin effect-introduction	Numerical problem solving on Permeability and susceptibility	Illustrations of total internal reflection
S-13 to S-16	SLO-1	Study of the I-V Characteristic of a Solar Cell	Dielectric constant Measurement	Determination of thermal conductivity of a bad conductor using Lee's disc method	Calibration of Ammeter using potentiometer	Study of attenuation and propagation characteristics of optical fiber cable
	SLO-2					
S-17	SLO-1	Mass defect and binding energy	Numerical problem solving on HCP structure	J-K effect- theory	Magnetic field due to a current carrying conductor-Biot-Savart's law	Problem solving on total internal reflection
	SLO-2	Solving numerical based on binding energy and mass defect.	Diamond crystal structure	Applications of J-K effect	Numerical problem solving on Biot-Savart's law	Mirrors and lenses
S-18	SLO-1	Fission reaction	Derivation of APF for diamond structure	Liquefaction of gases	Ampere's circuital law	Lens makers formula
	SLO-2	Evaluating nuclear energy generation by fission reaction	Numerical problem solving on diamond structure	Linde's process	Faraday's law	Problem solving on Lens makers formula
S-19	SLO-1	Fusion reaction	X-ray diffraction	Nitrogen gas liquefaction	Basic Electronics	Defects of images
	SLO-2	Fusion energy cycles	Problem solving on X-ray diffraction	H, He gas liquefaction	P and N type semiconductors	Coma distortion
S-20	SLO-1	Biological effects of radiation	Single crystal diffraction	Adiabatic demagnetization-introduction	Junction Diode	Spherical aberration in lenses
	SLO-2	Numerical problems involving Nuclear energy	powder diffraction	Working principle of adiabatic demagnetization-	Characteristics of Junction Diode	Chromatic aberration in lenses
S-21 to S-24	SLO-1	Hall effect- Hall coefficient determination	Revision class for experiments	Determination of specific heat capacity of the liquid by Joule's calorimeter method	Band gap determination using Post Office Box – Specific resistance	Revision class for experiments
	SLO-2					

Learning Resources	1. ModernPhysics,MurugeshanandK.Sivaprasath,(S.Chandpublications,revisededition, 2015). 2. FundamentalsofPhysics,ResnickR.andHallidayD.,(WileyPublication,8thEdition, 2011)	3. Heat and Thermodynamics, Zemansky M. W. and Ditlman R.H., (Tata McGraw Hill,2011) 4. Allied Physics I, Sundaravelusamy A., (Priya Publications,2009)

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %
Level 2	Apply Analyze	40 %	40 %	40 %	40 %	40 %	40 %	40 %	40 %	40 %	40 %
Level 3	Evaluate Create	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %	30 %
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. R Seshadri, Titan Company Limited, seshadri@titan.co.in	Prof. C Vijayan, IIT Madras, cvijayan@iitm.ac.in	Mr. Sandeep K. Lakhera, SRMIST
Dr. N Vijayan, NPL, nvijayan @nplindia.org	Prof. S Balakumar, University of Madras, balakumar@unom.ac.in	Dr. Gunasekran, SRMIST

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Course Code	UJK20301T	Course Name	Universal Human Values	Course Category	JK	Life Skill Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*To generate in students a sensitivity to current regional and national issues such as gender marginalization Eco sensitivity, vision for the Nation and general humanness*			
CLR-2 :	*An expanded consciousness with a mind to accommodate all is developed*			
CLR-3 :	*The ability to accept all and to co- exist is initiated*			
CLR-4 :	To create community connectivity and interdependence			
CLR-5 :	To instill intrinsic link between freedom and responsibility for both individuals and communities			
CLR-6 :	Make them learn the basic nature of human beings			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
CLO-1 :	*Become sensitive toward every living life and be able to respect every religion recognizing the universal values*	2	75	60	H	H	H	H	-	-	-	H	H	H	H	H	-	-	-
CLO-2 :	*Every way of life and culture will kindle the curiosity in them to know them and will be able appreciate the beauty in it*	2	80	70	H	H	H	H	-	-	-	H	H	H	H	H	-	-	-
CLO-3 :	*The presumptuous or prejudiced mentality will be overcome by them*	2	70	65	H	H	H	H		-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Critical thinking and accommodative nature will become so natural way of thinking for them*	2	70	70	H	H	H	H	H	-	-	-	-	-	H	-	-	-	-
CLO-5 :	*They will become aware of the social inequalities and justice*	2	80	70	H	H	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*Will be able to explore their own emotions, hopes & fear and be able to describe them verbally*	2	75	70	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Duration (hour)		06	06	06	06	06
S-1	SLO-1	What is love? Forms of love. For self, parents, family, friends, spouse, community, nation, humanity and other beings, both for living and non living	*Love compassion empathy sympathy and non violence*	*Narratives and anecdotes from history, literature including local folklore*	*What will learners lose if they don't practice love and compassion?*	*Sharing learners' individual and/ or group experiences*
	SLO-2	Love and Compassion inter relatedness	*Individuals who are remembered in history for practicing compassion and love*	*Practicing Love and Compassion: what will they gain if they practice compassion?*	*Simulated situations*	Case studies
S-2	SLO-1	*WhatisTruth ?*	*Universal truth, truth as value, as fact,*	*Veracity, sincerity, honesty among others*	Individuals who are remembered in the history who have practiced these values	Practicing truths

Duration (hour)		06	06	06	06	06
	SLO-2	*: what will they gain if they practice truth*	*What will learners lose if they don't practice truth?*	*Sharing learners' individual and/ or group experiences*	*Simulated situations*	Case studies
S-3	**SLO-1**	*What is non violence – its need, love compassion,*	*empathy sympathy for others as pre- requisites for non- violence*	Ahimsa as non violence and non killing	*Individuals and their organizations which are known for their commitment for non violence*	Narratives and anecdotes about non violence from history and literature including local folklore
	SLO-2	Practicing non violence	*What will they gain if they practice non violence*	*What will learners lose if they don't practice non violence?*	*Simulated situations*	Case studies
S-4	**SLO-1**	*Whatisrighteousness ?*	*Righteousness and Dharma*	*Righteousness and priority*	Individuals who are remembered in the history who have practicing righteousness.	Narratives and anecdotes about Righteousness from history and literature including local folklore
	SLO-2	Practicing *Righteousness*	*: Sharing learners' individual and/ or group experiences*	*what will learners lose if they don't practice Righteousness*	*Simulated situations*	Case studies
S-5	**SLO-1**	*What is peace?*	*Need of peace in Relation with harmony and balance*	Narratives and anecdotes about peace from history and literature including local folklore	Individuals who are remembered in the history who have practicing peace	Practicingpeace
	SLO-2	*What will they gain if they practice peace*	*what will learners lose if they don't practice peace*	*Sharing learners' individual and/ or group experiences*	*Simulated situations*	Case studies
S-6	**SLO-1**	What is service and renunciation	*Forms of service , & renunciation Individuals who have recommended service in history*	*Practicing service and renunciation*	Narratives and anecdotes about Service & renunciation from history and literature including local folklore	Individuals who are remembered in the history who have practicing renunciation
	SLO-2	*Sharing learners' individual and/ or group experiences on renunciation*	*Sharing learners' individual and/ or group experiences on service*	*what will learners lose or gain if they do/don't practice Renunciation and service*	*Simulated situations*	Case studies

Learning Resources	***Theory:*** 1. "Universal Human Values: Text Book"– Compiled and Edited by the Faculty of Science and Humanites, SRMIST, 2020.

Learning Assessment									
Level	Bloom'sLevel of Thinking	Continuous Learning Assessment (100% weightage)							
		CLA – 1 (20%)		CLA – 2 (20%)		CLA – 3 (30%)		CLA – 4 (30%)#	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	40%	-	40%	-	40%	-
	Understand								
Level 2	Apply	40%	-	40%	-	40%	-	40%	-
	Analyze								
Level 3	Evaluate	20%	-	20%	-	20%	-	20%	-
	Create								
	Total	100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
	1. Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	*1. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST*
		2. Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

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SEMESTER IV

Course Code	UCY20401J	Course Name	Organic Chemistry - II: Halogenated Compounds and Oxygen Containing Functional Groups	Course Category	C	Core course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	The core course Organic Chemistry II is designed in a manner that gives a better understanding of the organic functional groups			
CLR-2 :	Gains extensive conceptual knowledge on halogenated hydrocarbons and their reactivity patterns			
CLR-3 :	Gains extensive conceptual knowledge on oxygen containing functional groups and their reactivity patterns			
CLR-4 :	The detailed reactions mechanistic pathways for each functional group will be discussed			
CLR-5 :	To unravel the spectrum of organic chemistry and the extent of organic transformations			

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

		Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Understand preparation, properties and reactions of haloalkanes	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	H-	-	-
CLO-2 :	Understand preparation, properties and reactions of haloarenes	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Understand preparation, properties and reactions of oxygen containing functional groups	2	70	65	H	-	-		-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	Use the synthetic chemistry learnt in this course to do functional group transformations	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	H	M
CLO-5 :	To propose plausible mechanisms for any relevant reaction	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	H	M

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Chemistry of Halogenated Hydrocarbons :Alkyl halides: Methods of preparation	Nucleophilic aromatic substitution; Benzyne mechanism	Phenol: Ring substitution reactions	Mechanisms of Aldol and Benzoin condensation	Carboxylic Acids and their DerivativesGeneral methods of preparation
	SLO-2	Alkyl halides: Methods of preparation	Nucleophilic aromatic substitution; Benzyne mechanism	Phenol: Ring substitution reactions	Mechanisms of Aldol and Benzoin condensation	General methods of preparation
S-2	SLO-1	Alkyl halides: Properties	Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions	Reimer–Tiemann reaction with mechanism	Knoevenagel condensation	Physical properties and reactions of monocarboxylic acids
	SLO-2	Alkyl halides: Properties	Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions	Kolbe's–Schmidt Reactions with mechanism	Claisan-Schmidt reaction	Physical properties and reactions of monocarboxylic acids
S-3	SLO-1	Nucleophilic substitution reactions – S_N1	Organometallic compounds of Mg (Grignard reagent)	Fries rearrangements with mechanism	Perkin reaction	Effect of substituents on acidic strength
	SLO-2	Nucleophilic substitution reactions – S_N1	Organometallic compounds of Mg (Grignard reagent)	Fries rearrangements with mechanism	Cannizzaro reaction	Effect of substituents on acidic strength

Duration (hour)		24	24	24	24	24
S-4	SLO-1	*Nucleophilic substitution reactions – S_N2*	*Grignard Reagent: Use in synthesis of organic compounds*	*Claisen rearrangements with mechanism*	*Wittig reaction*	*Typical reactions of dicarboxylic acids*
	SLO-2	*Nucleophilic substitution reactions – S_N2*	*Grignard Reagent: Use in synthesis of organic compounds*	*Claisen rearrangements with mechanism*	*Beckmann rearrangements*	*Typical reactions of dicarboxylic acids*
S-5 to S-8	SLO-1	*Lab Introduction*	*Organic Preparation: Acetylation of one of the following compounds: Phenols (ß -naphthol, vanillin, salicylic acid) using conventional and green approach*	*Selective reduction of meta dinitrobenzene to m-nitroaniline*	*S-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid)*	*Experiment-Repeat-2*
	SLO-2					
S-9	SLO-1	*Nucleophilic substitution reactions – S_Ni*	*Alcohol, Phenol, Ether and Epoxides : Alcohols: preparation*	*Ethers and Epoxides: Preparation*	*Benzil-Benzilic acid rearrangements*	*Typical reactions of hydroxy acids*
	SLO-2	*Nucleophilic substitution reactions – S_Ni*	*Alcohols: preparation*	*Ethers and Epoxides: Preparation*	*Haloform reaction*	*Typical reactions of hydroxy acids*
S-10	SLO-1	*Mechanisms with stereochemical aspects*	*Alcohols: Properties*	*Ethers and Epoxides: Reactions with acids*	*Baeyer Villiger oxidation*	*Typical reactions of unsaturated acids*
	SLO-2	*Mechanisms with stereochemical aspects*	*Alcohols: Properties*	*Ethers and Epoxides: Reactions with acids*	*α - substitution reactions*	*Typical reactions of unsaturated acids*
S-11	SLO-1	*Effect of solvent*	*Relative reactivity of 1°, 2°, 3° alcohols*	*Reactions of epoxides with alcohols, ammonia derivatives*	*Clemmensen reduction*	*Preparation and reactions of acid chlorides and anhydrides*
	SLO-2	*Effect of solvent*	*Relative reactivity of 1°, 2°, 3° alcohols*	*Reactions of epoxides with alcohols, ammonia derivatives*	*Wolff-Kishner reduction*	*Preparation and reactions of acid chlorides and anhydrides*
S-12	SLO-1	*Nucleophilic substitution vs. elimination*	*Bouvaelt Blanc Reduction*	*Reactions of epoxides with $LiAlH_4$*	*$LiAlH_4$ reduction*	*Preparation and reactions of esters*
	SLO-2	*Nucleophilic substitution vs. elimination*	*Bouvaelt Blanc Reduction*	*Reactions of epoxides with $LiAlH_4$*	*$NaBH_4$ reduction*	*Preparation and reactions of esters*
S-13 To S-16	SLO-1	*Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group*	*Benzolyation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and one of the following phenols (ß -naphthol, resorcinol, p- cresol) by Schotten-Baumann reaction*	*Hydrolysis of amides and esters*	*Aldol condensation using either conventional or green method. The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.*	*Experiment-Repeat-3*
	SLO-2					
S-17	SLO-1	*Aryl halides: Preparation*	*Oxidation of diols by periodic acid and lead tetraacetate*	*Carbonyl Compounds : Structure and reactivity*	*MPV reduction*	*Preparation and reactions of amide*
	SLO-2	*Aryl halides: Preparation*	*Oxidation of diols by periodic acid and lead tetraacetate*	*Structure and reactivity*	*PDC oxidation*	*Comparative study of nucleophilic substitution at acyl group - Mechanism of acidic and alkaline hydrolysis of esters.*
S-18	SLO-1	*Preparation from diazonium salts*	*Pinacol-Pinacolone rearrangement*	*Preparation*	*Addition reactions of α, β- unsaturated carbonyl compounds: Michael addition*	*Comparative study of nucleophilic substitution at acyl group - Mechanism of acidic and alkaline hydrolysis of esters*
	SLO-2	*Preparation from diazonium salts*	*Pinacol-Pinacolone rearrangement*	*Preparation*	*Active methylene compounds: Keto-enol tautomerism*	*Mechanism of Claisen condensation*
S-19	SLO-1	*Aryl halides: Properties*	*Phenols: Preparation*	*Nucleophilic additions*	*Active methylene compounds: Preparation*	*Mechanism of Dieckmann reactions*

Duration (hour)		24	24	24	24	24
	SLO-2	*Aryl halides: Properties*	*Phenols: Preparation*	*Nucleophilic additions*	*Active methylene compounds: Preparation*	*Mechanism of Reformatsky reactions*
S-20	SLO-1	*Nucleophilic aromatic substitution; S_NAr*	*Phenols: Properties; Acidity and factors effecting it*	*Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism*	*Synthetic applications of diethyl malonate and ethyl acetoacetate*	*Mechanism of Hofmann- bromamide degradation*
	SLO-2	*Nucleophilic aromatic substitution; S_NAr*	*Phenols: Properties; Acidity and factors effecting it*	*Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism*	*Synthetic applications of diethyl malonate and ethyl acetoacetate*	*Mechanism of Curtius rearrangement*
S-21 to S-24	SLO-1	*Organic Preparation: Acetylation of one of the following compounds: Amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) using conventional and green approach*	*Oxidation of ethanol/ isopropanol (Iodoform reaction)*	*Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde*	*Experiment-Repeat-1*	*Demonstration Practical Session*
	SLO-2					*Demonstration Practical Session*

Learning Resources	*Theory:* 1. *Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).* 2. *Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).* 3. *Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc* 4. *Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education 2009.*	*Practicals:* 1. *Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson, 2012* 2. *Ahluwalia, V.K. &Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and QuantitativeAnalysis, University Press, 2000.* 3. *Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, UniversityPress 2000.*

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. Gopal ChandruSenadi, SRMIST*

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Course Code	UCY20402J	Course Name	Physical Chemistry - III: Phase Equilibria and Electrochemical Cells	Course Category	C	Core course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
CLR-1 :	To understand concepts of electrochemistry in batteries and fuel cell.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	To understand the phase, co-existence of phases, phase diagram.			
CLR -3:	To understand the concept of Ideal and non-ideal solutions.			
CLR-4:	To learn the CST of miscible liquids and distribution laws.			
CLR-5:	To understand surface phenomenon, adsorption and its factors.			
CLR-6	To understand the various adsorption isotherm - BET Equation.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Explain the phase rule and its derivation with applications.	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	H	M	-
CLO-2 :	Explain phase equilibrium, criteria, Gibbs-Duhem Margules Equation.	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Explain the terms of electrochemistry, including different electrode applications and role of electrolyte concentration.	2	75	60	H					M						H	H		
CLO-4 :	Explain the application of electrochemistry in cell battery, corrosion and happenings in surroundings.	2	75	60	H	H	H	H	H	H	H		H					M	H
CLO-5 :	Explain the surface chemistry of adsorption.	2	75	60	H		M		H							H	H		
CLO-6:	Derive the various adsorption isotherm expresions.	2	75	60	H		M		H							H	H		

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Introduction to Phase rule	Introduction to binary solutions	Factors influencing the solubility of gas	Standard electrode potential	By using quinhydrone electrode
	SLO-2	and its components	Raoults law, Ideal solution	Correlation between Henry and Raoults law	Electrochemical series	And its limitations
S-2	SLO-1	Degree of freedom	Vapor pressure of	Nernst distribution	Electromotive force of	pH determination of gas electrode,
	SLO-2	Conditions for equilibrium between phases	ideal solution	And its derivation	galvanic cell	SbO/Sb_2O_3
S-3	SLO-1	Derivation of Gibbs phase rule	Chemical potential of Ideal ,	Application to	Activity and	Qualitative discussion of
	SLO-2	For reactive and non-reactive systems	Non-ideal solutions.	Nernst equation.	Mean ionic activity of an electrolyte	potentiometric titrations,
S-4	SLO-1	One component system	Gibbs- Duhem – Margules	Introduction to Electrochemical cell	Concentration cell- Electrode concentration cell	Acid- base
	SLO-2	Water system with applications	Equation with derivation.	Galvanic cell	Electrolyte - Concentration cell	Titrations,
S-5 to S-8	SLO-1	1.Determination of critical solution temperature and composition at CST of the phenol water system andto	4. Study of equilibrium of atleast one of the following reactions by distribution method:a. I_2 (aq) + I^- (aq) → I_3^-(aq)	Repetition Lab	Repetition Lab	Repetition Lab
	SLO-2					

