

SCHOOL OF HUMANITIES, SCIENCES & MANAGEMENT
DEPARTMENT OF CHEMISTRY

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**PERIYAR
MANIAMMAI
UNIVERSITY**
(Under Sec. 3 of UGC Act, 1956) • NAAC Accredited
think • innovate • transform

CURRICULUM & SYLLABUS (I - VI Semester) FOR B.Sc. CHEMISTRY

(FULL TIME – 3 Years)

REGULATION 2018

**PERIYAR MANIAMMAI INSTITUTE OF
SCIENCE & TECHNOLOGY**

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY

I. UNIVERSITY VISION ANDMISSION

VISION

- To be a world class innovative, competitive, up-to-date, academic institution providing technological and other inputs appropriate to the branch of study student has chosen to specialize.

MISSION

UM1: Offering well balanced programmes with scholarly faculty and state of art facilities to impart high level of knowledge.

UM2: Providing student centric education and foster their growth in creativity and entrepreneurship, critical thinking and collaborative work.

UM3: Involving progressive and meaningful research with concern for sustainability and environment.

UM4: Enabling the students to acquire the skill sets for global competencies.

UM5: Inculcating social responsibilities and ethics along with imparting knowledge.

II. DEPARTMENT VISION AND MISSION

To prepare the students with basic scientific knowledge in Chemistry for technological development and to provide resources for industry and society through education and research to achieve environmental protection, energy generation and drug development.

MISSION

DM 1: To provide in-depth knowledge in Chemistry to impart technology.

DM 2: To create new idea to improve the technology by offering M.Phil. and Doctoral programme.

DM 3: To undertake project in thrust areas with societal requirements.

DM 4: To develop novel method for clean technology, Bio energy and drug development.

Table1: Mapping of University Mission with Department Mission

	DM1	DM2	DM3	DM4	TOTAL
UM1	3	3	2	1	9
UM2	3	2	3	1	9
UM3	2	2	3	3	10
UM4	3	2	3	2	10
UM5	2	2	3	3	10

3 -Highlyrelated

2 -Medium

1 - Low

III. PROGRAMME EDUCATIONAL OBJECTIVE (PEO's)

The Graduate will be

PEO-1: proficient in applying a broad understanding of the basic principles of chemistry to the solution of chemical problems

PEO-2: able to become a highly professional teacher/professor or renowned scientist

PEO-3: able to plan, coordinate, communicate, organize, make decision and lead a team to solve problems and develop application using chemistry.

PEO-4: professional, ethical, responsible and will contribute to society through active management.

Table 2: Mapping of Department Mission (DM) with Program Educational Objectives (PEOs)

	PEO-1	PEO-2	PEO-3	PEO-4	Total
DM1	3	2	1	0	6
DM2	3	1	1	1	6
DM3	2	2	1	3	8
DM4	0	2	0	3	5

3 -Highlyrelated

2 -Medium

1 - Low

IV. GRADUATE ATTRIBUTES

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The GAs are examples of the attributes expected of a graduate from an accredited programme. The Graduate Attributes of a Chemist are as follows:

GA-1: Disciplinary Knowledge: Apply knowledge of chemistry along with mathematics, physics and other domains appropriate to the programme.

GA-2: Problem analysis and solution: Identify, formulate, analyse and solve problems pertaining to chemistry by interdisciplinary approach

GA-3: Design / Development of solutions: Design and develop solutions for problem with appropriate consideration to public health, safety, environment and society.

GA-5: Tool usage: Acquire, select, manipulate relevant techniques, resources and ICT tools to interpret solutions to the problems .

GA-6: Ethics and Social responsibility: Practice ethical codes as a chemistry professional and realize the responsibility to environment and society.

GA-7: Effective Communication: Professional communication with the society to comprehend and formulate reports, documentation, effective delivery of presentation and responsible to clear instructions.

GA-8: Individual and teamwork: Perform as an individual and as a leader in diverse teams and in multi-disciplinary environment.

GA-9: Lifelong learning: Recognize the need and have the ability to engage in independent learning for continual development as a chemist.

V. PROGRAMME OUTCOMES(PO'S)

The Graduates will be able to

PO-1: understand how scientific and mathematical knowledge continually evolve and that is Course to change.

PO-2: identify and apply universal chemical laws to the problem.

PO-3: communicate effectively (written /oral) and work effectively as an individual or team.

PO-4: understand the impact and ethics of scientific discoveries on influencing society locally and globally.

PO-5: work effectively in bringing multidisciplinary ideas to diverse professional environment.

PO-6: find, collect and assess scientific-based information - its relevance and reliability.

PO-7: design and perform experiments and thereby analyse and interpret data.

PO-8: use techniques, tools and skills necessary for emerging technologies.