Duration (hour)		24	24	24	24	24
		study the effect of impurities of NaCl and succinic acid on it.	*b. Cu^{2+} (aq) + $nNH_3 \rightarrow [Cu(NH_3)_n]^{2+}$*			
S-9	**SLO-1**	*Clausius-Clapeyron equation*	*Thermodynamics of*	*Reversible electrodes-*	*Types of electrolyte – concentration cells*	*Redox Titrations*
	SLO-2	*Meta stable equilibrium, effect of change of P and T*	*Ideal solution*	*Metal –Metal ion electrodes, gas electrode*	*Without transference,*	*Redox Titrations*
S-10	**SLO-1**	*Phase diagram for Sulphur*	*Vapour pressure of real*	*Metal – Insoluble metal salt electrode*	*Concentration cell-*	*Precipitations Titrations*
	SLO-2	*With its applications*	*and non-ideal solutions*	*Oxidation-reduction electrodes*	*with transference*	*Precipitations Titrations*
S-11	**SLO-1**	*Including meta stable equilibrium*	*Fractional distillation of Binary miscible liquid*	*Single electrode Potential*	*Liquid junction*	*Introduction to surface*
	SLO-2	*And areas*	*Solution of type I, II and III*	*Single electrode Potential*	*Potential,*	*chemistry, adsorption-*
S-12	**SLO-1**	*Comparison between the phase diagram*	*Lever rule*	*Thermodynamics of reversible cell*	*Fuel cell-*	*Applications.*
	SLO-2	*of CO_2 and Water*	*and distillation of immiscible liquids*	*And electrodes*	*(hydrogen-oxygen)*	*Factors influencing the adsorption*
S-13 To S-16	**SLO-1**	*2. Construction of the phase diagram using cooling curves or ignition tube method: a.simple eutectic and b. congruently melting systems.*	*5. Perform the following potentiometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base*	*Repetition Lab*	*Repetition Lab*	*Repetition Lab*
	SLO-2					
S-17	**SLO-1**	*Polymorphism*	*Solubility of partially*	*Determination of ΔG^o,*	*Applications of EMF measurements*	*Freundlich adsorption*
	SLO-2	*Two component system*	*Miscible liquids*	*ΔS^o and ΔH^o*	*Determination of activity coefficient of electrolytes*	*Isotherm,*
S-18	**SLO-1**	*Simple eutectic system*	*CST and*	*Electromotive force and*	*Determination of Transport number*	*Langmuir theory of Adsorption*
	SLO-2	*Thermal analysis cooling curve*	*Phenol – water system*	*equilibrium constant of a cell*	*Valency of Ions in doubtful cases*	*Langmuir theory of Adsorption*
S-19	**SLO-1**	*System in which two component form a stable compound*	*Aniline- Hexane system*	*Effect of concentration of electrolyte on cell potential*	*Determination of the solubility product constants*	*BET theory of multilayer Adsorption*
	SLO-2	*Formation of compounds with congruent melting point*	*Triethylamine- Water system*	*Effect of concentration of electrolyte on cell potential*	*Determination of the solubility product constants*	*BET theory of multilayer Adsorption*
S-20	**SLO-1**	*Formation of compounds with incongruent melting point*	*Solution of gaseous in liquids*	*Effect of concentration of electrolyte on cell potential*	*Determination of pH- using hydrogen electrode*	*Types of adsorption Isoptherm*
	SLO-2	*Transition temperature*	*Solution of gaseous inliquids*	*Effect of concentration of electrolyte on cell potential*	*Determination of pH- using hydrogen electrode*	*Types of adsorption Isoptherm*
S-21 to S-24	**SLO-1**	*3. Distribution of acetic acid/benzoic acid between water and chloroform or cyclohexane.*	*6. Perform the following potentiometric titrations: i. Dibasic acid vs. strong base ii. Potassium dichromate vs. Mohr's salt*	*Repetition Lab*	*Repetition Lab*	*Repetition Lab*
	SLO-2					

Learning Resources	*Theory:* 1. *Peter Atkins & Julio De Paula, Physical Chemistry 9th Ed., Oxford University Press 2010.* 2. *Castellan, G. W. Physical Chemistry, 4th Ed., Narosa , 2004..* 3. *McQuarrie, D. A. & Simon, J. D., Molecular Thermodynamics, Viva Books Pvt. Ltd.: New Delhi , 2004.* 4. *Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall, 2012.* 5. *Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. Commonly Asked Questions in Thermodynamics. CRC Press: NY, 2011.*	*Practicals:* 1. *Zundhal, S.S. Chemistry concepts and applications Cengage India, 2011.* 2. *Ball, D. W. Physical Chemistry Cengage India, 2012.* 3. *Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP , 2009.* 4. *Levine, I. N. Physical Chemistry 6th Ed., Tata McGraw-Hill , 2011.* 5. *Metz, C. R. Physical Chemistry 2nd Ed., Tata McGraw-Hill 2009* .

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Dr. S. Ashok Kumar, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. J.Arockiaselvi, SRMIST*

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Course Code	UCY20D01T	Course Name	*Polymer Chemistry*	Course Category	*D*	Discipline specific elective	L	T	P	C
							5	1	0	6

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*To provide the knowledge regarding history of polymeric materials, functionality, nomenclature and texture of polymers.*
CLR-2 :	*Learning this course will help to distinguish different polymerization reactions and their mechanisms/kinetics, and learn how actual polymerization is performed in the laboratory.*
CLR-3 :	*Student will be able to develop skills to predict which polymerization reactions is suitable for a new monomer.*
CLR-4 :	*Get knowledge on glass transition temperature (Tg), melting temperature (Tm), crystallinity and structure property relationships of the polymers, This will improve and expand the skills in performing and analyzing the thermal properties of polymers, and demonstrate an ability to predict how the molecular weight will affect these properties.*
CLR-5 :	*Learning this course will develop skills necessary to synthesize and characterize polymeric materials, molecular weight of polymers, solubility and degradation of polymers.*
CLR-6 :	*Get knowledge on preparation, structure, properties and application of various types of polymers. Learning this course will help to design new polymers for commercial application.*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Get knowledge on history of polymeric materials and their classification	*2*	*70*	*65*	-	-	-	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	Learn about different mechanisms of polymerization and also polymerization techniques	*2*	*80*	*70*	*H*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	Get knowledge on different methods of finding out average molecular weight of polymers, dispersity	*2*	*75*	*60*	-	*H*	*H*	*H*	-	-	-	-	-	-	-	-	*H*	*M*	-
CLO-4 :	Can determine Tg and Tm, differentiate Tg and Tm and establish structure property relationships of polymers.	*2*	*70*	*70*	*H*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	*H*	*M*
CLO-5 :	Know about solution properties of polymers	*2*	*80*	*70*	-	*H*	-	-	-	-	*H*	-	-	-	-	-	*H*	-	-
CLO-6 :	Learn properties and applications of various useful polymers in our daily life.	*2*	*75*	*65*	-	*H*	*H*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	*H*

Duration (hour)		18	18	18	18	18
S-1	SLO-1	*History of polymeric materials*	*Mechanism of step growth polymerization*	*Glass transition temperature*	*Introduction: Molecular weight of polymers*	*Properties of Polymers: Brief Introduction*
	SLO-2	*History of polymeric materials*	*Mechanism of step growth polymerization*	*determination of Tg,*	*Number – average molecular weights (Mn)*	*preparation, structure, properties and application of polymers- polyolefins*
S-2	SLO-1	*History of polymeric materials*	*Mechanism of step growth polymerization*	*determination of Tg,*	*Weight– average molecular weights (Mw)*	*polyolefins*
	SLO-2	*History of polymeric materials*	*Mechanism of step growth polymerization*	*determination of Tg,*	*Determination of molecular weight of polymers by-end group analysis*	*polystyrene*
S-3	SLO-1	*Different schemes of classification of polymers*	*kinetics of step growth*	*determination of Tg,*	*-end group analysis*	*polystyrene*

Duration (hour)		18	18	18	18	18
	SLO-2	*Different schemes of classification of polymers*	*kinetics of step growth*	*Free volume theory*	*-viscometry*	*styrene copolymers*
S-4	SLO-1	*Different schemes of classification of polymers*	*kinetics of step growth*	*Free volume theory*	*-viscometry*	*styrene copolymers*
	SLO-2	*Different schemes of classification of polymers*	*kinetics of step growth*	*Free volume theory*	*-viscometry*	*poly(vinyl chloride)*
S-5	SLO-1	*Polymer nomenclature*	*radical chain growth*	*WLF equation*	*- light scattering*	*poly(vinyl chloride)*
	SLO-2	*Polymer nomenclature*	*radical chain growth*	*WLF equation*	*-light scattering*	*poly(vinyl acetate)*
S-6	SLO-1	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*
	SLO-2	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*
S-7	SLO-1	*Polymer nomenclature*	*Kinetics of radical chain growth*	*Factors affecting glass transition temperature (Tg)*	*osmotic pressure*	*acrylic polymers,*
	SLO-2	*Molecular forces and chemical bonding in polymers*	*Kinetics of radical chain growth*	*Factors affecting glass transition temperature (Tg)*	*osmotic pressure*	*fluoro polymers,*
S-8	SLO-1	*Molecular forces and chemical bonding in polymers*	*ionic polymerization*	*Factors affecting glass transition temperature (Tg)*	*Molecular weight distribution and its significance*	*fluoro polymers,*
	SLO-2	*Molecular forces and chemical bonding in polymers*	*Cationic polymerization*	*Factors affecting glass transition temperature (Tg)*	*Molecular weight distribution and its significance*	*polyamides,*
S-9	SLO-1	*Texture of Polymers.*	*Cationic polymerization*	*Determination of crystalline melting point*	*Polydispersity*	*polyamides,*
	SLO-2	*Texture of Polymers.*	*Kinetics of Cationic polymerization*	*Determination of crystalline melting point*	*Polymer solutions: Introduction*	*polyamides,*
S-10	SLO-1	*Texture of Polymers.*	*Kinetics of Cationic polymerization*	*Determination of crystalline melting point*	*Criteria for polymer solubility and solubility parameter*	*phenol formaldehyde resins (Bakelite)*
	SLO-2	*Texture of Polymers.*	*Kinetics of Cationic polymerization*	*Determination of degree of crystallinity,*	*Criteria for polymer solubility and solubility parameter*	*Novalac*
S-11	SLO-1	*Criteria for synthetic polymer formation*	*Anionic polymerization*	*Determination of degree of crystallinity,*	*Thermodynamics of polymersolutions*	*polyurethanes*
	SLO-2	*Criteria for synthetic polymer formation*	*Anionic polymerization*	*Determination of degree of crystallinity,*	*Thermodynamics of polymersolutions,*	*polyurethanes*
S-12	SLO-1	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*
	SLO-2	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*
S-13	SLO-1	*classification of polymerization processes,*	*Kinetics of Anionic polymerization*	*Morphology of crystalline polymers,*	*entropy, enthalpy and free energy change of mixing of polymers solutions.*	*silicone polymers*
	SLO-2	*classification of polymerization processes,*	*Kinetics of Anionic polymerization*	*Morphology of crystalline polymers,*	*entropy, enthalpy and free energy change of mixing of polymers solutions.*	*silicone polymers*
S-14	SLO-1	*functionality, extent of reaction and degree of polymerization.*	*Mechanism and kinetics of copolymerization*	*Morphology of crystalline polymers,*	*Degradation-Thermal*	*polydienes*
	SLO-2	*functionality, extent of reaction and degree of polymerization.*	*Mechanism and kinetics of copolymerization*	*Factors affecting crystalline melting point.*	*-Thermal*	*Polycarbonates*
S-15	SLO-1	*Bifunctional systems,*	*Mechanism and kinetics of copolymerization*	*Factors affecting crystalline melting point.*	*-oxidative*	*Conducting Polymer [polyacetylene]*
	SLO-2	*Bifunctional systems,*	*Mechanism and kinetics of copolymerization*	*Factors affecting crystalline melting point.*	*-oxidative*	*polyaniline*

Duration (hour)		18	18	18	18	18
S-16	SLO-1	*Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems,*	*polymerization techniques.*	*Structure Property relationships.*	*-Hydrolytic*	*polyaniline*
	SLO-2	*Relationships between functionality, extent of reaction and degree of polymerization. Polyfunctional systems,*	*polymerization techniques.*	*Structure Property relationships.*	*-Hydrolytic*	*poly(p-phenylene sulphide)*
S-17	SLO-1	*Relationships between functionality, extent of reaction and degree of polymerization. Polyfunctional systems,*	*polymerization techniques.*	*Structure Property relationships.*	*-photodegradation*	*polypyrrole*
	SLO-2	*Relationships between functionality, extent of reaction and degree of polymerization. Polyfunctional systems,*	*polymerization techniques.*	*Structure Property relationships.*	*-photodegradation*	*polythiophene*
S-18	SLO-1	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*
	SLO-2	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*	*tutorial hours*

Learning Resources	
1. *G.Odian, Principles of Polymerization, 4nd Ed., John Wiley & Sons, New York, 2004.* 2. *Fred. W. Billmeyer, Textbook of Polymer Science, 3rd edition, Wiley India, Delhi, 2008.* 3. *P.J.Flory, Principles of Polymer Chemistry, Cornell University press, New York, 1953.*	*4. P. Ghosh: Polymer Science & Technology, Tata Mcgraw-Hill.* *5. V.R.Gowariker, N.V.Viswanathan and J. Sreedhar, Polymer Science, New Age International, New Delhi, 2003.* *6. Jeol R. Fried, Polymer Science and Technology, Prentice Hall of India PrivateLimited, New Delhi, 1999.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. Samarendra Maji, SRMIST*

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Course Code	UCY20D02T	Course Name	Analytical Chemistry	Course Category	D	Discipline specific elective	L	T	P	C
							5	1	0	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
CLR-1 :	Familiarization with fundamentals of analytical chemistry and basics of spectroscopic, thermal, electrochemical techniques.	1	2	3
CLR-2 :	Learning basics of separation techniques and its applications and Understanding analytical tools, statistical methods applied to analytical chemistry.			
CLR-3 :	Understanding principle of UV-Vis spectroscopy and its applications.			
CLR-4 :	Understanding principles of thermo-gravimetric analysis and study of thermaldecomposition of materials/characterization of materials			
CLR-5 :	Understanding basics of electro-analytical techniques and its applications.			
CLR-6 :	Understanding principles of separation technology and its use in advanced Instrumentations.			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	How to perform experiment with accuracy and precision.	2	75	60
CLO-2 :	Develop methods of analysis for different samples independently.	2	80	70
CLO-3 :	Understand basic principle of instrument like,UV-VISIBLE.	2	70	65
CLO-4 :	Learn separation of analytes by chromatography.	2	70	70
CLO-5 :	Thermo-gravimetric Analysis of different compounds and application of mathematicalmodels	2	80	70
CLO-6 :	Analysis of GC/HPLC data for known materials/compounds.	2	75	70

Program Learning Outcomes (PLO)

	1 Fundamental Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	H	H	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	-	H	-	H	-	-	-	-	-	-	-	-	-	H	H
CLO-3 :	H	-	-	-	-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	H	-	H	H	H	-	-	-	-	-	-	-	H	-	-
CLO-5 :	-	H	-	H	-	-	-	-	-	-	-	-	M	H	-
CLO-6 :	-	-	-	-	-	-	-	-	-	-	-	-	-	H	M

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Qualitative and quantitative aspects of analysis : Tools in analytical chemistry	Interaction of radiation with matter	Theory of thermogravimetry (TG and DTG)	Technique of extraction: counter current extractions	Qualitative and quantitative aspects of chromatographic methods of analysis using TLC
	SLO-2	Tools in analytical chemistry	Interaction of radiation with matter	Theory of thermogravimetry (TG and DTG)	Technique of extraction: counter current extractions	Qualitative and quantitative aspects of chromatographic methods of analysis using TLC
S-2	SLO-1	Tools in analytical chemistry	Fundamental laws of spectroscopy	Theory of thermogravimetry (TG and DTG)	Qualitative and quantitative aspects of solvent extraction	Qualitative and quantitative aspects of chromatographic methods of analysis using HPLC
	SLO-2	Tools in analytical chemistry	Fundamental laws of spectroscopy	Theory of thermogravimetry (TG and DTG)	Qualitative and quantitative aspects of solvent extraction	Qualitative and quantitative aspects of chromatographic methods of analysis using HPLC
S-3	SLO-1	Its Applications	Selection rules	Instrumentation	Extraction of metal ions from aqueous solution	Atomic spectroscopy : Atomic absorption spectroscopy, theory

Duration (hour)		18	18	18	18	18
	SLO-2	Its Applications	Selection rules	Instrumentation	Extraction of metal ions from aqueous solution	Atomic absorption spectroscopy, theory
S-4	SLO-1	Its Applications	Validity of Beer-Lambert's law	Instrumentation	Extraction of organic species from the aqueous and nonaqueous media	Atomic absorption spectroscopy, theory
	SLO-2	Its Applications	Validity of Beer-Lambert's law	Instrumentation	Extraction of organic species from the aqueous and nonaqueous media	Atomic absorption spectroscopy, theory
S-5	SLO-1	Sampling	Vibration spectroscopy: Basic principles of instrumentation	Estimation of Ca and Mg from their mixture	Chromatography techniques: Classification	Application (with some examples)
	SLO-2	Sampling	Vibration spectroscopy: Basic principles of instrumentation	Estimation of Ca and Mg from their mixture	Chromatography techniques: Classification	Application (with some examples)
S-6	SLO-1	Tutorial Session	Tutorial Session	Electroanalytical methods : Classification of electroanalytical methods	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Classification of electroanalytical methods	Tutorial Session	Tutorial Session
S-7	SLO-1	evaluation of analytical data	Sampling techniques	Basic principle of pH metric	Principle and efficiency of the technique	Application (with some examples)
	SLO-2	evaluation of analytical data	Sampling techniques	Basic principle of pH metric	Principle and efficiency of the technique	Application (with some examples)
S-8	SLO-1	Errors	Application of IR spectroscopy for characterization through interpretation of data	Potentiometric titrations	Mechanism of separation: adsorption	Analysis of fuel and drugs **:** Ultimate and proximate analysis of solid fuel
	SLO-2	Errors	Application of IR spectroscopy for characterization through interpretation of data	Potentiometric titrations	Mechanism of separation: adsorption	Uultimate and proximate analysis of solid fuel
S-9	SLO-1	Accuracy	Application of IR spectroscopy for characterization through interpretation of data	Conductometric titrations	Mechanism of separation: Partition	Determination of calorific value of solid fuel
	SLO-2	Accuracy	Application of IR spectroscopy for characterization through interpretation of data	Conductometric titrations	Mechanism of separation: Partition	Determination of calorific value of solid fuel
S-10	SLO-1	Precision	Effect and importance ofisotope substitution	Techniques used for the determination of equivalence points	Mechanism of separation:Ion-exchange	Determination of calorific value of liquid fuel
	SLO-2	Precision	Effect and importance ofisotope substitution	Techniques used for the determination of equivalence points	Mechanism of separation:Ion-exchange	Determination of calorific value of liquid fuel
S-11	SLO-1	Statistical test of data; F test	Introduction to Raman spectra	Determination of pKa values	Development of chromatograms: frontal method	Determination of calorific value of gaseous fuel
	SLO-2	Statistical test of data; F test	Introduction to Raman spectra	Determination of pKa values	Development of chromatograms: frontal method	Determination of calorific value of gaseous fuel
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Duration (hour)		18	18	18	18	18
S-13	SLO-1	Statistical test of data; Q test	UV-Visible Spectrometry: Basic principles of instrumentation	Separation techniques :Solvent extraction: Classification	Development of chromatograms: elution method	Flash point
	SLO-2	Statistical test of data; Q -test	UV-Visible Spectrometry: Basic principles of instrumentation	Solvent extraction: Classification	Development of chromatograms: elution method	Flash point
S-14	SLO-1	Statistical test of data; t-test	principles of quantitativeanalysis using estimation of metal ions from aqueous solution	Principle and efficiency of the technique	Development of chromatograms: displacement method	Fire point
	SLO-2	Statistical test of data; t-test	principles of quantitativeanalysis using estimation of metal ions from aqueous solution	Principle and efficiency of the technique	Development of chromatograms: displacement method	Fire point
S-15	SLO-1	Rejection of data	Determination of composition of metal complexes using Job's method of continuous variation	Mechanism of extraction: extraction by solvation and chelation	Qualitative and quantitative aspects of chromatographic methods of analysis using LC	Classification of drugs
	SLO-2	Rejection of data	Determination of composition of metal complexes using Job's method of continuous variation	Mechanism of extraction: extraction by solvation and chelation	Qualitative and quantitative aspects of chromatographic methods of analysis using LC	Classification of drugs
S-16	SLO-1	Confidence intervals	Mole ratio method	Technique of extraction: batch	Qualitative and quantitative aspects of chromatographic methods of analysis using GLC	Classification of drugs
	SLO-2	Confidence intervals	Mole ratio method	Technique of extraction: batch	Qualitative and quantitative aspects of chromatographic methods of analysis using GLC	Classification of drugs
S-17	SLO-1	Spectroscopy : Origin of spectra	Thermal Analysis : Theory of thermogravimetry (TG and DTG)	Technique of extraction: continuous	Qualitative and quantitative aspects of chromatographic methods of analysis using GLC	Analysis of some standard drug using various chromatographic techniques
	SLO-2	Origin of spectra	Theory of thermogravimetry (TG and DTG)	Technique of extraction: continuous	Qualitative and quantitative aspects of chromatographic methods of analysis using TLC	Analysis of some standard drug using various chromatographic techniques
S-18	SLO-1	Tutorial Session	Tutorial Session	.Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	*Theory:* 1. *Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009* 2. *Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth PublishingCalifornia, USA, 1988.* 3. *Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Saunder CollegePublications, 1998.* 4. *Christian, G.D, Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.* 5. *Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.* 6. *Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles HarwoodJohn Wiley 1979.* 7. *Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.* 8. *Khopkar, S. M., Basic Concepts of Analytical Chemistry, New Age (Second edition)1998* **9.** *Skoog D.A., Holler F.J., Nieman T.A., Principles of instrumental analysis, 5th Edn., Brooks &Cole,1997*

Learning Assessment											
	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Dr. Ashok Sundaramoorthy , SRMIST*
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Course Code	UCY20D03T	Course Name	Industrial Chemistry	Course Category	D	Discipline Specific Elective	L	T	P	C
							5	1	0	6

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-1 :	*Exploit the water quality parameters and water treatment*																		
CLR-2 :	*Employ different methods to control air and water pollution*																		
CLR-3 :	*Address different sources of energy*																		
CLR-4 :	*Get knowledge on the fertilizers and insecticides used in agriculture*																		
CLR-5 :	*Employ the concepts of chemistry in manufacturing industrial gases*																		
CLR-6 :	*Utilize the chemistry behind the safe handling of hazardous chemicals*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*learn the basic concepts in water treatment*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*understand the effects and control measures oir pollution*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*understand about different types of energy*	*2*	*70*	*65*	*H*	-	-		-	-	-	-	-	-	-	-	*H*	-	-
CLO-4 :	*study in depth about the use of various fertilizers and insecticides in agriculture*	*2*	*70*	*70*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	-	-	-	*H*	*M*
CLO-5 :	*gain knowledge about manufacture and applications and hazards in handling various Industrial gases*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	*H*	-
CLO-6 :	*gain knowledge about analysis and hazards in handling various industrial chemicals*	*2*	*75*	*70*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Indtoduction-Sources of water,	Major regions of atmosphere	Large scale production uses and hazards in handling industrial gases	Fertilizers - definition	Manufacture of hydrochloric acid
	SLO-2	Temporary hardness and Permanent hardness, Units of hardness	Compositions of atmosphere	Introduction	Types of fertilizers	applications of hydrochloric acid
S-2	SLO-1	Disadvantages of hard water,	Chemical and photochemical reactions in atmosphere	Production and uses of oxygen	NPK	Analysis of hydrochloric acid
	SLO-2	Effect of Iron and manganese in water.	Chemical and photochemical reactions in atmosphere	Hazards in handling:Oxygen	superphosphate	Hazards in handling hydrochloric acid
S-3	SLO-1	Equvalents of Calcium Carbonate	Pollution: Air pollution-causes and effects	Production and uses of Nitogen	triple superphosphate	Manufacture of nitric acid
	SLO-2	Activity in Equvalents of Calcium Carbonate	Pollution by oxides of carbon, nitrogen, sulphur and H_2S	Hazards in handling: Nitogen	uses of mixed fertilizers	applications of nitric acid
S-4	SLO-1	Estimation of hardness in water-EDTA Method	Acid rain	Production and uses of Argon	Micronutrients and their role	Analysis of nitric acid

Duration (hour)		18	18	18	18	18
	SLO-2	Estimation of hardness in water-EDTA Method	Green house effect	Hazards in handling: Argon	Micronutrients and their role	Hazards in handling nitric acid
S-5	SLO-1	Numerival Problems in EDTA Method	Global warming -causes	Production and uses of Neon	Biofertilizers – definition, types	Manufacture of sulphuric acid
	SLO-2	Numerival Problems in EDTA Method	Global warming – Effects and control measures	Hazards in handling: Neon	Biofertilizers – components and importance	applications of sulphuric acid
S-6	SLO-1	O. Hehner's method (or) Alkali titration method – Principle and Procedure	Ozone layer depletion - Causes	Production and uses of Helium	plant growth harmones-definition, types	Analysis of sulphuric acid
	SLO-2	O. Hehner's method (or) Alkali titration method- Calculation	Ozone layer depletion- Effects and control measures	Hazards in handling:Helium	plant growth harmones- importance	Hazards in handling sulphuric acid
S-7	SLO-1	Determination of Dissolved Oxygen (Winkler's method)	Photochemical Smog - Causes	Production and uses of Hydrogen	Pesticides- definition	Manufacture of caustic soda
	SLO-2	Determination of Dissolved Oxygen (Winkler's method)	Photochemical Smog – Effects and Control measures	Hazards in handling:Hydrogen	Pesticides-classification with examples	applications of caustic soda
S8	SLO-1	Determination of Alkalinity in water	Water Pollution-Sources	Production and uses of Acetylene	Insecticides-definition	Analysis of caustic soda
	SLO-2	Determination of type of Alkalinity in water	Water Pollution-Effects	Hazards in handling:Acetylene	Classification of Insecticides	Hazards in handling caustic soda
S-9	SLO-1	Boiler troubles- Scales and Sludges	Water Pollution- control measures	Production and uses of Carbon monoxide	stomach poisons	Manufacture of borax
	SLO-2	Other Boiler troubles	Impact on hydrological process	Hazards in handling:Carbon monoxide	contact insecticides	applications of borax
S-10	SLO-1	Water softening methods - General description	Impact on eco systems	Production and uses of Chlorine	Fumigants –definition with examples	Analysis of borax
	SLO-2	Internal conditioning	Chemical oxygen demand –definition	Hazards in handling:Chlorine	Fumigants-importance	Hazards in handling borax
S-11	SLO-1	Zeolite process	COD estimation	Production and uses of Flourine	Manufacture and uses of insecticides	Manufacture of bleaching powder
	SLO-2	Ion exchange process – Demineralization method	Biological oxygen demand -definition	Hazards in handling:Flourine	Manufacture and uses of insecticides	applications of bleaching powder
S-12	SLO-1	Ion exchange process – Demineralization method	BOD estimation	Production and uses of Sulphur dioxide	DDT	Analysis of bleaching powder
	SLO-2	Mixed bed deionization	Total organic carbon	Hazards in handling:Sulphur dioxide	BHC(gammaxane: conformation of gamma isomer)	Hazards in handling bleaching powder
S-13	SLO-1	Electrodialysis	Industrial effluents- definition	Sources of Energy	Banned pesticides and Herbicides	Manufacture of sodium thiosulphate
	SLO-2	Reverse Osmosis	Industrial effluents - characteristics	Coal	Pyrethrin	applications of sodium thiosulphate
S-14	SLO-1	Domestic waste water treatment- Primary & Secondary trearment	Industrial effluent from electroplating industry	Petrol	manufacture of 2,4-D Fungicides	Analysis of sodium thiosulphate
	SLO-2	Domestic waste water treatment - Tertiary trearment	And its treatment	Natural Gas	manufacture of 2,4,5-T. Fungicides	Hazards in handling sodium thiosulphate
S-15	SLO-1	Purification methods-Chlorination, break point chlorination	Industrial effluent from tannery industry	Nuclear Fusion	preparation of Bordeaux mixture, lime-sulphur mixture (formula only)	Manufacture, applications of hydrogen peroxide

Duration (hour)		18	18	18	18	18
	SLO-2	Water Quality Parameters- Definition	And its treatment	Nuclear Fission	preparation of creosote oil (formula only)	Analysis and hazards in handling hydrogen peroxide
S-16	SLO-1	Water quality parameters for waste water	Industrial effluent from petroleum industry	Solar	Sugar industry-soluble sulphitation process	Manufacture, applications of potassium dichromate
	SLO-2	Water quality parameters for Industrialwater	And its treatment	Hydrogen	Refining and grading of sugar	Analysis and hazards in handling of potassium dichromate
S-17	SLO-1	Water quality parameters for domestic water	Industrial effluent from agro fertilizer industry	Geothermal	Saccharin usage as a sugar substitute –	Manufacture, applications of potassium permanganate
	SLO-2	Water quality parameters for domestic water	And its treatment	Tidal and Hydel	aspartame.	Analysis and hazards in handling potassium permanganate
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources	***Theory:*** 1. *K.H. Buchel, H.H. Moretto, P. Woditsch, Industrial Inorganic Chemistry, Wiley-VCH, Second Edition 2003.* 2. *E. Stocchi, Industrial Chemistry, Vol-1, Ellis Horwood Ltd.,. UK.* 3. *A.K. De, Environmental Chemistry, New Age International Pvt., Ltd., New Delhi, Eight Edition 2017.*	4. *S.E. Manahan, Environmental Chemistry, CRC Press 2005.* 5. *G.T. Miller, Environmental Science, 11th Edition, Brooks/Cole 2006.*

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr.SudarshanMahapatra, EncubeEthicalsPvt. Ltd, sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr.ShanmukhaprasadGopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. VivekPolshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. J. ArockiaSelvi, SRMIST*

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Course Code	UCY20D04T	Course Name	Molecular Modeling and Drug Design	Course Category	D	Discipline Specific Elective	L	T	P	C
							5	1	0	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Understanding the principles of quantum and classical mechanics methods and Coordinates.			
CLR-2 :	Energy minimization and identify transition state structure			
CLR-3 :	Basic principles of Molecular Mechanics and Force Fields			
CLR-4 :	Understanding potentials and simulation protocol for Molecular Dynamics			
CLR-5 :	Fundamentals of Ab initio and DFT methods and knowledge			
CLR-6 :	Implementation and workouts of semi-empirical and QSAR methods			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Able to understand theoretical background of computational techniques	2	70	65	H	M	H	L	-	-	-	-	-	-	-	H	H	-	-
CLO-2 :	Studies on various molecular systems and energy minimization process	2	80	70	H	-	-	H	H	-	-	-	-	-	-	-	-	H	-
CLO-3 :	Gaining the knowledge in force field based simulations	2	75	60	-	H	-		-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	Learning molecular dynamics tools and techniques	2	70	70	H	H	-	H	-	-	-	-	-	-	-	-	-	H	-
CLO-5 :	Understanding the fundamentals of first principles based calculations	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-6 :	Utilize the semi empirical methods and QSAR techniques to drug design and delivery applications	2	75	65	-	M	H	-	H	-	H	-	H	-	-	H	-	H	H

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Introduction to Molecular Modeling	Reaction mechanism in computational perspective	Theory about Molecular dynamics	Calculation of oxidation and reduction	Advantages of ab-initio calculation
	SLO-2	Introduction to Molecular Modeling	Reaction mechanism in computational perspective	Theory about Molecular dynamics	Calculation of oxidation and reduction	Advantages of ab-initio calculation
S-2	SLO-1	Basic concepts of Quantum mechanics	Steepest descent method	Radial Distribution Functions (RDF)	Examples	Koopman's theorem
	SLO-2	Basic concepts of Quantum mechanics	Newton-Raphson method	Radial Distribution Functions (RDF)	Examples	Koopman's theorem
S-3	SLO-1	Basic concepts of Classical mechanics	Hessian matrix	Intermolecular potentials (Hard sphere, finite square)	Extended Huckel theory and PPP method	Brief introduction to Density Functional Theory (DFT)
	SLO-2	Ab initio Methods	Hessian matrix	Intermolecular potentials (Hard sphere, finite square)	Extended Huckel theory and PPP method	Brief introduction to Density Functional Theory (DFT)
S-4	SLO-1	Semi-empirical Methods	Comparison of all energy minimization methods in computational perspective	Periodic box and its condition	Ab-initio methods	Applications of DFT
	SLO-2	Molecular mechanics	Comparison of all energy minimization methods in computational perspective	Periodic box and its type	Hamiltonian of a system	Applications of DFT

Duration (hour)		18	18	18	18	18
S-5	SLO-1	*Overview of Molecular dynamics simulations*	*Introduction to Molecular mechanics*	*Ensembles and Types of ensembles*	*Hamiltonian of a system*	*Semi-empirical methods*
	SLO-2	*Overview of Molecular dynamics simulations*	*Introduction to Molecular mechanics*	*Ensembles and Types of ensembles*	*Hamiltonian of a system*	*Semi-empirical methods*
S-6	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S-7	SLO-1	*Overview of Monte Carlo simulations*	*Overview of force field*	*Integration of newton's equation (leapfrog algorithm)*	*H-atom solution using Hamiltonian*	*Brief idea of CNDO,*
	SLO-2	*Overview of Monte Carlo simulations*	*Overview of force field*	*Integration of newton's equation (verlet algorithm)*	*H-atom solution using Hamiltonian*	*Brief idea of INDO,*
S-8	SLO-1	*Coordinates(x,y,z) of the system*	*Optimization or Energy minimization*	*Water models (TIP and TIP3P)*	*Brief introduction about quantum and it units*	*MINDO/3, MNDO,*
	SLO-2	*Cartesian coordinates (x,y,z)*	*Optimization or Energy minimization*	*Water models (TIP and TIP3P)*	*Brief introduction about quantum and it units*	*AM1, PM3 methods*
S-9	SLO-1	*Internal coordinates from bond length, angle and torsion.*	*Methods of energy minimization*	*Radial distribution functions of water models*	*Born-Oppenheimer approximation*	*Types of file formats eg. PDB*
	SLO-2	*Internal coordinates from bond length, angle and torsion.*	*Multivariate grid search*	*Radial distribution functions of water models*	*Born-Oppenheimer approximation*	*Types of file formats eg. PDB*
S-10	SLO-1	*Understanding of Z-matrix*	*Bonded interactions (Bond length, angle, and torsion)*	*Types of MD simulation*	*Antisymmetry principles and slater determinants*	*Visualization of orbitals*
	SLO-2	*Z-Matrix Examples (e.g. small molecules)*	*Bonded interactions (Bond length, angle, and torsion)*	*Types of MD simulation*	*Antisymmetry principles and slater determinants*	*HOMO-LUMO and ESP*
S-11	SLO-1	*Introduction to potential energy surface*	*Non-bonded interactions*	*Overview of Brownian and Langewin dynamics*	*Coulomb and exchange integrals*	*Descriptors of QSAR*
	SLO-2	*Introduction to potential energy surface*	*Torsion for flexible molecules*	*Overview of Brownian and Langewin dynamics*	*Coulomb and exchange integrals*	*Descriptors of QSAR*
S-12	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S-13	SLO-1	*Reactant to product mechanism*	*Lennard-Jones potential*	*Introduction to Monte Carlo simulation*	*Hartree fock methods for for H atom and He molecule*	*Descriptors of QSAR*
	SLO-2	*Reactant to product mechanism*	*H-bonding and Electrostatic interactions*	*Introduction to Monte Carlo simulation*	*Hartree fock methods for for H atom and He molecule*	*Descriptors of QSAR*
S-14	SLO-1	*Stationary and equilibrium points*	*Applications of molecular mechanics*	*Metropolis algorithm*	*Basis sets and its function*	*Descriptors of QSAR*
	SLO-2	*Stationary and equilibrium points*	*Applications of molecular mechanics*	*Metropolis algorithm*	*Basis sets and its function*	*Descriptors of QSAR*
S-15	SLO-1	*Reaction minima and maxima*	*Different variants of Force fields (MM1, MM2, MM3 and MM4)*	*Huckel Molecular orbital theory*	*Slater type orbitals (STOs) and Gaussian type orbitals (GTOs)*	*Descriptors of QSAR*
	SLO-2	*Local minima and maxima*	*Variants of Force fields (Bio+ and OPLS. GUI)*	*Huckel Molecular orbital theory*	*Slater type orbitals (STOs) and Gaussian type orbitals (GTOs)*	*Descriptors of QSAR*
S-16	SLO-1	*Concepts of transition state*	*Variants of Force fields (Bio+ and OPLS. GUI)*	*Calculation energies, charges and dipole moments*	*Diffusion and polarization functions*	*Biological activities using QSAR*
	SLO-2	*Concepts of transition state*	*Introduction to Amber and Validation of Force field*	*Calculation energies, charges and dipole moments*	*Diffusion and polarization functions*	*Biological activities using QSAR*
S-17	SLO-1	*Examples of transition state*	*Introduction to Molecular dynamics simulations*	*Calculation of bond order, electronic and resonance energies*	*Minimal and types of basis set*	*QSAR (LD50, IC50, ED50 etc).*

Duration (hour)		18	18	18	18	18
	SLO-2	*Examples of transition state*	*Introduction to Molecular dynamics simulations*	*Calculation of bond order, electronic and resonance energies*	*Minimal and types of basis set*	*QSAR (LD50, IC50, ED50 etc).*
S-18	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*

Learning Resources	*1. A. R. Leach, Molecular Modelling, Prentice-Hall, 2001.* *2. Alan Hinchcliffe, Modelling Molecular Structures, John Wiley & Sons, 1996* *3. Alan Hinchcliffe, Molecular Modelling for Beginners, John-Wiley, 2003.* *4. C.J. Cramer, Essentials of Computational Chemistry, John Wiley & Sons, 2004*	*5. E. Lewars, Computational Chemistry, Kluwer academic Publisher, 2003* *6. Jonathan Goodman ,Chemical Applications of Molecular Modelling.* *7. Guy H, Grant & W. Graham Richards, Computational Chemistry, Oxford University Press*

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

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Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. SudarshanMahapatra, EncubeEthicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. ShanmukhaprasadGopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. Prakash Muthuramalingam, SRMIST*

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Course Code	UMI20S01L	Course Name	My India Project	Course Category	S	Skill Enhancement course	L	T	P	C
							0	0	0	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards	*Nil*		

(Assessment Method – Fully Internal)

Assesment Tools	Marks
Review – I (Activities)	50
Review – II (Project report and Presentation)	50
Total	100