Table 3: Mapping of Graduate Attributes (GA) with Program Outcomes (PO)

GA	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Total
Disciplinary Knowledge	3	2	1	1	1	2	2	2	14
Problem analysis	3	2	0	0	1	1	3	2	12
Design / Development of solutions	2	1	0	1	2	3	3	2	14
Tool usage	1	1	1	2	1	2	3	3	14
Environment and sustainability	2	2	1	1	2	2	2	2	14
Ethics and Social responsibility	1	1	1	3	2	2	1	1	12
Effective communication	1	1	3	1	2	1	2	2	13
Individual and teamwork	2	2	1	2	2	2	2	1	14
Lifelong learning	3	2	1	1	2	2	2	2	15

Table 4: Mapping of Program Educational Objectives (PEOs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	Total
PEO-1	3	3	1	1	2	3	2	2	17
PEO-2	3	3	1	1	2	2	2	2	16
PEO-3	2	3	1	1	1	2	2	2	14
PEO-4	1	2	1	3	1	3	2	1	14

3 -Highlyrelated

2 -Medium

1 - Low

**CURRICULUM AND SYLLABUS FOR
B.Sc. (Chemistry) - BACHELOR OF SCIENCE
(THREE YEAR - FULL TIME)
REGULATION - 2018**

(Applicable to the students admitted from the academic year 2018-2019 onwards)

SEMESTER I								
Type	Course Code	Course Title	L	T	P	SS	H	C
AECC 1	XGL101	Communication Skills in English	2	0	0	2	4	2
LAN 1	XGL102A/ XGL102B	Ariviyal Tamil/Comprehensive English	3	0	0	0	3	3
CC 1	XMG103	Algebra, Trigonometry and Transform	4	1	0	0	5	5
CC 2 (DSC 2A)	XCY104	Fundamental Concepts of Chemistry	3	1	0	0	4	4
CC 3 (DSC 3A)	XCY105	Inorganic Chemistry I	3	1	0	0	4	4
UMAN 1	XUM106	Human Ethics, Values, Rights and Gender Equality	0	0	0	3	3	0
CC 2 Lab	XCY107	Volumetric Analysis, Practical -I	0	0	4	0	4	2
Total			15	3	4	5	27	21

SEMESTER II								
Type	Course Code	Course Title	L	T	P	SS	H	C
AECC 2	XGL201	English for Effective Communication	2	0	0	2	4	2
AECC 3	XES202	Environmental Studies	2	0	0	1	3	2
CC4	XMG203	Calculus and Differential Equations	4	1	0	0	5	5
CC 5 (DSC 2B)	XCY204	Organic Chemistry I	3	1	0	0	4	4
CC 6 (DSC 3B)	XCY205	Physical Chemistry I	3	1	0	0	4	4
CC 5 Lab	XCY206	Volumetric Analysis Practical- II	0	0	4	0	4	2
Total			14	3	4	3	24	19

SEMESTER III								
Type	Course Code	Course Title	L	T	P	SS	H	C
SEC 1	XCY301	Water Quality Analysis	1	0	2	1	4	2
CC7	XCY302	Fundamental Physics	3	1	0	0	4	4
CC 8 (DSC 2C)	XCY303	Inorganic Chemistry II	3	1	0	0	4	4
CC 9 (DSC 3C)	XCY304	Organic Chemistry II	3	1	0	0	4	4
GE 1		*Open Elective - To be chosen by student	3	0	0	0	3	3
CC7 lab	XPG 305	Fundamental Physics Practical	0	0	4	0	4	2
UMAN 2	XUM306	Disaster Management	0	0	0	3	3	0
CC 8 Lab	XCY307	Semi Micro Inorganic Qualitative Analysis Practical III	0	0	4	0	4	2
Minor course 1 *Extra credit		Office Automation (15 Hours)						1*
Total			13	3	10	4	30	21+1*

SEMESTER IV								
Type	Course Code	Course Title	L	T	P	SS	H	C
SEC 2	XCY401	Pharmaceutical Chemistry	1	0	2	1	4	2
CC10	XCY402	Modern Physics	3	1	0	0	4	4
CC 11 (DSC 2D)	XCY403	Physical Chemistry II	3	1	0	0	4	4
CC 12 (DSC 3D)	XCY404	Inorganic Chemistry III	3	1	0	0	4	4
GE 2		*Open Elective - To be chosen by student	3	0	0	0	3	3
CC10 lab	XPH405	Modern Physics Practical	0	0	4	0	4	2
CC11 Lab	XCY406	Inorganic Quantitative Analysis PracticalIV	0	0	4	0	4	2
Minor course 2 *Extra credit		Animation Software I (15 Hours)						1*
Total			13	3	10	1	27	21+1*