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Course Code	UJK20401T	Course Name	Professional Skills	Course Category	JK	Life Skill Course	L	T	P	C
							2	0	0	2

re-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	-		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	expose students to the requirements of job market	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	develop resume building practice			
CLR-3 :	increase efficiency in speaking during group discussions			
CLR-4 :	prepare students for job interviews			
CLR-5 :	instill confidence in students and develop skills necessary to face audience			
CLR-6 :	develop speaking and presentation skills in students			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
CLO-1 :	understand the importance of resume preparation and build resume	3	80	70
CLO-2 :	acquire group discussion skills	3	85	75
CLO-3 :	face interviews confidently	3	85	80
CLO-4 :	Ask appropriate questions during an interview	3	85	80
CLO-5 :	understand various types of presentation and use presentation skills in projects	3	85	80
CLO-6 :	build confidence during any presentation	3	85	80

	Program Learning Outcomes (PLO)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-2 :	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-3 :	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-4 :	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-5 :	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H
CLO-6 :	M	M	L	L	M	H	-	-	-	M	H	L	H	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Introduction of resume and its importance	Meaning and methods of group discussion	Meaning and types of interview (face to face, telephonic, video)	Types - Informative, Instructional, Arousing, Persuasive, Decision-making	PowerPoint presentation–body language and stage etiquettes
	SLO-2	Difference between a CV, Resume and Bio Data	Procedure of group discussion	Dress code, background research	Structure of a presentation – Introduction of the event, Introducing the speaker, vote of thanks	PowerPoint presentation–body language and stage etiquettes
S-2	SLO-1	Essential components of a good resume, common errors people make while preparing a resume	Group discussion – simulation	STAR Technique (situation, task, approach and response) for facing an interview	Working with audience – ice-breaking, Creating a 'Plan B',	PowerPoint presentation–practice session
	SLO-2	Resume building format	Group discussion – common errors	Interview procedure (opening, listening skills, closure, asking questions)	Getting the audience in the mood, working with emotions,	PowerPoint presentation– practice session
S-3	SLO-1	Resume building using templates	Group discussion – types – Topic based	Important questions generally asked in an interview	Improvisation and unprepared presentations, man-woman view, feedback – appreciation and critique	PowerPoint presentation–practice session
	SLO-2	Resume building using templates	Group discussion – types – Case study based	Important questions generally asked in an interview	Improvisation and unprepared presentations, man-woman view, feedback – appreciation and critique	PowerPoint presentation– practice session

Duration (hour)		6	6	6	6	6
S-4	SLO-1	*Resume building activity*	*Group discussion – practice session- Topic based*	*Mock interview – face to face*	*Power point presentation, skit, drama, dance, mime, short films and documentary – Dos and Don'ts*	*PowerPoint presentation–practice session*
	SLO-2	*Resume building activity - Feedback*	*Group discussion - Feedback*	*Mock interview- Feedback*	*Power point presentation, skit, drama, dance, mime, short films and documentary – Dos and Don'ts*	*PowerPoint presentation– practice session*
S-5	SLO-1	*Video resume – Tips and tricks*	*Group discussion – practice session- Topic based*	*Mock interview - face to face*	*PowerPoint presentation – content preparation*	*PowerPoint presentation–practice session*
	SLO-2	*Video resume – Do's and Don'ts*	*Group discussion - Feedback*	*Mock interview - Feedback*	*PowerPoint presentation–logical arrangement of content*	*PowerPoint presentation– practice session*
S-6	SLO-1	*Video resume – Templates*	*Group discussion – practice session- Case study based*	*Mock interview - face to face*	*PowerPoint presentation–using internet source, citations, bibliography*	*PowerPoint presentation–practice session*
	SLO-2	*Video resume – Templates*	*Group discussion - Feedback*	*Mock interview- Feedback*	*PowerPoint presentation–using internet source, citations, bibliography*	*PowerPoint presentation– practice session*

Learning Resources	*1. Scott Bennett, The Elements of Resume Style: Essential Rules for Writing Resumes and Cover Letters That Work, AMACOM, 2014* *2. David John, Tricks and Techniques of Group Discussions, Arihant, 2012* *3. Singh O.P., Art of Effective Communication in Group Discussion and Interview, S Chand & Company, 2014*	*4. Paul Newton, How to deliver a presentation ; e-book* *5.Eric Garner, A-Z of Presentation, Eric Garner and Ventus Publishing ApS, 2012, bookboon.com*

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)			
		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (30%)#	CLA-4 (30%) ##
		Theory	Theory	Theory	Theory
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	**100 %**	**100 %**	**100 %**	**100 %**

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.

##CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Ajay Zener, Director, Career Launcher	-	*1. MrPriyanand, Assistant Professor, CDC, E&T, SRMIST* *2. Ms Sindhu Thomas, Head in charge, CDC, FSH, SRMIST* *3. MsMahalakshmi, Assistant Professor, CDC, FSH, SRMIST*

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SEMESTER V

Course Code	UCY20501J	Course Name	Inorganic Chemistry-IV: Organometallic and Bioinorganic Chemistry	Course Category	C	Core course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Periodic Table		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Exploit the basic principles of qualitative inorganic analysis for the separation of cations and anions			
CLR-2 :	Get knowledge on organometallic compounds as various types of catalyst			
CLR-3 :	Employ various organic reactions towards the design of fine chemical and drug molecules for industries			
CLR-4 :	Address concepts related to organometallic chemistry using stability based on 18-electron rule			
CLR-5 :	Utilize the bioinorganic chemistry in various pharmaceutical problems and identify appropriate solutions			
CLR-6 :	Address the concepts related to the active sites and action cycles of the metalloenzymes			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Understand and explain the basic principles of qualitative inorganic analysis	2	70	65	H	-	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Relate the concepts of solubility product and common ion effect to the separation of cations and anions	2	80	70	H	-	-	H	H	-	-	-	-	-	-	-	-	H	-
CLO-3 :	Apply 18-electron rule to rationalize the stability of organometallic compounds	2	75	60	-	H	-		-	-	-	-	-	-	-	-	H	M	-
CLO-4 :	Develop a general idea of catalysis and describe the mechanism in detail	2	70	70	H	H	-	H	-	-	-	-	-	-	-	-	-	M	-
CLO-5 :	Explain the sources and consequences of excess and deficiency of trace metals and learn about the toxicity of certain metal ions	2	80	70	-	H	H	-	-	-	-	-	-	-	-	-	-	H	-
CLO-6 :	Utilize concepts in bioinorganic chemistry for scientific advancement towards the developments of various drugs	2	75	65	-	-	-	H	-	-	-	-	-	-	-	-	-	-	H

Duration (hour)		24	24	24	24	24
S-1	SLO-1	Introduction to Theoretical Principles in Qualitative Analysis	Introduction to Organometallic Compounds	Structures of mononuclear and binuclear carbonyls of Co using VBT	classification of elements according to their action in biological system	Cisplatin as an anti-cancer drug
	SLO-2	Introduction to Theoretical Principles in Qualitative Analysis	Introduction to Organometallic Compounds	Structures of mononuclear and binuclear carbonyls of Co using VBT	classification of elements according to their action in biological system	Cisplatin as an anti-cancer drug
S-2	SLO-1	Basic principles involved in analysis of cations and anions	Definition and	π-acceptor behaviour of CO (MO diagram of CO to be discussed)	Geochemical effect on the distribution of metals	Iron and its application in bio-systems
	SLO-2	Basic principles involved in analysis of cations and anions	classification of organometallic compounds on the basis of bond type	π-acceptor behaviour of CO (MOdiagram of CO to discussed)be	Geochemical effect on the distribution of metals	Iron and its application in bio-systems
S-3	SLO-1	Solubility products	Concept of hapticity oforganic ligands	synergic effect and	Sodium / K-pump	Haemoglobin
	SLO-2	Solubility products	Examples	Use of IR data to explain extent of back bonding.	Sodium / K-pump	Myoglobin
S-4	SLO-1	common ion effect	Introduction to Metal carbonyls	Zeise's salt: Preparation and structure	carbonic anhydrase	Storage and transfer of iron
	SLO-2	common ion effect	Introduction to Metal carbonyls	Zeise's salt: Preparation and structure	carbonic anhydrase	Storage and transfer of iron
S-5 to	SLO-1	Lab Introduction	Qualitative semimicro analysis of	Qualitative semimicro analysis of	Inorganic Preparations: Acetylacetonate	Experiment - Repeat - 2

Duration (hour)		24	24	24	24	24
S-8	SLO-2		*mixtures-3(anions and cations)*	*mixtures-6 (anions and cations)*	*complexes of Cu^{2+}/Fe^{3+}*	
S-9	SLO-1	*Principles involved in separation of cations into groups and*	*18 electron rule*	*Zeise's salt: evidences of synergic effect and comparison of synergic effect with thatin carbonyls*	*carboxypeptidase*	*Catalysis by Organometallic Compound General principles of catalysis, properties of catalysts*
	SLO-2	*Principles involved in separation of cations into groups and*	*18 electron rule*	*Zeise's salt: evidences of synergic effect and comparison of synergic effect with thatin carbonyls*	*carboxypeptidase*	*homogeneous and heterogeneous catalysis (catalytsteps, examples and industrial applications),*
S-10	SLO-1	*choice of group reagents*	*electron count of mononuclear and polynuclear metal carbonyls of 3d series*	*Metal Alkyls: Important structural features of methyl lithium (tetramer) and*	*Excess and deficiency of some trace metals*	*deactivation and regeneration of catalysts*
	SLO-2	*choice of group reagents*	*electron count of mononuclear and polynuclear metal carbonyls of 3d series*	*trialkyl aluminium (dimer)*	*Excess and deficiency of some trace metals*	*Catalytic poison, promoter.*
S-11	SLO-1	*Interfering anion-fluoride*	*electron count of substituted metal carbonyls of 3d series*	*Metal Alkyls: concept of multicentre bonding in these compounds*	*Toxicity of metal ions:*	*Alkene hydrogenation (Wilkinson's Catalyst)-industrial processes*
	SLO-2	*Interfering anion-fluoride*	*electron count of substituted metal carbonyls of 3d series*	*Metal Alkyls: concept of multicentre bonding in these compounds*	*Toxicity of Hg*	*Alkene hydrogenation (Wilkinson's Catalyst)-industrial processes*
S-12	SLO-1	*Interfering anion-borate*	*General methods ofof mononuclearcarbonyls of 3d series*	*Ferrocene: Preparation, physical properties and*	*Toxicity of Pb*	*Alkene hydrogenation (Wilkinson's Catalyst)-mechanism*
	SLO-2	*Interfering anion-borate*	*General methods of of mononuclearcarbonyls of 3d series*	*Reactions (acetylation, alkylation, metallation, Mannich Condensation).*	*Toxicity of Pb*	*Alkene hydrogenation (Wilkinson's Catalyst)-mechanism*
S-13 To S-16	SLO-1	*Qualitative semimicro analysis of mixtures-1(anions and cations)*	*Qualitative semimicro analysis of mixtures-4 (anions and cations)*	*Qualitative semimicro analysis of mixtures-7 (anions and cations)*	*Inorganic Preparations:Potassium tri(oxalato)ferrate(III)*	*Experiment - Repeat - 3*
	SLO-2					
S-17	SLO-1	*Interfering anion-oxalate*	*General methods of of binuclearcarbonyls of 3d series*	*Structure and aromaticity*	*Toxicity of Cd*	*Synthetic gasoline (Fischer Tropsch reaction)-industrial processes*
	SLO-2	*Interfering anion-oxalate*	*General methods of of binuclearcarbonyls of 3d series*	*Structure and aromaticity*	*Toxicity of Cd*	*Synthetic gasoline (Fischer Tropsch reaction)-industrial processes*
S-18	SLO-1	*Interfering anion-phosphate*	*Structures of mononuclear carbonyls of Cr and Ni using VBT*	*Comparison of aromaticity and reactivity with that of benzene*	*Toxicity of As*	*Synthetic gasoline (Fischer Tropsch reaction)-mechanism*
	SLO-2	*Interfering anion-phosphate*	*Structures of mononuclear carbonyls of Cr and Ni using VBT*	*Comparison of aromaticity and reactivity with that of benzene*	*Toxicity of As*	*Synthetic gasoline (Fischer Tropsch reaction)-mechanism*
S-19	SLO-1	*Need to remove them after Group II and methods of removal*	*Structures of mononuclear and binuclear carbonyls of Mn using VBT*	*Introduction to Bioinorganic Chemistry*	*reasons for toxicity*	*Polymerisation of ethene using Ziegler-Natta catalyst-industrial processes*
	SLO-2	*Need to remove them after Group II and methods of removal*	*Structures of mononuclear and binuclear carbonyls of Mn using VBT*	*Introduction to Bioinorganic Chemistry*	*reasons for toxicity*	*Polymerisation of ethene using Ziegler-Natta catalyst-industrial processes*
S-20	SLO-1	*Analysis of insoluble substances*	*Structures of mononuclear and binuclear carbonyls of Fe using VBT*	*Metal ions present in biological systems*	*Use of chelating agents in medicine*	*Polymerisation of ethene using Ziegler-Natta catalyst-mechanism*
	SLO-2	*Analysis of insoluble substances*	*Structures of mononuclear and binuclear carbonyls of Fe using VBT*	*Metal ions present in biological systems*	*Use of chelating agents in medicine*	*Polymerisation of ethene using Ziegler-Natta catalyst-mechanism*
S-21 to S-24	SLO-1	*Qualitative semimicro analysis of mixtures-2(anions and cations)*	*Qualitative semimicro analysis of mixtures-5 (anions and cations)*	*Inorganic Preparations: . Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$*	*Experiment - Repeat - 1*	*Demonstration Practical Session*
	SLO-2					

Learning Resources	*Theory:*	*Practical:*
	1. Cotton, F.A., Wilkinson, G., & Gaus, P.L. Basic Inorganic Chemistry 3rd Ed.;Wiley India.	*1. Vogel, A.I. Qualitative Inorganic Analysis, Longman, 1972.*

	2. *Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson 2006.* 3. *Sharpe, A.G. Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005* 4. *Douglas, B. E.; McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry 3rd Ed., John Wiley and Sons, NY, 1994.* 5. *Greenwood, N.N. & Earnshaw, A. Chemistry of the Elements 2nd Ed, Elsevier, 1997 (Ziegler Natta Catalyst and Equilibria in Grignard Solution).* 6. *Lee, J.D. Concise Inorganic Chemistry 5th Ed., John Wiley and sons 2008.* 7. *Powell, P. Principles of Organometallic Chemistry, Chapman and Hall, 1988.* 8. *Shriver, D.D., Atkins, P. and Langford, C.H., Inorganic Chemistry 2nd Ed., Oxford University Press, 1994.* 9. *Purcell, K.F. & Kotz, J.C., Inorganic Chemistry, W.B. Saunders Co. 1977*	2. *Svehla, G. Vogel's Qualitative Inorganic Analysis, 7th Edition, Prentice Hall, 1996-03-07.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. S. Shanmugan, SRMIST*

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Course Code	UCY20502T	Course Name	Organic Chemistry - III: Nitrogen Containing Functional Group, Polyaromatic and Heterocyclic Chemistry	Course Category	C	Core course	L	T	P	C
							5	1	0	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)

		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	The Core Course Organic Chemistry III is infused with the details of Nitrogen containing functional groups			
CLR-2 :	Introduction of polynuclear hydrocarbons, heterocyclic systems and natural compounds viz terpenes and alkaloids			
CLR-3 :	A comprehensive understanding of these topics will be developed by taking examples of 2-3 representatives members of each class			
CLR-4 :	The constitution of the course strongly aids in the paramount learning of the concepts and their applications			
CLR-5 :	The chemical synthesis, properties and reactions of these compounds will be discussed in details with some key applications of each class of compounds in diverse fields			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Gain theoretical understanding of chemistry of compounds having nitrogen containing functional groups, heterocyclics, polynuclear hydrocarbons, alkaloids and terpenes which includes various methods for synthesis through application of the synthetic organic chemistry concepts learnt so far.	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Become familiar with their particular properties, chemical reactions, criterion of aromaticity with reference to polynuclear hydrocarbons and heterocyclic compounds, trends in basicity of amines and heterocyclics compounds and their behavior at different pH.	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Learn practical approach to structural elucidation of organic compounds with specific examples of terpenes and alkaloids.	2	70	65	H	-	-		-	-	-	-	-	-	-	-	H	M	-
CLO-4 :	Predict the carbon skeleton of amines and heterocyclic compounds via use of Hoffmann's exhaustive methylation and Emde's modification methods.	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	H	H	M
CLO-5 :	Understand the applications of these compounds including their medicinal applications through their reaction chemistry	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	M	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	Nitrogen Containing Functional Groups : Amines: Introduction and Classification	Nitro compounds: Reduction- electrolytic reduction, reduction in acidic	Properties: Physical properties	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution- Nitration	Natural occurrence
	SLO-2	Amines: Introduction and classification	Nitro compounds: Reduction in basic and neutral medium (for aromatic compounds)	Discussion on Addition and oxidation reactions with mechanism	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution- Nitration	Natural occurrence

Duration (hour)		18	18	18	18	18
S-2	SLO-1	Chirality in amines (pyramidal inversion)	Nitro compounds: Reaction with nitrous acid	Discussion on Addition and oxidation reactions with mechanism	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution- Sulphonation	Classification
	SLO-2	Chirality in amines (pyramidal inversion)	Nitro compounds: Electrophilic substitution-Halogenation	Discussion on Electrophilic substitution- Friedel Craft reaction with mechanism	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution- Sulphonation	Classification
S-3	SLO-1	Amines: General methods of preparation	Nitro compounds: Nitration and sulphonation reaction	Discussion on Chloromethylation with mechanism	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Halogenation	Uses
	SLO-2	Amines: General methods of preparation	Nitro compounds: Nucleophilic substitution on the ring	Discussion on Halogenation, Formylation with mechanism	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Halogenation	Uses
S-4	SLO-1	Amines properties : Physical properties	Nitriles: Introduction, Nomenclature and uses	Discussion on Nitration, Sulphonation with mechanism	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Formylation	General structural features
	SLO-2	Basicity of amines: Effect of substituent	Nitriles: Introduction, Nomenclature and uses	Discussion on Reduction reaction, Diels Alder reaction with mechanism	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Formylation	General structural features
S-5	SLO-1	Solvent and steric effects	Nitriles: Preparation from the dehydration of amides and aldoximes	Heterocyclic Compounds :Introduction, importance, classification	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Formylation	General methods for structure elucidation: Hoffmann's exhaustive methylation
	SLO-2	Solvent and steric effects	Nitriles: Preparation from the substitution reaction in alkyl halides and tosylates	Introduction, importance, classification	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Formylation	General methods for structure elucidation: Hoffmann's exhaustive methylation
S-6	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-7	SLO-1	Distinction between Primary , secondary and tertiary amines using Hinsberg's method	Nitriles: From Grignard reagents and from dehydrogenation of primary amines	Nomenclature of heterocyclic compounds (containing only one hetero atom)	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Mercuration	General methods for structure elucidation: Emde's method
	SLO-2	Distinction between Primary , secondary and tertiary amines using nitrous acid method	Properties: Physical properties of Nitriles	Nomenclature of heterocyclic compounds (containing only one hetero atom)	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Mercuration	General methods for structure elucidation: Emde's method

Duration (hour)		18	18	18	18	18
S-8	SLO-1	Reactions with emphasis on the mechanistic pathway: Gabriel PhthalimideSynthesis	Nitriles: Reaction with Grignard reagent and hydrolysis with mechanism discussions	General discussion on Structure, aromaticity in 5-membered rings containing one heteroatom	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Carboxylation	Structure elucidation of Nicotine
	SLO-2	Reactions with emphasis on the mechanistic pathway: Hoffmann-Bromamide reaction	Nitriles: Addition reaction with HX, NH_3 and reaction with aqueous ROH with mechanism	General discussion on Structure, aromaticity in 5-membered rings containing one heteroatom	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Electrophilic substitution: Carboxylation	Structure elucidation of Nicotine
S-9	SLO-1	Reactions with emphasis on the mechanistic pathway: Carbylamine reaction	Reduction reactions-catalytic reduction and Stephen's reaction, Condensation reactions-Thorpe Nitrile Condensation with mechanism	General discussion on Structure, aromaticity 6-membered rings containing one heteroatom	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Oxidation	Synthesis of Nicotine
	SLO-2	Reactions with emphasis on the mechanistic pathway: Mannich reaction	Isonitriles: Introduction, Nomenclature and uses	General discussion on Structure, aromaticity 6-membered rings containing one heteroatom	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Oxidation	Synthesis of Nicotine
S-10	SLO-1	Reactions with emphasis on the mechanistic pathway: Hoffmann's exhaustive methylation	Preparation of Isonitriles from Carbylamine reaction, substitution in alkyl halides and dehydrogenation of N-substituted formamides	Basicity and relative reactivity towards electrophilic substitution reactions (amongst five membered and six membered rings)	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Reduction	Physiological action of Nicotine
	SLO-2	Reactions with emphasis on the mechanistic pathway: Hofmann-elimination reaction	Isonitriles properties: Physical properties, discussion on reactions with mechanism ofHydrolysis and reduction	Basicity and relative reactivity towards electrophilic substitution reactions (amongst five membered and six membered rings)	Discussion the reaction mechanism for Furan, Pyrrole, thiophene, Pyridine, Indole, Quinoline and Isoquinoline: Reduction	Physiological action of Nicotine
S-11	SLO-1	Reactions with emphasis on the mechanistic pathway: Cope elimination	Isonitriles: Discuss on reaction mechanism of addition with – HX, X_2 and sulphur	General methods of synthesis for Furan	Reactions showing acidic /basic character	**Terpenes** : Introduction, Occurrence and Uses
	SLO-2	Diazonium Salts: Preparation	Isonitriles: Discuss on reaction mechanism of Grignard reagent reaction, oxidation and rearrangement	General methods of synthesis for Furan	Reactions showing acidic /basic character	Introduction, Occurrence and Uses
S-12	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
S-13	SLO-1	Synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitro compounds	Polynuclear Hydrocarbons : Introduction, Classification, Structure, Nomenclature and uses	Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis)	Ring opening and Ring expansion	Classification, isoprene and special isoprene rule
	SLO-2	Synthetic applications of diazonium salts including preparation phenols, cyano and nitro compounds	Introduction, Classification, Structure, Nomenclature and uses	Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis)	Ring opening and Ring expansion	Classification, isoprene and special isoprene rule
S-14	SLO-1	Coupling reactions of diazonium salts (preparation of azo dyes)	Aromaticity of polynuclear hydrocarbons	General methods of synthesis for Thiophene	Reaction with diazonium salts	general methods of structure elucidation including distinction between isopropylidene and isopropenyl group

Duration (hour)		18	18	18	18	18
	SLO-2	Nitro compounds (Aliphatic and Aromatic): Nomenclature & classification	Structure elucidation of Naphthalene	General methods of synthesis for Thiophene	Reaction with diazonium salts	general methods of structure elucidation including distinction between isopropylidene and isopropenyl group
S-15	SLO-1	Nitro compounds: General methods of preparation from alkyl halides and alkanes	General methods of preparation of naphthalene, phenanthrene and anthracene: Howarth method	General methods of synthesis for pyridine (Hantzsch synthesis) and for Indole (Fischer indole synthesis)	Nucleophilic substitution reactions	general methods of structure elucidation including distinction between isopropylidene and isopropenyl group
	SLO-2	Nitro compounds: Oxidation of amines and oximes and diazonium salts	Friedel Craft acylation	Indole: Madelung synthesis, reduction of o-nitro benzaldehyde)	Nucleophilic substitution reactions	general methods of structure elucidation including distinction between isopropylidene and isopropenyl group
S-16	SLO-1	Nitro compounds: Properties: Physical properties	Diels Alder reaction	Quinoline Synthesis: Skraup synthesis, Friedlander's synthesis	Nucleophilic substitution reactions	Citral: Elucidation of structure
	SLO-2	Nitro compounds: Mechanism and reaction with alkali and its synthetic applications	Elbs reaction	Knorr quinoline synthesis, Doebner-Miller synthesis	Nucleophilic substitution reactions	Citral: Elucidation of structure
S-17	SLO-1	Nitro compounds: Condensation reaction with mechanism	Pschorr Synthesis	Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction)	Alkaloids **:** Introduction	Synthesis of Citral, its industrial application.
	SLO-2	Nitro compounds: Mannich reaction and Hydrolysis reaction with mechanism	Relative reactivity of naphthalene, phenanthrene and anthracene in comparison to benzene.	Properties: Physical properties	Introduction	Synthesis of Citral, its industrial application.
S-18	SLO-1	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session
	SLO-2	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session	Tutorial Session

Learning Resources

Theory:

1. *Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.*
2. *Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
3. *Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products),Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
4. *Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly&Sons ,1976.*
5. *Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.*
6. *Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.*
7. *Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, Prajati Parakashan , 2010.*
8. *Thomas L. Gilchrist, Heterocyclic chemistry, Pearson Education, 3. ed. 1997 (ISBN 0-582-27843-0).*

Learning Assessment											
	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. Gopal Chandru Senadi, SRMIST*

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Course Code	UCY20503J	Course Name	Physical Chemistry - IV: Conductance and Chemical Kinetics	Course Category	C	Core course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): ***The purpose of learning this course is to:***

		Learning		
		1	2	3
CLR-1 :	*understand the laws governing migration of ions and evaluate important paramenters from the concept of conductance*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Elaborate the concept of rates laws and identify the order and molecularity of reactions*			
CLR-3 :	*Analyze various theories of kinetics of chemical reactions*			
CLR-4 :	*Explain the mechanisms of different catalytic reactions*			
CLR-5 :	*Infer the laws of photochemistry and explore its application in photochemical reactions*			
CLR-6	*understand the photochemical reactions and the consequences of light absorption.*			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*understand and learn the concept of ionic dissociation and types of electrolytes, laws governing migration of ions in solutions, various ways of quantifying conductance and its experimental determination.*	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	*understand and apply this knowledge in determining important parameters like solubility product, dissociationconstants, rate of reactions and the factors that affect the rates of reaction.*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	-	-
CLO-3 :	*understand the concept of rate laws e.g., order, molecularity, half-life etc. and their determination, various theories of reaction rates and how these account for experimental observations.*	2	70	65	H	-	-		-	-	-	-	-	-	-	-	H	-	-
CLO-4 :	*deduce rate laws from reaction mechanisms thereby grasping the concepts of elementary and complex reactions and chain reactions, steady state approximation and rate determining step.*	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	H	-	-
CLO-5 :	*understand the mechanism of catalytic action on reactions for homogeneous, surface catalysed and enzyme catalysed reactions, laws of absorption of light energy by molecules and the subsequent photochemical reactions.*	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	H	M	-
CLO-6 :	*understand the concept of quantum efficiency and mechanisms of photochemical reactions.*	2	75	70	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-

Duration (hour)		24	24	24	24	24
S-1	**SLO-1**	*Introduction to conductance*	*Ostwald dilution law*	*Order and molecularity of complex reaction*	*Influence of solvent in reaction rate*	*Photochemisty-Introduction*
	SLO-2	*Faraday law of electrolysis*	*Debye-Huckel equation*	*Mechanism of complex reactions*	*Reactions in flow system*	*Characteristics of electromagnetic radiation*
S-2	**SLO-1**	*First and second law*	*Onsager equation*	*Effect of temperature on reaction rate*	*Types of flow system*	*Consequences of light absorption – Jablonski diagram*
	SLO-2	*Ohm's law*	*Debye-Falkenhagen effect*	*Concept of activation energy*	*Plug flow method*	*Beer-Lamberts law*
S-3	**SLO-1**	*Conductance, specific conductance and equivalent conductance*	*Wien effect*	*Concept of energy barrier*	*Qualitative treatment of the theory of absolute reaction rates*	*And its limitations*
	SLO-2	*Relation between specific conductance and equivalent conductance*	*Activity coefficient and mean activity coefficient*	*Arrhenius equation*	*Molecular reaction dynamics.*	*Physical significance of molar absorption coefficients.*

Duration (hour)		24	24	24	24	24
S-4	SLO-1	*Molar conductance and cell constant*	*Debye-Huckel theory of mean activity of coefficients*	*Collision theory*	*Flash photolysis*	*Laws of photochemistry*
	SLO-2	*Variation of molar conductance with dilution*	*Debye-Huckel limiting law*	*Collision theory of bimolecular reaction*	*Pulse radiolysis*	*Quantum yield*
S-5 to S-8	SLO-1	*1. Determination of cell constant.*	*4. To study the kinetics of Acid hydrolysis of methyl acetate with HCl using integrated rate law method.*	*7.To study the kinetics of saponification of ethyl acetate*	*Repetition Lab*	*Repetition Lab*
	SLO-2					
S-9	SLO-1	*Ionic mobility*	*Determination of equivalent conductance*	*Activated complex theory*	*Catalysis:Catalyst, catalysis and auto catalysis*	*Experimental determination of quantum yield*
	SLO-2	*Transport number*	*Relation between molar ionic conductance and ionic activity*	*Activated complex theory of bimolecular reaction*	*General characteristics of catalyst*	*actinometer*
S-10	SLO-1	*Transport number determination*	*Ionic mobility determination*	*Evaluation of standard enthalpy of activation and standard entropy of activation*	*Types of catalyst*	*Types of photochemical reaction*
	SLO-2	*Moving Boundary method*	*Ionic strength*	*Lindemann theory of unimolecular reaction*	*Acid-base catalysis*	*Example of low and high quantum yields*
S-11	SLO-1	*Hittorf method*	*Introduction to chemical kinetics*	*Lindemann derivation*	*Kinetics of acid-base catalysis reaction*	*Rate law for photochemical reaction*
	SLO-2	*Effect of concentration on transport number*	*Rate equation and rate constant*	*Kinetics of complex reaction*	*Enzyme catalysed reaction*	*Kinetics of photochemical reaction*
S-12	SLO-1	*Molar conductivity at infinite dilution*	*Order of reaction*	*Opposing reaction*	*Michaelis-menten mechanism*	*Photosensitized reaction,*
	SLO-2	*Kohlraush's law*	*Rate laws*	*Opposing reaction derivation*	*Mechanism of catalysed reaction at the surface*	*Fluorescence quenching*
S-13 To S-16	SLO-1	*2. Determination of conductivity, molar conductivity, degree of dissociation and dissociation constant of aweak acid.*	*5. To study the kinetics of iodide-persulphate reaction by initial rate method*	*Repetition Lab*	*Repetition Lab*	*Repetition Lab*
	SLO-2					
S-17	SLO-1	*Application of Kohlraush's law-calculation of molar conductance at infinite dilution for weak electrolyte*	*Integrated form of rate equation-first order,*	*Kinetics of consecutive reaction*	*Langumir-Hinshelwood mechanism*	*Stern-volmer equation*
	SLO-2	*Determination of transport number*	*Integrated form of rate equation-second order*	*consecutive reaction derivation*	*Kinetics of surface reaction*	*Chemiluminescence*
S-18	SLO-1	*Waldens rule*	*Half-life time of a reaction*	*Kinetics of chain reaction*	*Kinetics of unimolecular reaction derivation*	*Role of photochemical reaction in biochemical process*
	SLO-2	*Application of conductometric measurements* *Degree of dissociation of weak electrolyte*	*$t^{1/2}$ for n^{th} order reaction*	*chain reaction example*	*Kinetics of bimolecular reaction derivation*	*Photostationary state*
S-19	SLO-1	*Ionic product of water,*	*Method for determining order of a reaction*	*Kinetics of branched chain reaction*	*Effect of temperature on heterogeneous reaction*	*Photocatalytic decomposition of HI*
	SLO-2	*Solubility and solubility product of sparingly soluble salts (uses of Kohlraush's law)*	*Different methods*	*with examples*	*Temperature effect on uni and bimolecular reactions*	*Lasers*
S-20	SLO-1	*Conductometric titrations*	*Molecularity of a reaction*	*Kinetics of reaction in solution*	*pH dependence of rate constant*	*Uses of lasers*
	SLO-2	*Hydrolysis constant of salts*	*Order and molecularity of a simple*	*Diffusion constant reaction in solution*	*and derivation*	*Geometry of excited state and its life*

Duration (hour)		24	24	24	24	24
			reaction			*time*
S-21 to S-24	**SLO-1**	*3.Perform the following conductometric titrations.(i)strong acid vs. strong base,ii.weak acid vs.strong base, iii. Mixture of strong acid and weak acid vs. Strong base*	*6.To study the kinetics of iodine-persulphate reaction using integrated rate law method.*	*Repetition Lab*	*Repetition Lab*	*Repetition Lab*
	SLO-2					

Learning Resources	*Theory:* *1.Atkins, P.W & Paula, J.D. Physical Chemistry, 10th Ed., Oxford University Press 2011.* *2. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP ,2009.* *3. Silbey, R. J.; Alberty, R. A. & Bawendi, M. G. Physical Chemistry 4th Ed., John Wiley & Sons, Inc., 2005* *4. Kapoor, K.L. A Textbook of Physical Chemistry, McGraw Hill Education (India) , 2014* *5. Ball, D,W. Physical Chemistry, Cengage India Private Limited 2nd Ed., 2017* *6. Laidler K.J. Chemical Kinetics 3rd Ed. Pearson Education India, 2003*	*Practicals:* *1. Khosla, B.D., Garg, V.C. and Gulati, A. Senior Practical Physical, R.Chand & Co., New Delhi , 2011.*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,
*Attendance includes 5% weightage in internals

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Dr. Ashok Kumar Sundaramoorthy,, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. J.Arockiaselvi, SRMIST*

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Course Code	UCY20S03T	Course Name	Green Chemistry	Course Category	S	Skill enhancement course	L	T	P	C
							2	0	0	2

CLR-1 :	To gain knowledge about the obstacles present in employing green chemistry
CLR-2 :	Understanding the principles governing Green chemistry
CLR-3 :	To employ nonconventional reaction techniques for synthesis of molecules
CLR-4:	Gain ability to design of chemical reactions/chemical synthesis using green chemistry principles.
CLR-5:	Learn about future trends in Green chemistry

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	1 Level of Thinking (Bloom)	2 Expected Proficiency (%)	3 Expected Attainment (%)	1 Fundamental Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	Students will gain knowledge about Atom economy and principles involved in Green chemistry.	*2*	*70*	*65*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	*H*	*M*	-
CLO-2 :	Student will have ablilty to visualize a green chemistry approach to existing synthetic reactions	*2*	*80*	*70*	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	*H*	-	*M*
CLO-3:	To employ nonconventional reaction methods to existing conventional synthetic methods	*2*	*80*	*70*	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	-	*H*	-
CLO-4 :	Utilize the knowledge gained in the course for experimenting with solventless reactions	*2*	*80*	*70*	-	-	-	-	*H*	-	-	-	-	-	-	-	*H*	*H*	
CLO-5 :	To identify reactions wherein sustainable synthetic methods can be employed	*2*	*80*	*70*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	*H*	-	*M*

Pre-requisite Courses	*Nil*	**Co-requisite Courses**	*Nil*	**Progressive Courses**	*Nil*
Course Offering Department	*Chemistry*	**Data Book / Codes/Standards**		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	**Learning**	**Program Learning Outcomes (PLO)**

Duration (hour)		**6**	**6**	**6**	**6**	**6**
S-1	**SLO-1**	Introduction to Green Chemistry	Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples	Green Synthesis / Reactions I: Green Synthesis of Adipic acid	Green Synthesis / Reactions II : Surfactants	Future Trends in Green Chemistry: Oxidation reagents and catalysts
	SLO-2	Introduction to Green Chemistry	Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples	Green Synthesis / Reactions I: Green Synthesis of Adipic acid	Green Synthesis / Reactions II : Surfactants	Future Trends in Green Chemistry: Oxidation reagents and catalysts
S-2	**SLO-1**	Goals of Green Chemistry	Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples	Green Synthesis of catechol	Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO2 for precision cleaning and dry cleaning of garments.	Biomimetic, multifunctional reagents;
	SLO-2	Goals of Green Chemistry	Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples	Green Synthesis of disodium iminodiacetate (alternative to Strecker synthesis).	Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO2 for precision cleaning and dry cleaning of garments.	Biomimetic, multifunctional reagents;

Duration (hour)		6	6	6	6	6
S-3	SLO-1	Basic introduction and explaining goals of Green Chemistry	Specialemphasis on Designing a Green Synthesis using these principles	Microwave assisted reactions in water: Hofmann Elimination	Designing of Environmentally safe Marine antifoulant.	Combinatorial green chemistry
	SLO-2	Basic introduction and explaining goals of Green Chemistry	Prevention of Waste/ byproducts	Microwave assisted reactions in water: methyl benzoate to benzoic acid	Designing of Environmentally safe Marine antifoulant.	Combinatorial green chemistry
S-4	SLO-1	Basic introduction and explaining goals of Green Chemistry	Maximum incorporation of the materials used in the process into the final products	Microwave assisted reactions in water: oxidation of toluene	An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn	Proliferation of solventless reactions;
	SLO-2	Basic introduction and explaining goals of Green Chemistry	Atom Economy - calculation of atom economy of the rearrangement	Microwave assisted reactions in water: oxidation of alcohols	An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn	Proliferation of solventless reactions;
S-5	SLO-1	Limitations/Obstacles in the pursuit of the goals of Green Chemistry	Additionreactions	Reactions in organic solvents - Diels-Alder reaction	Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils	co crystal controlled solid state synthesis (C2S3);
	SLO-2	Limitations/Obstacles in the pursuit of the goals of Green Chemistry	Additionreactions	Reactions in organic solvents - Decarboxylation reaction	Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils	co crystal controlled solid state synthesis (C2S3);
S-6	SLO-1	Limitations/Obstacles in the pursuit of the goals of Green Chemistry	Substitutionreactions	Ultrasound assisted reactions: Sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine	Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils	Green chemistry in sustainable development
	SLO-2	Limitations/Obstacles in the pursuit of the goals of Green Chemistry	Elimination reactions	Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)	Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils	Green chemistry in sustainable development

Learning Resources

1. .Ahluwalia, V.K., Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005.
2. Anastas, P.T. & Warner, J.K, Green Chemistry- Theory and Practical, Oxford University Press, 1998.
3. Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker, 2001.
4. Cann, M.C.and Connely, M.E. Real-World cases in Green Chemistry, ACS 2000.
5. Ryan, M.A. and Tinnesand, M. Introduction to Green Chemistry, American Chemical Society, 2002.
6. Lancaster, M. Green Chemistry: An Introductory Text RSC Publishing, Second Edition, 2010.

Learning Assessment											
	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. M. R. Ganesh, SRMIST*

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Course Code	UCY20S04T	Course Name	Pharmaceutical Chemistry	Course Category	S	Skill Enhancement Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	**Data Book / Codes/Standards**	*Nil*		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	Develop basic understanding of drugs discovery, design, development and their side effects			
CLR-2 :	Comprehend the mode of action of antiinflammatory agents, antibacterial, antifungal agents ans antiviral agents			
CLR-3 :	Give the knowledge of synthesis of major drug classes including-analgesics, antipyretics, antiinflammatory agents, antibacterial and antifungal agents antiviral agents, Central Nervous System agents and drugs for HIV--AIDS .			
CLR-4 :	Gain knowledge about enzyme reactions and influence of cofactors on the reactions			
CLR-5 :	Gain an overview of fermentation process and production of certain dietary supplements and certain common antibiotics will be discussed.			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*			
CLO-1 :	Students will dvelop ability to apply retro-synthesis approach to synthsize drug molecules	*2*	*70*	*65*
CLO-2 :	Ability to correlate various features of the drug to its biological action	*2*	*80*	*70*
CLO-3 :	To differentiate between drug and poison	*2*	*75*	*60*
CLO-4 :	Utilize the knowledge gained in the course to synthesize of molecules	*2*	*80*	*70*
CLO-5 :	Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins	*2*	*80*	*75*

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	-	*H*	-	-	-	-	-	-	-	-	-	-	-	-
H	-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-
-	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-
H	-	*H*	-	*H*	-	-	-	-	-	-	-	*H*	*H*	-
H	-	-	-	-	-	*H*	-	-	-	-	-	*H*	*H*	*M*

Duration (hour)		6	6	6	6	6
S-1	**SLO-1**	Introduction - Drug discovery	Drugs and Pharmaceuticals – I Study of pharmaceutical aids - talc, diatomite and kaolin	Drugs and Pharmaceuticals – II Definition and actions of Antiviral agents	Introduction - Enzymes	Fermentation - Aerobic and anaerobic fermentation
	SLO-2	Introduction - Design and development	Study of pharmaceutical aids - bentomite, gelatin and natural colours	Synthesis of the representative drugs Antiviral agents (Acyclovir)	Introduction - Enzymes	Fermentation - Aerobic and anaerobic fermentation
S-2	**SLO-1**	Sources of drugs: biological, marine, minerals and plant tissue culture	Definition and actions of antipyretic drug	Definition and actions of Central Nervous System agents	Classification of enzymes	Production of Ethyl alcohol
	SLO-2	Physio-chemical aspects (optical, geometric and bioisosterism) of drug molecules and biological action	Synthesis of the representative drugs of the following classes: antipyretic agents	Synthesis of the representative drugs Central Nervous System agents (Phenobarbital, Diazepam)	Enzyme specificity	Production of citric acid
S-3	**SLO-1**	Drug receptor interaction	Definition and actions of anti-inflammatory drug	Definition and actions of Cardiovascular drug	Mechanism of enzyme action	Production of Antibiotics - Penicillin
	SLO-2	Drug receptor interaction	Synthesis of the representative drugs of the following classes: antiinflammatory agents (Aspirin)	Synthesis of the representative Cardiovascular drug(Glyceryl trinitrate)	Mechanism of enzyme action	Production of Antibiotics - Cephalosporin
S-4	**SLO-1**	Basic Retro-synthetic approach for development of drug.	Definition and actions of representative antibacterial agent	Definition and actions of antilaprosy drug	Enzyme cofactor	Production of Antibiotics -Chloromycetin

Duration (hour)		6	6	6	6	6
	SLO-2	Basic Retro-synthetic approach for development of drug.	Synthesis of the representative drugs of the following classes: antibacterial agent (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim	Synthesis of the representative antilaprosy drugs (Dapsone)	Role of enzyme cofactor in reactions	Production of Antibiotics -Streptomycin
S-5	SLO-1	Cause of side effect of drugs like ibuprofen, cetirizine, thalidomide, etc	Synthesis of the representative drugs of the following classes: antibacterial agent (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim	Definition and actions of HIV-AIDS related drugs	coenzyme - – its role in enzyme reactions	Production of - Lysine,Glutamic acid
	SLO-2	Cause of side effect of drugs like ibuprofen, cetirizine, thalidomide, etc	Synthesis of the representative drugs of the following classes: antibacterial agent (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim	Definition and actions of HIV-AIDS related drugs	ATP	Production of - Vitamin B2
S-6	SLO-1	Difference between drug and poison.	Synthesis of the representative drugs of the following classes: antifungal agent	Synthesis of the representative HIV-AIDS related drugs (AZTZidovudine)	Immobilization of enzymes	Production of - Vitamin B12
	SLO-2	Difference between drug and poison.	Definition and actions of representative antifungal agent	Synthesis of the representative HIV-AIDS related drugs (AZTZidovudine)	Immobilization of enzymes	Production of - Vitamin C

Learning Resources	1. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK. 2. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi. 3. William O. Foye, Thomas L., Lemke , David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi.	4. Richard A. Kjonaas, Peggy E. Williams, David A. Counce, and Lindsey R. Crawley, Synthesis of Ibuprofen. in the Introductory Organic Laboratory, J. Chem. Educ., 88 (6), pp 825– 828, 2011. 5. Daniel G. Marsh, Deborah L. Jacobs, and Hans Veening, Analysis of commercial vitamin C tablets by iodometric and coulometric titrimetry, J. Chem. Educ., 50 (9), p 62,61973.

Learning Assessment											
	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*		*30%*		*30%*		*30%*		*30%*	
Level 2	Apply Analyze	*40%*		*40%*		*40%*		*40%*		*40%*	
Level 3	Evaluate Create	*20%*		*30%*		*30%*		*30%*		*30%*	
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in	1. Prof. M. Arthanareeswari, SRMIST
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in	2. Dr. M. R. Ganesh, SRMIST

Course Code	UES20AE1T	Course Name	Environmental Studies	Course Category	A	Ability Enhancement Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computer Applications*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*To teach the importance of environment*
CLR-2 :	*To impart the knowledge about ecosystem*
CLR-3 :	*To teach about Biodiversity*
CLR-4 :	*To create awareness about environmental pollution*
CLR-5 :	*To understand about Environment Protection*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*To gain knowledge on the importance of natural resources and energy*	*2*	*75*	*60*
CLO-2 :	*To understand the structure and function of an ecosystem*	*2*	*80*	*70*
CLO-3 :	*To imbibe an aesthetic value with respect to biodiversity, understand the threats and its conservation and appreciate the concept of interdependence*	*2*	*70*	*65*
CLO-4 :	*To understand the causes of types of pollution and disaster management*	*2*	*70*	*70*
CLO-5 :	*To observe and discover the surrounding environment through field work*	*2*	*80*	*70*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO -1	PSO -2	PSO-3
H	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	-		-	-	-	-	-	-	-	-	-	-	-
H	-	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-
-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	*Environmental Studies- Concept*	*Concept of an ecosystem*	*Biodiversity at Global, National And Local Levels*	*Causes, Effects and Control Measures of Nuclear hazards*	*Need for equitable utilization*
	SLO-2	*Scope and Importance of Environmental Studies*	*Ecosystem degradation and Resource utilization*	*India as a Mega Diversity Nation*		*Equity – Disparity*
S-2	SLO-1	*Need for public awareness.*	*Structure and Functions of an ecosystem*	*Threats to biodiversity: habitat loss, poaching of wildlife*	*Solid Waste ManagementCauses, Effects and Control Measures of Urban and Industrial Waste*	*Urban – rural equity issues*
	SLO-2	*Institutions in Environment*	*Producers, consumers and decomposers*	*man-wildlife conflicts*		*The need for Gender Equity*
S-3	SLO-1	*People in Environment*	*Energy flow in the ecosystem*	*Endangered species of India*	*Role of Individuals In Pollution Prevention*	*Preserving resources for future generations*
	SLO-2	*Awareness about Environmental Studies*	*The water cycle , The Carbon cycle , The Oxygen cycle , The Nitrogen cycle , The energy cycle and, Integration of cycles in nature*	*Endemic species of India*		*The rights of animals*

Duration (hour)		9	9	9	9	9
S-4	SLO-1	*Introduction to natural resources- Associated Problems*	*Ecological succession*	*Environmental Pollution- Definition*	*Disaster management- NatureFloods, Earthquakes*	*The ethical basis of environment education and awareness*
	SLO-2	*Renewable and Nonrenewable resources*	*Food chains, Food webs and Ecological pyramids*			
S-5	SLO-1	*Forest resources*	*Ecosystem, Introduction, Types, Characteristic features, Structure and functions*	*Causes, Effects and Control Measures of Air Pollution*	*Cyclones Landslides*	*The conservation ethic and traditional value systems of India*
	SLO-2	*Water Resources*	*Forest ecosystem*			
S-6	SLO-1	*Mineral Resources*	*Grassland ecosystem*	*Causes, Effects and Control Measures ofWater Pollution*	*Social Issues and the EnvironmentFrom Unsustainable to Sustainable Development*	*Wasteland Reclamation*
	SLO-2	*Food Resources*	*Desert ecosystem*			
S-7	SLO-1	*Energy Resources*	*Aquatic ecosystems (ponds, lakes, streams)*	*Causes, Effects and Control Measures ofSoil Pollution*	*WaterConservation*	*Climate change & Global warming*
	SLO-2	*Land Resources*	*Aquatic ecosystems (rivers, estuaries, oceans)*			
S-8	SLO-1	*Renewable and non-renewable resources- Wind*	*Value Of Biodiversity*	*Causes, Effects and Control Measures of Marine pollution*	*Rain Water HarvestingWatershed*	*Acid rain & Ozone layer depletion*
	SLO-2	*Renewable and non-renewable resources- geothermal*	*Consumptive Value And Productive Value*			
S-9	SLO-1	*Renewable and non-renewable resources- Solar*	*Social Value and Ethical Value*	*Causes, Effects and Control Measures of Noise Pollution*	*Environmental Ethics: Issues and Possible Solutions*	*Nuclear Accidents and Nuclear Holocaust*
	SLO-2	*Renewable and non-renewable resources- Biomass*	*Aesthetic Value and Option Value*	*Causes, Effects and Control Measures of Thermal Pollution*	*Resource consumption patterns*	

Learning Resources	**Theory:** 1. BharuchaErach, (2013), Textbook of Environmental Studies for Undergraduate Courses (Second edition). Telangana, India: Orient BlackSwan. 2. BasuMahua, Savarimuthu Xavier, (2017), SJ Fundamentals of Environmental Studies. Cambridge, United Kingdom: Cambridge University Press 3. Dr.R.Jeyalakshmi.2014.,Text book of Environmental Studies, Devi publications, Chennai 4. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380013, India, Email:mapin@icenet.net (R)

Learning Assessment

Level	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40	-	40	-	40	-	40	-	40	-
	Understand										
Level 2	Apply	30	-	30	-	30	-	30	-	30	-
	Analyze										
Level 3	Evaluate	30	-	30	-	30	-	30	-	30	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Academic**	**Internal Experts**
1. Mr. Suresh S, Program Head, Hello FM	*1. Dr. G Balasubramania Raja, Prof & Head, ManonmaniamSundranar University Mail- gbs_raja@yahoo.com*	*1. Dr. Rajesh R, Head, SRM IST*
		2.Dr.S.Albert Antony Raj, Associate Professor and Head, SRMIST

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Course Code	UJK20501T	Course Name	Leadership and Management Skills	Course Category	JK	Life Skill Courses	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Career Development Centre	Data Book / Codes/Standards	-		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	help students to develop essential skills to influence and motivate others	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	Inculcate emotional and social intelligence and integrative thinking for effective leadership			
CLR-3 :	create and maintain an effective and motivated team to work for the society			
CLR-4 :	nurture a creative and entrepreneurial mindset			
CLR-5 :	make students understand the personal values and apply ethical principles in professional and social contexts			
CLR-6 :	manage competency-mix at all levels for achieving excellence with ethics			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
CLO-1 :	examine various leadership models and understand / assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision	3	80	75
CLO-2 :	learn and demonstrate a set of practical skills such as time management, self-management, handling conflicts, team leadership, etc	3	80	75
CLO-3 :	understand the basics of entrepreneurship and develop business plan	3	75	70
CLO-4 :	apply the design thinking approach for leadership	3	75	70
CLO-5 :	appreciate the importance of ethics and moral values for making of a balanced personality	3	75	70
CLO-6 :	be an integral human being	3	75	70

		Program Learning Outcomes (PLO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :		L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-2 :		L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-3 :		L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-4 :		L	M	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-5 :		L	H	H	-	M	M	-	-	-	M	H	L	-	H	H
CLO-6 :		L	H	H	-	M	M	-	-	-	M	H	L	-	H	H

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Leadership - definition	Team building	Management – definition	*Women in management*	*Entrepreneurship*
	SLO-2	Leadership – qualities	Team dynamics	Manager – traits	*Global gender perspective in business. Do women make good managers? - discussion*	*Entrepreneurship*
S-2	SLO-1	Leadership – styles	Work delegation	Scheduling work	*Confronting problems faced by women managers – case study*	*Successful Indian entrepreneurs – case study*
	SLO-2	Leadership – styles	Work delegation – activity	Scheduling work – activity	*Confronting problems faced by women managers – case study*	*Successful Indian entrepreneurs – case study*
S-3	SLO-1	*Difference between leader and boss*	Decision making	*Strategic planning*	*Successful women managers – documentary screening*	*Successful women entrepreneurs – case study*

Duration (hour)		6	6	6	6	6
	SLO-2	*Case study (based on leadership styles)*	Decision making - activity	*Strategic planning*	*Successful women managers – documentary screening*	*Successful women entrepreneurs – case study*
S-4	SLO-1	*Case study (based on leadership styles)*	Motivation	Change management	*Women labour force in work place*	*Ethics – definition*
	SLO-2	*Case study (based on leadership styles)*	Motivating for results	Change management – activity	*Problems faced by women labour force in work place - case study*	*Corporate ethics*
S-5	SLO-1	Leadership in diverse organizational structures, cultures and communications	Argumentation, Persuasion	*Energy management*	Sexual harassment of women at workplace (prevention, prohibition, and redressal) Act, 2013	*Essential elements of business ethics*
	SLO-2	Leadership in diverse organizational structures, cultures and communications	Negotiation , Networking	*Novel ways to manage energy in work place – activity*	Documentary screening - Sexual harassment of women at workplace	*Activity (students formulate ethical code of their business organization)*
S-6	SLO-1	Leading the organisation through stability and turbulence	Budget planning	*Work force management*	Transgender persons protection of rights act, 2019	*Ethical dilemma*
	SLO-2	Case study	Taking risk	*Grievance redressal policy in organisations*	Documentary screening –based on inclusiveness of the third gender in workplace	*Ethical dilemma - case study*

Learning Resources	
	1. *Craig E Johnson, Meeting the ethical challenges of leadership, Sage publications, 2018* 2. *Allan R Cohen, David L Bradford, Influence without authority, Wiley, 2018* 3. *T V Rao, Managers who make a difference: Sharpening your management skill, Random house India, 2016* 4. *Alexander Osterwalder, Business Model Generation,Wiley, 2013* 5. *Deborah Tannen, Talking from nine to five: Women and men in the workplace, Harper Collins publishers, 2010* 6. *Amish Tandon, Law of sexual harassment at workplace: Practice and procedure,Niyogi books, 2017* 7. *Rashmi Bansal, Connect the dots, Westland books, 2012*

Learning Assessment

Level	Bloom'sLevel of Thinking	Continuous Learning Assessment (100% weightage)			
		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (30%) #	CLA-4 (30%)##
		Theory	Theory	Theory	Theory
Level 1	Remember	10%	10%	30%	15%
	Understand				
Level 2	Apply	50%	50%	40%	50%
	Analyze				
Level 3	Evaluate	40%	40%	30%	35%
	Create				
	Total	100 %	100 %	100 %	100 %

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ajay Zener, Director, Career Launcher	-	*1. Ms Sindhu Thomas B, AssistantProfessor& Head in Charge, CDC, FSH, SRMIST*
		2.MrRajsekar, Assistant Professor, CDC, FOM, SRMIST

SEMESTER VI

Course Code	UCY20601T	Course Name	Organic Chemistry - IV: Biomolecules	Course Category	C	Core course	L	T	P	C
							5	1	0	6

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	**Data Book / Codes/Standards**		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	**Learning**	**Program Learning Outcomes (PLO)**

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Scientific Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-1 :	*The core course of Organic Chemistry IV is an extrapolation of fundamental concept and functional group chemistry studied in the previous core courses*																		
CLR-2 :	*The focus area of this course is on the chemistry of biomolecules i.e. amino acids, peptides and proteins*																		
CLR-3 :	*The focus area of this course is on the chemistry of biomolecules i.e. enzymes and nucleic acids*																		
CLR-4 :	*The focus area of this course is on the chemistry of biomolecules i.e. carbohydrates and lipids*																		
CLR-5 :	*Through the study of energetics in biological systems, it aims to build the concept of metabolism for biological systems more lucid*																		
CLO-1 :	*Understand and demonstrate how structure of biomolecules determines their reactivity and biological functions*	*2*	*75*	*60*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	*H*	-	-
CLO-2 :	*Gain insight into concepts of heredity through the study of genetic code, replication, transcription and translation.*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	*H*	-	-
CLO-3 :	*Demonstrate and understanding of metabolic pathways, their inter relationship, regulation and energy production from biochemical processes.*	*2*	*70*	*65*	*H*	-	-		-	-	-	-	-	-	-	-	-	*H*	-
CLO-4 :	*Understand the synthetic importance of amino acids, peptides, enzymes and nuclei acids*	*2*	*70*	*70*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	-	-	*H*	-	-
CLO-5 :	*Able to demsonstrate and imply the synthetic chemistry knowledge of carbohydrates*	*2*	*80*	*70*	-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	*H*

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

Duration (hour)		18	18	18	18	18
S-1	**SLO-1**	***Carbohydrates** : Carbohydrates: Occurrence, classification and their biological importance*	*Polysaccharides – Elementary treatment of starch*	*α-Amino Acids – Ionic properties*	*Proteins and its classification*	*Enzyme inhibitors and their importance*
	SLO-2	*Carbohydrates: Occurrence, classification and their biological importance*	*Polysaccharides – Elementary treatment of starch*	*α-Amino Acids – Ionic properties*	*Proteins and its classification*	*Enzyme inhibitors and their importance*
S-2	**SLO-1**	*Carbohydrates: Occurrence, classification and their biological importance*	*Polysaccharides – Elementary treatment of cellulose*	*α-Amino Acids – Ionic properties*	*primary, secondary and tertiary structures of proteins*	*Enzyme inhibitors and their importance*
	SLO-2	*Carbohydrates: Occurrence, classification and their biological importance*	*Polysaccharides – Elementary treatment of cellulose*	*α-Amino Acids – Ionic properties*	*primary, secondary and tertiary structures of proteins*	*Enzyme inhibitors and their importance*

Duration (hour)		18	18	18	18	18
S-3	SLO-1	*Monosaccharides: Constitution and absolute configuration of glucose*	*Polysaccharides – Elementary treatment of glycogen*	*α-Amino Acids – Reactions*	*primary, secondary and tertiary structures of proteins*	*Enzyme inhibitors and their importance*
	SLO-2	*Monosaccharides: Constitution and absolute configuration of glucose*	*Polysaccharides – Elementary treatment of glycogen*	*α-Amino Acids – Reactions*	*primary, secondary and tertiary structures of proteins*	*Enzyme inhibitors and their importance*
S-4	SLO-1	*Monosaccharides: Constitution and absolute configuration of fructose*	*Lipids : Introduction to oils and fats*	*α-Amino Acids – Reactions*	*primary, secondary and tertiary structures of proteins*	*Nucleic Acids : Structure of components of nucleic acids: Bases and sugars*
	SLO-2	*Monosaccharides: Constitution and absolute configuration of fructose*	*Introduction to oils and fats*	*α-Amino Acids – Reactions*	*primary, secondary and tertiary structures of proteins*	*Structure of components of nucleic acids: Bases and sugars*
S-5	SLO-1	*Monosaccharides: Epimers and anomers*	*Common fatty acids present in oils and fats*	*Zwitterions, pKa values andIsoelectric point*	*Denaturation*	*Structure of components of nucleic acids: Nucleosides*
	SLO-2	*Monosaccharides: Epimers and anomers*	*Common fatty acids present in oils and fats*	*Zwitterions, pKa values andIsoelectric point*	*Denaturation*	*Structure of components of nucleic acids: Nucleosides*
S-6	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S-7	SLO-1	*Determination of ring size of glucose*	*Hydrogenation of fats and oils*	*Zwitterions, pKa values andIsoelectric point*	*Enzymes : Enzymes: Introduction*	*Structure of components of nucleic acids: Nucleotides*
	SLO-2	*Determination of ring size of glucose*	*Hydrogenation of fats and oils*	*Zwitterions, pKa values andIsoelectric point*	*Enzymes: Introduction*	*Structure of components of nucleic acids: Nucleotides*
S-8	SLO-1	*Determination of ring size of Fructose*	*Saponification value*	*Electrophoresis*	*Classification and characteristics of enzymes*	*Nomenclature of nucleosides*
	SLO-2	*Determination of ring size of Fructose*	*Saponification value*	*Electrophoresis*	*Classification and characteristics of enzymes*	*Nomenclature of nucleosides*
S-9	SLO-1	*Haworth projections and conformational structures*	*Acid value*	*Peptides and its classification*	*Classification and characteristics of enzymes*	*Nomenclature of nucleotides*
	SLO-2	*Haworth projections and conformational structures*	*Acid value*	*Peptides and its classification*	*Classification and characteristics of enzymes*	*Nomenclature of nucleotides*
S-10	SLO-1	*Interconversions of aldoses and ketoses*	*Iodine number*	*Study of peptides: determination of their primary structures-end group analysis*	*Mechanism of enzyme action (taking chymotrypsin as an example)*	*Structure of polynucleotides (DNA and RNA)*
	SLO-2	*Interconversions of aldoses and ketoses*	*Iodine number*	*Study of peptides: determination of their primary structures-end group analysis*	*Mechanism of enzyme action (taking chymotrypsin as an example)*	*Structure of polynucleotides (DNA and RNA)*
S-11	SLO-1	*Interconversions of aldoses and ketoses*	*Reversion*	*Study of peptides: determination of their primary structures-end group analysis*	*Mechanism of enzyme action (taking chymotrypsin as an example)*	*Structure of polynucleotides (DNA and RNA)*
	SLO-2	*Interconversions of aldoses and ketoses*	*Reversion*	*Study of peptides: determination of their primary structures-end group analysis*	*Mechanism of enzyme action (taking chymotrypsin as an example)*	*Structure of polynucleotides (DNA and RNA)*
S-12	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S-13	SLO-1	*Killiani- Fischer synthesis*	*Rancidity*	*Synthesis of peptides using N-protecting, C-protecting and C-activating groups*	*Factors affecting enzyme action*	*Biological roles of DNA and RNA*

Duration (hour)		18	18	18	18	18
	SLO-2	*Killiani- Fischer synthesis*	*Rancidity*	*Synthesis of peptides using N-protecting, C-protecting and C-activating groups*	*Factors affecting enzyme action*	*Biological roles of DNA and RNA*
S-14	SLO-1	*Ruff degradation*	*Amino Acids, Peptides and Proteins :Amino acids and its classification*	*Synthesis of peptides using N-protecting, C-protecting and C-activating groups*	*Factors affecting enzyme action*	*Concept of heredity: Genetic Code*
	SLO-2	*Ruff degradation*	*Amino acids and its classification*	*Synthesis of peptides using N-protecting, C-protecting and C-activating groups*	*Factors affecting enzyme action*	*Concept of heredity: Genetic Code*
S-15	SLO-1	*Disaccharides – Structure elucidation of maltose*	*Amino acids and its classification*	*Synthesis of peptides using N-protecting, C-protecting and C-activating groups*	*Coenzymes and cofactors (NAD, FAD)*	*Concept of heredity: Replication*
	SLO-2	*Disaccharides – Structure elucidation of maltose*	*Amino acids and its classification*	*Solid-phase synthesis*	*Coenzymes and cofactors (NAD, FAD)*	*Concept of heredity: Replication*
S-16	SLO-1	*Disaccharides – Structure elucidation of lactose*	*α-Amino Acids – Synthesis*	*Solid-phase synthesis*	*Coenzymes and cofactors (NAD, FAD)*	*Concept of heredity: Transcription*
	SLO-2	*Disaccharides – Structure elucidation of lactose*	*α-Amino Acids – Synthesis*	*Solid-phase synthesis*	*Coenzymes and cofactors (NAD, FAD)*	*Concept of heredity: Transcription*
S-17	SLO-1	*Disaccharides – Structure elucidation of sucrose*	*α-Amino Acids – Synthesis*	*Solid-phase synthesis*	*Specificity of enzyme action (including stereospecificity)*	*Concept of heredity: Translation*
	SLO-2	*Disaccharides – Structure elucidation sucrose*	*α-Amino Acids – Synthesis*	*Solid-phase synthesis*	*Specificity of enzyme action (including stereospecificity)*	*Concept of heredity: Translation*
S-18	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*

Learning Resources

Theory:

1. *Berg, J.M., Tymoczko, J.L. and Stryer, L. Biochemistry. VIth Edition. W.H. Freeman and Co., 2006.*
2. *Nelson, D.L., Cox, M.M. and Lehninger, A.L. Principles of Biochemistry. IV Edition. W.H. Freeman and Co., 2009*
3. *Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. Harper's Illustrated Biochemistry. XXVIII edition. Lange Medical Books/McGraw-Hill, 2009*
4. *Finar, I.L. Organic Chemistry, Volume 2, Fifth Edition, Pearson Education, 2008*
5. *P. Y. Bruice, Organic Chemistry, 5th Ed., Pearson, 2014.*
6. *Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).*
7. *Kemp, W. Organic Spectroscopy, Palgrave*
8. *Spectrometric Identification of Organic Compounds By Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce*

Learning Assessment

Level	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40	-	40	-	40	-	40	-	40	-
	Understand										
Level 2	Apply	30	-	30	-	30	-	30	-	30	-
	Analyze										
Level 3	Evaluate	30	-	30	-	30	-	30	-	30	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2.Dr. Gopal Chandru Senadi, SRMIST*

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Course Code	UCY20D05J	Course Name	Instrumental Methods of Chemical Analysis	Course Category	D	Discipline Specific Elective	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to make students aware about the following concepts::	Learning	Program Learning Outcomes (PLO)

		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-1 :	Knowledge of analytical data analysis and classification of analytical methods. Basic components in Infrared, UV, Visible and near IR and Mass spectrophotometer.	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-2 :	Advantages of Fourier-Transform Infrared (FTIR) and NMR spectroscopy. Portable instrumentation and issues regarding quality assurance and quality control.																		
CLR-3 :	Single and Double Beam instruments Interpretation like quantification, mixtures, absorption vs. fluorescence and the use of time, photoaccoustic, fluorescent tags.																		
CLR-4 :	To unravel the spectrum of organic chemistry and the extent of organic transformations.																		
CLR-5 :	Separation techniques like Chromatography, Electrophoresis and DNA techniques																		
CLR-6 :	Elemental analysis, Electroanalytical Methods, Radiochemical Methods, X-ray analysis and electron spectroscopy.																		
CLO-1 :	How to handle Analytical data. Basic Components of IR, FTIR , UV-Visible and Mass spectrometer.	2	75	60	H	H	H	-	-	-	-	-	-	-	-	-	M	H	-
CLO-2 :	Interpretation of IR, FTIR, UV-visible spectra and their applications.	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	H-	H
CLO-3 :	Signal detections in photocells, photomultipliers, etc. Use of single and double beam instruments.	2	70	65	H	-	-		-	-	-	-	-	-	-	-	H	M	-
CLO-4 :	Separations techniques like Chromatography, DNA techniques.	2	70	70	H	-	H	H	H	-	-	-	-	-	-	-	-	H	-
CLO-5 :	Mass spectra and its applications.	2	80	70	-	H	-	H	-	-	-	-	-	-	-	-	-	H	H
CLO-6 :	Elemental analysis, NMR spectroscopy, Electroanalytical Methods, Radiochemical Methods, X-ray analysis and electron spectroscopy.	2	75	70	-	-	-	-	-	-	-	-	-	-	-	-	-	M	H

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:

Duration (hour)		24	24	24	24	24
		Introduction to analytical methods of data analysis	UV-Visible/ Near IR Spectroscopy		Elemental analysis	
S-1	SLO-1	Treatment of analytical data, including error analysis	Emission	Detection: simple vs. specific (gas and liquid)	Mass spectrometry (electrical discharges)	Electroanalytical Methods: Potentiometry
	SLO-2	Treatment of analytical data, including error analysis	Absorption	Detection: simple vs. specific (gas and liquid)	Mass spectrometry (electrical discharges)	Electroanalytical Methods: Potentiometry
S-2	SLO-1	Classification of analytical methods	Fluorescence	Detection as a means of further analysis (use of tags and coupling to IR and MS)	Atomic spectroscopy: Atomic absorption	Electroanalytical Methods: Potentiometry
	SLO-2	Classification of analytical methods	Photoaccoustic	Detection as a means of further analysis (use of tags and coupling to	Atomic spectroscopy: Atomic absorption	Electroanalytical Methods: Potentiometry

Duration (hour)		24	24	24	24	24
				IR and MS)		
S-3	SLO-1	The types of instrumental methods	Excitation sources (lasers, time resolution)	Electrophoresis (plates and capillary) and use with DNA analysis	Atomic spectroscopy: Atomic emission	Electroanalytical Methods: Voltammetry
	SLO-2	The types of instrumental methods	Excitation sources (lasers, time resolution)	Electrophoresis (plates and capillary) and use with DNA analysis	Atomic spectroscopy: Atomic emission	Electroanalytical Methods: Voltammetry
S-4	SLO-1	Consideration of electromagnetic radiations	wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution)	Immunoassays and DNA techniques	Atomic spectroscopy: Atomic fluorescence	Electroanalytical Methods: Voltammetry
	SLO-2	Consideration of electromagnetic radiations	wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution)	Immunoassays and DNA techniques	Atomic spectroscopy: Atomic fluorescence	Electroanalytical Methods: Voltammetry
S-5 to S-8	SLO-1	Lab Introduction	Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)	Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values	Determination of the isoelectric pH of a protein	Experiment-Repeat-2
	SLO-2					
		Infrared spectroscopy		Mass spectroscopy		
S-9	SLO-1	Interaction of radiations with molecules	Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N)	Making the gaseous molecule into an ion (electron impact)	Excitation and getting sample into gas phase (flames, electrical discharges, plasmas)	Radiochemical Methods: Radiochemical Nuclides
	SLO-2	Interaction of radiations with molecules	Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N)	Making the gaseous molecule into an ion (electron impact)	Excitation and getting sample into gas phase (flames, electrical discharges, plasmas)	Radiochemical Methods: Radiochemical Nuclides
S-10	SLO-1	Absorption and scattering	Single and Double Beam instruments	Making the gaseous molecule into an ion (chemical ionization)	Wave length separation and resolution(dependence on technique)	Radiochemical Methods: Instrumentation
	SLO-2	Absorption and scattering	Single and Double Beam instruments	Making the gaseous molecule into an ion (chemical ionization)	Wave length separation and resolution(dependence on technique)	Radiochemical Methods: Instrumentation
S-11	SLO-1	Means of excitation (light sources)	Interpretation (quantification, mixtures, absorption vs. fluorescence)	Making liquids and solids into ions (electrospray, electrical discharge)	Detection of radiation (simultaneous/ scanning, signal noise)	Radiochemical Methods: Neutron Activation Methods
	SLO-2	Means of excitation (light sources)	Interpretation (quantification, mixtures, absorption vs. fluorescence)	Making liquids and solids into ions (electrospray, electrical discharge)	Detection of radiation (simultaneous/ scanning, signal noise)	Radiochemical Methods: Neutron Activation Methods
S-12	SLO-1	separation of spectrum (wavelength dispersion, time resolution)	Interpretation (the use of time, photoaccoustic, fluorescent tags)	Making liquids and solids into ions (laser desorption, fast atom bombardment)	Interpretation (errors due to molecular and ionic species, matrix effects, other interferences)	Radiochemical Methods: Isotope Dilution Methods
	SLO-2	separation of spectrum (wavelength dispersion, time resolution)	Interpretation (the use of time, photoaccoustic, fluorescent tags)	Making liquids and solids into ions (laser desorption, fast atom bombardment)	Interpretation (errors due to molecular and ionic species, matrix effects, other interferences)	Radiochemical Methods: Isotope Dilution Methods
S-13 To S-16	SLO-1	IR Absorption Spectra (Study of Aldehydes and Ketones)	Potentiometric Titration of a Chloride-Iodide Mixture	Chromatographic separation of the active ingredients of plants, flowers and juices by TLC	Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple	Experiment-Repeat-3
	SLO-2					

Duration (hour)		24	24	24	24	24
			Separation techniques			
S-17	SLO-1	Detection of the signal (heat, differential detection)	Gas chromatography	Separation of ions on basis of mass to charge ratio, magnetic	NMR spectroscopy: Principle	X-ray analysis (surface analysis)
	SLO-2	Detection of the signal (heat, differential detection)	Gas chromatography	Separation of ions on basis of mass to charge ratio, magnetic	NMR spectroscopy: Principle	X-ray analysis (surface analysis)
S-18	SLO-1	Interpretation of spectrum (qualitative, mixtures, resolution)	Liquid chromatography	time of flight	Instrumentation	X-ray analysis (surface analysis)
	SLO-2	Interpretation of spectrum (qualitative, mixtures, resolution)	Liquid chromatography	Electric quadrupole	Instrumentation	X-ray analysis (surface analysis)
S-19	SLO-1	Advantages of Fourier-Transform Infrared (FTIR) spectroscopy	Importance of column technology (packing,capillaries)	Resolution, time and multiple separations	Factors affecting chemical shift	Electron spectroscopy (surface analysis)
	SLO-2	Advantages of Fourier-Transform Infrared (FTIR) spectroscopy	Importance of column technology (packing,capillaries)	Resolution, time and multiple separations	Spin-coupling	Electron spectroscopy (surface analysis)
S-20	SLO-1	Applications: Issues of quality assurance and quality control	Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field)	Detection and interpretation	Applications	Electron spectroscopy (surface analysis)
	SLO-2	Special problems for portable instrumentation and rapid detection.	Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field)	Detection and interpretation	Applications	Electron spectroscopy (surface analysis)
S-21 to S-24	SLO-1	Determination of a Mixture of Cobalt and Nickel (UV-visible spectroscopy)	Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)	Titration curve of an amino acid	Experiment-Repeat-1	Demonstration Practical Session
	SLO-2					Demonstration Practical Session

Learning Resources	***Theory:*** 1. *Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7)* 2. *Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle* 3. *P.W. Atkins: Physical Chemistry* 4. *G.W. Castellan: Physical Chemistry* 5. *C.N. Banwell: Fundamentals of Molecular Spectroscopy* 6. *Brian Smith: Infrared Spectral Interpretations: A Systematic Approach* **7.** *W.J. Moore: Physical Chemistry*	***Practicals:*** 1. *Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7)* 2. *Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle.* 3. *Y.R. Sharma, Elementary Organic Spectroscopy: Principles and Chemical Applications, 5th edition, S. Chand and company Ltd., Ram Nagar, New Delhi, 2010.* **4.** *D.A. Skoog, D.M. West and F.J. Holler, Analytical Chemistry: An Introduction, 5th edition, Saunders college publishing, Philadelphia, 1990*

		Learning Assessment									
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. Gopal Chandru Senadi, SRMIST*

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Course Code	UCY20D06J	Course Name	Introduction To Nanochemistry and Applications	Course Category	D	Discipline Selective Elective	L	T	P	C
							4	0	4	6

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Chemistry	Data Book / Codes/Standards	NIL		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	To stimulate the learner in understanding the basic conceptsof nanochemistry
CLR-2 :	To help the students in synthesizing th various nanoparticles
CLR-3 :	To help the studentsn characterizing the nanoparticles
CLR-4 :	To make them understand Principles, instrumentation and applications of SEM, TEM andAFM
CLR-5 :	To make them understand the properties and applications of various nanoparticles

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Understand the basic concepts and classification of nanomaterials.	2	70	65	H	-	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Study the common properties and size dependent absorption behavior ofnanomaterials.	2	80	70	H	-	-	H	H	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Demonstrate the physical and chemical synthetic routes of nanomaterilals.	2	75	60	-	H	-	-	-	-	-	-	-	-	-	-	-	H	M
CLO-4 :	Analyze the application of nanomaterials in various fields including catalysis,photonics, and medicine.	2	70	70	H	H	-	H	-	-	-	-	-	-	-	-	-	H	-
CLO-5 :	Characterize the nanomaterials using various microscopic techniques.	2	80	70		H	H	-	-	-	-	-	-	-	-	-	-	H	M
CLO-6 :	Understand the mechanism of synthesis of nanoparticles	2	75	65	H	H	H	H	H	-	-	-	-	-	-	-	H	-	-

		Learning Module 1	Learning Module 2	Learning Module 3	Learning Module 4	Learning Module 5
Duration (hour)		24	24	24	24	24
S-1	SLO-1	Introduction to nanoscience nanostructure and nanotechnology	Size dependent properties of nanomaterials:uniqueness in these properties compared to bulk and microscopic solids	Thermal properties	Characterization Techniques of Nanomaterials: Basic principles and applications of UV-Vis-NIR,	ICP-AES (Atomic Emission Spectroscopy)
	SLO-2					
S-2	SLO-1	Properties of nanomaterials	Quantum confinement	Catalytic properties	FTIR	Atomic Force Microscopy (AFM).
	SLO-2				FT-Raman	
S-3	SLO-1	Particle size	Electrical Properties:Properties, Electronic materials, Band structures	Synthesis of Nanomaterials: Top-down and Bottom-up approaches	Photoluminescence	Applications of Nanomaterials: Catalysis on nanoparticles

		Learning Module 1	Learning Module 2	Learning Module 3	Learning Module 4	Learning Module 5
Duration (hour)		24	24	24	24	24
	SLO-2	Particle shape			NMR	semiconductors
S-4	SLO-1	Particle density	Brillouin zones	self-assembly techniques of nanoparticles synthesis	ESR	sensors
	SLO-2	Specific surface area and pore	Hall effects		Light Scattering methods	electronic devices
S-5	SLO-1	semiconducting nanoparticles	Magnetic and Dielectric properties: Brief review on Dia, Para, Ferromagnetic materials, Superparamagnetism and limitation	Solvothermal process	X – ray techniques: X-ray powder diffraction –Quantitative determination of phases	photochemistry
	SLO-2	nanowires				nanophotonics
S-6	SLO-1	nanoclusters	Important properties in relation to nanomagnetism	Preparation of gold nanoparticles	particle size analysis using Scherer formula	applications of CNTs
	SLO-2	quantum wells		Preparation of silver metallic nanoparticles		
S-7 TO S-10	SLO-1	LAB INTRODUCTION	Chemical synthesis of CdS nanoparticles;	Characterize the TiO_2 nanoparticles using XRD and SEManalysis	Synthesis of metal oxide nanoparticles by Chemical reduction method	Characterisation of metal oxide nanoparticles byXRD and SEM analysis
	SLO-2					
S-11 TO S-14	SLO-1	Synthesis of ZnOnanoparticles	UV absorption studies of CdS nanoparticles	measuring the crystallitesize	UV-VIS absorption studies	Determination of particle size
	SLO-2					
S-15	SLO-1	Classification of the nano materials –– zero dimensional, one dimensional	Dielectric properties: Effect of particle size on dielectric properties	self-assembled nanostructures	Particle Size Analyzer	Applications of superconducting materials
	SLO-2					
S-16	SLO-1	Classification of the nano materials -two dimensional and three dimensional nanostructures	Ferroelectrics	Control of nanoarchitecture	Ellipsometry	Organic superconductors
	SLO-2		Multiferroics			
S-17	SLO-1	Quantum dots	Optical Properties: Photoconductivity	one dimensional control	thicknessmeasurements	nanomaterials in biology
	SLO-2	Nanowires				
S-18	SLO-1	Nanotubes	Optical absorption & transmission	Carbon nanotubes	X-Ray Photoelectron Spectroscopy,	medical field
	SLO-2	2D films	Optical absorption & transmission			
S-19	SLO-1	Calculation of percentage of surface atom and surface to volume ratio of spherical, wire shaped nanoparticle	Surface Plasmon resonance phenomena	Carbon nanotubes	Auger Electron Spectroscopy	environmental issue
	SLO-2		variation in colors (Blue shift & Red shift)			
S-20	SLO-1	Calculation of percentage of surface atom and surface to volume ratio of rod, and disc shapes nanoparticles.	optical properties of semiconductor nanoparticles	inorganic nanowires	Optical spectroscopy: Inductively coupled Plasma- mass spectroscopy (ICP-MS)	toxicity
	SLO-2		Photoluminescence			biosafety and ethical issues.
S-21 TO S-24	SLO-1	UV absorption studies of ZnO nanoparticles	Synthesis of TiO_2 Nanoparticles by Sol-Gel Method	Synthesis of metal oxide nanoparticles by Sol-Gel Method	Synthesis of metal oxide nanoparticles by Polyol method	Synthesis of Hydroxyapatite by Sol-gel method
	SLO-2					

Learning Resources	Theory: 1.C. N. R. Rao, A. Muller, A. K. Cheetam, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Willey-VCH Verlag, Germany, 2005. 2.G. Cao, Nanostructures and Nanomaterials: Synthesis, Properties and Appications, Imperial College Press, London, 2004 3.R.W.Kelsall,I.W.Hameley,M.Geoghegan,NanoscaleScience and Technology, John Wiley & Sons, England,2005	Practicals: 1.Pradeep T., A text book of nanoscience and nanotechnology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012

Learning Assessment

	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (5%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.
*Attendance includes 5% weightage in internals

Course Designers		
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2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. T.Pushpamalini , SRMIST*

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Course Code	UCY20D07L	Course Name	Project Work	Course Category	D	Discipline Specific Elective	L	T	P	C
							0	0	12	6

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	***Chemistry***	**Data Book / Codes/Standards**	***Nil***		

	Continuous Learning Assessment (50% weightage)		Final Evaluation (50% weightage)	
	Review – 1	Review – 2	Project Report	Viva-Voce
Project Work	20%	30 %	30 %	20 %

Course Code	UCY20S05T	Course Name	Research Methodology	Course Category	S	Skill Enhancement Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	To understand the concept of research and different types of research in the context of chemistry			
CLR-2 :	To evaluate the different methods of scientific writing and reporting			
CLR-3 :	*To impart the knowledge about the statistical distribution and applications*			
CLR-4 :	To develop the skill of technical writing			
CLR-5 :	To inculcate the knowledge of intellectual property and rights			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Understand the key areas of research	*2*	*70*	*65*
CLO-2 :	Develop laboratory experiment related skills.	*2*	*80*	*70*
CLO-3 :	Develop competence on data collection and process of scientific documentation	*2*	*75*	*60*
CLO-4 :	Understand the research ethics			
CLO-5 :	Submit proposals for funding agencies			

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FundamentalKnowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	-	*H*	-	-	-	-	-	-	-	-	-	*H*	-	-
H	-	-	*H*	*H*	-	-	-	-	-	-	-	-	*H*	*M*
-	*H*	-		-	-	-	-	-	-	-	-	-	*H*	*H*
													H	
													H	

Duration (hour)		6	6	6	6	6
S-1	**SLO-1**	Objectives of research	Citation indices	Basic statistical distribution-applications	Creativity in research – Basic idea	Ethics in research - authors
	SLO-2	Introduction about research	Principles underlying impact factor	Basic statistical distribution-applications	Creativity in research - Explanation	Ackowledgement
S-2	**SLO-1**	types of research-Descriptive vs analytical	Library research, field research	Sample test – Student –t –test, F- test	Good practicals – Units, numbers	Group discussion on ethics in research
	SLO-2	types of research -applied vs fundamental	Laboratory research	κ^2 test	Reproducibility	Outcome of group discussion
S-3	**SLO-1**	types of research- quantitative vs qualitative	Data collection – Maintaining a laboratory record	Modelling skills	Scientific writing - Abbreviations	Plagiarism
	SLO-2	types of research- conceptual vs empirical	Tabulation and generation of graphs	Static Model	nomenclature	Tools to avoid plagiarism
S-4	**SLO-1**	Research methods and methodologies- Description	Basic statistical distribution	Dynamic Model	Writing references	Proposal submission for funding agencies
	SLO-2	Research methods and methodologies –Explanation	Binomial distribution	Limitations	Research report writing	Knowledge of funding agencies

Duration (hour)		6	6	6	6	6
S-5	SLO-1	Literature-review	Poisson distribution	Technical writing	Presentations - Power-point presentation.	Intellectual property
	SLO-2	Consolidation of Literature-review	Normal distribution	Activity in Technical writing	Posterpresentation	Intellectual property rights
S-6	SLO-1	Online databases	Exponential distribution	Technical presentation	Elements of excellent presentation	Copy rights
	SLO-2	Search tools	Geometric distribution	Activity in Technical presentation	Communication skills	Patent rights

Learning Resources	1. Dawson, C.. Practical research methods. UBS Publishers, New Delhi, 2002 2. Walpole R.A., Myers R.H., Myers S.L.and Ye King: Probablity and statstics for engineers and scientist, Pearson Prentice Hall, Pearson Education, Inc. 2007	3. Kothari C.K., Research Methodology-Methods and Techniques(New Age International, New Delhi), 2004

Learning Assessment											
	Bloom'sLevel of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40%*		*30%*		*30%*		*30%*		*30%*	
Level 2	Apply Analyze	*40%*		*40%*		*40%*		*40%*		*40%*	
Level 3	Evaluate Create	*20%*		*30%*		*30%*		*30%*		*30%*	
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.
*Attendance includes 5% weightage in internals

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. S. Rajeswari*

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Course Code	UCY20S06T	Course Name	Chemistry in Everyday Life	Course Category	S	Skill Enhancement Course	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning
CLR-1 :	To familiarize the students on chemistry in everyday life	
CLR-2 :	To gain necessary details and information related to preparation of cosmetic items	
CLR-3 :	To know about the health hazards of the cosmetic items and food colors	
CLR-4:	To understand the properties of food composition and adulterants in food	
CLR-5:	To understand the concept of types of fibre biodegradable polymers	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					FundamentalKnowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Apply the knowledge gained to generate home made products like soap and camphor tablets	2	70	65	H	-	H	-	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Ability to identiy the adulterants present in regular food items	2	80	70	H	-	-	H	H	-	-	-	-	-	-	-	-	H	-
CLO-3 :	Understand the hazards of food colors and its real life implications	2	75	60	-	H	-	-	-	-	H	-	-	-	-	-	-	H	-
CLO-4 :	Application of various food preservation techniques	2	75	70	H	-	H	-	-	-	H	-	H	-	-	H	H	H	
CLO-5 :	The students will be able to understand the importance and benefits of antioxidants to the living system	2	75	70	H	-	-	-	-	H	-	-	-	-	-	-	H	H	M

Duration (hour)		6	6	6	6	6
S-1	SLO-1	Cosmetics: Introduction	Definitions and sources – Carbohydrates	Food preservatives- Definition-examples	Significance of Radical chemistry in living system	Fibers: natural fibers
	SLO-2	Cosmetics: Preparation of Talcum Powder-	Definitions and sources - Carbohydrates	methods of preservation-Low and high temperature-	Radical production in environment	and artificial fibers
S-2	SLO-1	Preparation of shampoo	Definitions and sources - proteins -fats	methods of preservation-dehydration-osmotic pressure	superoxide and peroxide	artificial fibers - polyamides
	SLO-2	Preparation of tooth paste	Definitions and sources - proteins -fats	methods of preservation- food irradiation	superoxide and peroxide	acrylic acid
S-3	SLO-1	Preparation of Nail Polish	Definitions and sources - minerals	Food colour chemicals used in food - soft drinks and its health hazards	Health impacts Action of radicals	PVC
	SLO-2	Preparation of Perfumes	Definitions and sources – vitamins	chemicals in food production	Diseases caused by free radicals	PVA
S-4	SLO-1	Cottage industries: agarbatti	physiological importance-balanced diet.	fertilizers used in natural sources	cancer Radical quencher	Examples of natural biodegradable polymers-
	SLO-2	Cottage industries: agarbatti	physiological importance-balanced diet	fertilizers used in natural sources	Anti-oxidants.	cellulose, cellulose acetate, cellophane, soy protein, corn, zein protein, wheat gluten protein,

Duration (hour)		6	6	6	6	6
S-5	SLO-1	Soaps and detergents -General formulations and preparation	Adulterants in milk – ghee – oil - identification..	fertilizers-urea- NPK and super phosphates need -uses and hazards	Natural anti-oxidants like vegetables, beverages like tea and coffee, fruits	synthetic biodegradable polymers
	SLO-2	Soaps and detergents -General formulations and preparation	Adulterants in coffee powder – tea – identification	fertilizers-urea- NPK and super phosphates need -uses and hazards	Natural anti-oxidants like vegetables, beverages like tea and coffee, fruits	synthetic biodegradable polymers
S-6	SLO-1	Possible Hazards of cosmetic use.	Adulterants in asafoetida - chilli powder	Pesticides –definition and examples	Radical destroying enzymes: superoxide dismutase	Use of polymeric materials in daily life
	SLO-2	Possible Hazards of cosmetic use.	Adulterants in pulses and turmeric powder – identification	Pesticides –definition and examples	Radical destroying enzymes: catalase, peroxidase	Use of polymeric materials in daily life

Learning Resources	
1 .Poucher, W.A., Perfumes, Cosmetic and Soaps (Vol 3),10th edition.	4. Bagavathi Sundari . K., Applied chemistry - MJP Publishers, New Delhi. 2006.
2. Vermani, O. P., A. K. Narula Industrial Chemistry Galgotia Publications Pvt. Ltd., New Delhi.	5. Lillian Hoagland Meyer., Food Chemistry , CBS publishes & distributors. 2004.
3. Berg J. M., Tymoczeko J. L., Stryer l. Biochemistry, W. H. Freeman, 2008.	6. V. R. Gowariker, N. V.Viswanathan, J. Sreedhar, Polymer science, New Age, International.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*		*30%*		*30%*		*30%*		*30%*	
	Understand										
Level 2	Apply	*40%*		*40%*		*40%*		*40%*		*40%*	
	Analyze										
Level 3	Evaluate	*20%*		*30%*		*30%*		*30%*		*30%*	
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd,sudarshan.m@encubeethicals.com	*1. Prof. G. Sekar, IIT Madras, gsekar@iitm.ac.in*	*1. Prof. M. Arthanareeswari, SRMIST*
2. Dr. Shanmukhaprasad Gopi, Dr. Reddy' s Laboratories, shanmukhaprasadg@drreddys.com	*2. Prof. Vivek Polshettiwar, TIFR Mumbai, vivekpol@tifr.res.in*	*2. Dr. M.R.Ganesh , SRMIST*

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Course Code	UCY20A03J	Course Name	Allied Chemistry	Course Category	G	Generic elective Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Chemistry	Data Book / Codes/Standards	NIL		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Make students understand the nature of Chemical Bonding in compounds
CLR-2 :	Provide basic knowledge about the chemistry of hydrogen, silicon and other metals
CLR-3 :	Make aware of the fuels, fertilizers and other detergents
CLR-4 :	Understand the basic principles of chemical kinetics
CLR-5 :	Study the concepts in electrochemistry

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	Gain knowledge on the basic fundamentals in organic chemistry.	2	2	75	H	H	H	H	-	-	-	-	-	-	-	-	H	-	-
CLO-2 :	Acquire knowledge about hydrocarbon and their reactions.	2	2	80	-	-	H	-	H	-	-	-	-	-	-	-	H	-	-
CLO-3 :	Promote the importance of silicon and metals.	2	2	70	H	H	-	-		-	-	-	-	-	-	-	-	M	-
CLO-4 :	Understand the facts in chemical kinetics and photochemistry.	2	2	70	H	H	-	H	H	H	-	-	-	-	-	-	H	-	-
CLO-5 :	Understand the basic concepts in industrial chemistry	2	2	80	H	-	H	-	H	-	-	-	-	-	-	-	H	-	-
CLO-6 :	Acquire knowledge in the principles of electrochemistry	2	2	75	-	-	-	-	-	-	-	-	-	-	-	-	H	-	-

		Learning Module 1	Learning Module 2	Learning Module 3	Learning Module 4	Learning Module 5
Duration (hour)		24	24	24	24	24
S-1	SLO-1	Introduction of Hybridisation and Isomerism: Hybridisation - sp, sp^2 and sp^3	Chemical Kinetics:Rate of reaction	Gobar gas and natural gas	Chelation	Electrochemistry:Faradays laws of electrolysis
	SLO-2	Bond length- bond angle- dipole moment	order- molecularity		Industrial applications	
S-2	SLO-1	inductive effect- mesomeric effect and hyperconjucation	first order rate law and simple problems	Fertilizers –NPK and mixed	Industrial Chemistry: Hardness of water – Temporary and permanent hardness	Specific conductance, equivalent conductance
	SLO-2	Isomerism- geometrical and optical isomerism	Half-life period of first order reaction	soaps and detergents.	disadvantages of hard water	Cell constant

		Learning Module 1	Learning Module 2	Learning Module 3	Learning Module 4	Learning Module 5
Duration (hour)		24	24	24	24	24
S-3	SLO-1	optical activity- asymmetry- dissymmetry	pseudo first order reaction	Carbohydrates, Benzene and Heterocyclic Compounds:Classification of carbohydrates	Boiler scales and sludges	Arrhenius theory of electrolytic dissociation
	SLO-2	elements of symmetry- R, S notations.	zero and second order reactions			Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution
S-4 TO S-8	SLO-1	LAB INTRODUCTION	Estimation of FAS using standard oxalic acid	Estimation of Zn/Mg	Estimation of $K_2Cr_2O_7$ using decinormal solution of Sodium thiosulphatesolution	Determination of Molecular Weight of a Polymer
	SLO-2					
S-9	SLO-1	Hydrocarbons: Methods of preparation of alkanes	Arrhenius and collision theories	Properties and uses of glucose and fructose	Softening of hard water – Zeolite process	Ostwald"s dilution law
	SLO-2	Properties - Reactions		mutarotation	demineralization process	Kohlrausch law of independent migration of ions
S-10	SLO-1	Free radical mechanism of halogention of alkanes	Arrhenius and collision theories	Chemistry of benzene	reverse osmosis	Nernst equation
	SLO-2	Methods of preparation of alkenes	Arrhenius and collision theories	Preparation	Purification of water for domestic use	Standard electrode (reduction) potential and its application to different kinds of half-cells.
S-11	SLO-1	Stereochemistry of dehydrohalogenation (E1, E2, E1CB mechanism)	Industrial Chemistry:Introduction-Fuel gases	Mechanism of electrophilic substitution reactions	use of Chlorine	
	SLO-2	Properties of alkenes, Electrophilic and nucleophilic addition mechanisms.			Ozone and UV light	
S-12 TO S-15	SLO-1	Estimation of NaOH using standard sodium carbonate	Estimation of FAS using standard potassium dichromate	Estimation of ascorbic acid	Estimation of Copper using decinormal solution of Potassium dichromate solution	Conductometric Titrations- II (KClvs $AgNO_3$)
	SLO-2					
S-16 TO S-20	SLO-1	Estimation of HCl using standard oxalic acid	Estimation of $KMnO_4$using standard potassium dichromate	Estimation of phenol / aniline	Estimation of Nickel using decinormal solution of EDTA	Potentiometric Titration (Redox Titrations)
	SLO-2					
S-21	SLO-1	Chemistry of Hydrogen, Silicon and Metals: Occurrence- extraction of iron- cobalt- nickel and copper	Water gas	Heterocyclic compounds– Preparation of pyrrole and pyridine.	Phase Rule and Adsorption: Phase rule- Definition of terms involved	Electromotive force of a cell and its measurement
	SLO-2			Propertiesofpyrrole and pyridine.		
S-22	SLO-1	chemical properties of iron- cobalt- nickel and copper		Coordination Chemistry:Nomenclature and isomerism of coordination compounds	phase diagram of H_2O	Nernst equation; Standard electrode (reduction) potential
	SLO-2				phase diagram of Pb-Ag	
S-23	SLO-1	atomic hydrogen and isotopes of hydrogen	producer gas	EAN rule	Adsorption - Langmuir adsorption isotherms	Nernst equation application to different kinds of half-cells
	SLO-2	Preparation and structure of borazole		VB Theory		
S-24	SLO-1	Preparation and structure of borazole	LPG gas	Crystal field theories of octahedral, tetrahedral and square planar complexes	Principles of chromatography (Paper, TLC and column).	Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants
	SLO-2	SiO_2, SiC and $SiCl_4$				

Learning Resources	1. R. Gopalan, Text Book of Inorganic Chemistry, 2nd edition, Hyderabad, Universities Press, (India), 2012. 2. R.T. Morrison and R.N. Boyd, S. K. Bhattacharjee, Organic Chemistry, 7th edition, Pearson India, 2011. 3. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 35th edition, New Delhi ShobanLalNagin Chand and Co, 2013.	1. V.Venkateswaran, R.Veeraswamy, A.R.Kulandaivelu, *Basic Principles of Practical Chemistry*, 2nd edition, Sultan Chand and Sons, 1997. 2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*, 5th edition, Pearson Education, 2005.

Learning Assessment

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		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

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