SEMESTER V								
Type	Course Code	Course Title	L	T	P	SS	H	C
SEC 3	XCY501	Clinical Chemistry	1	0	2	1	4	2
DSE 1A	XCY502A	Phyto Chemistry	3	1	0	0	4	4
	XCY502B	Forensic Science						
DSE 2A	XCY503A	Analytical Methods in Chemistry	3	1	0	0	4	4
	XCY503B	Agricultural Chemistry						
DSE 3A	XCY504A	Computer Applications in Chemistry	3	1	0	0	4	4
	XCY504B	Programming in C						
GE 3		*Open Elective - To be chosen by student	3	0	0	0	3	3
DSE 1A Lab	XCY505	Organic Qualitative Analysis PracticalVA	0	0	4	0	4	2
CC lab	XCY506	Physical Chemistry Practical VB	0	0	4	0	4	2
Minor course 3 *Extra credit		Animation Software II (15 Hours)						1*
* Extra credit	–	IPT (21 days)						2*
Total			13	3	10	1	27	21+3*
SEMESTER VI								
Type	Course Code	Course Title	L	T	P	SS	H	C
SEC 4	XCY601	Renewable Energy	1	0	2	1	4	2
DSE 1B	XCY602A	Industrial Chemistry	3	1	0	0	4	4
	XCY602B	Material Chemistry						
DSE 2B	XCY603A	Food Chemistry	3	1	0	0	4	4
	XCY603B	Polymer Chemistry						
DSE2B lab	XCY604	Organic Qualitative Analysis PracticalVI	0	0	4	0	4	2
CCLab	XCY605	Physical Chemistry Practical VIA	0	0	4	0	4	2
DSE 3B	XCY606	Project	0	0	0	0	8	6
	–	NSS/NCC/RRC....						
Total			7	2	10	1	28	20

DSC: Department Specific Core
SEC: Skill Enhancement course
GE: Generic Elective

DSE: Discipline Specific Elective
AECC: Ability Enhancement Compulsory Course
UMAN: University Mandatory

*Extra Credit

L-Lecture

T-Tutorial

SS -SelfStudy

P-Practical

C-Credit

Summary

Semester	S1	S2	S3	S4	S5	S6	P1	P2	Others
I	AECC1	LAN1	CC1	CC2 (DSC2A)	CC3 (DSC3A)	UMAN1	CC2 Lab		
II	AECC2	AECC3	CC4	CC5 (DSC2B)	CC6 (DSC3B)			CC5 Lab	
III	SEC1	CC7	CC8 (DSC2C)	CC9 (DSC3C)	GE1	UMAN2	CC7 Lab	CC8 Lab	*Minor Course
IV	SEC2	CC10	CC11 (DSC2D)	CC12 (DSC3D)	GE2		CC10 Lab	CC11 Lab	*Minor Course
V	SEC3	DSE1A	DSE 2A	DSE3A	GE3		CC Lab	CC lab	IPT* *Minor Course
VI	SEC4	DSE1B	DSE 2B	DSE3B (PROJECT)			CC Lab	CC lab	NSS/ NCC....

* Extra Credit

Total Number of Courses proposed with the credits is given below:

S. No.	Type of Course	Numbers	Total Credit	Credits As per UGC norms
1	AECC (Theory & Lab)	03	06	04
2	Core Course (Theory & Lab)	12	66	72
3	DSE (Theory & Lab)	06	30	36
4	SEC	04	08	08
5	GE	03	09	-
6	UMAN	02	00	-
7	LAN	01	03	
	IPT & Minor Courses /NSS/NCC...	4*	4*	-
Total		31 + 4*	122 + 4*	120

*Extra credit

Branch	Total Credit	Core DSC (%)	DSE(%)	SEC (%)	AECC (%)	GE (%)	UMAN (%)	LAN	IPT & NSS/NCC..
B.Sc.(Chemistry)	122+4*	66 (54.1%)	30 (24.6%)	8 (6.6%)	6 (4.9%)	9 (7.4%)	0 (0%)	1 (0.8%)	4* (Extra Credit)

* Extra Credit

DSC: Department Specific Core
SEC: Skill Enhancement course
DSE: Discipline Specific Elective

AECC: Ability Enhancement Compulsory Course
GE: Generic Elective
UMAN: University Mandatory

Course Vs PO Mapping

	C	P	A	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	L	T	P	C
XCY101															
XCY102															
XCY103															
XCY104															
XCY105															
XUM106															
XCY107															
XCY201															
XES202															
XCY203															
XCY204															
XCY205															
XCY206															
XCY301															
XCY302															
XCY303															
XCY304															
XCY305															
XUM306															
XCY401															
XCY402															
XCY403															
XCY404															
XCY405															
XCY406															
XCY501															
XCY502															
XCY503															
XCY504															
XCY505															
XCY506															
XCY601															
XCY602															
XCY603															
XCY604															
XCY605															
XCY606															

		SEMESTER I			L	T	SS	P	C
COURSE CODE		XCY104			3	1	0	0	4
COURSE NAME		FUNDAMENTAL CONCEPTS OF CHEMISTRY			L	T	SS	P	H
C: P: A		3.2:0:0.8			3	1	0	0	4
COURSE OUTCOMES:				Domain		Level			
CO1	<i>Explain</i> the principle of atomic structure and basics of quantum mechanism			Cognitive		Understand			
CO2	<i>Describe</i> the periodic properties of various elements			Cognitive		Remember			
CO3	<i>Interpret</i> IUPAC nomenclature of compounds.			Cognitive Affective		Apply Receiv g			
CO4	<i>Describe</i> the physical properties of dipole moment, polarizability and magnetic properties.			Cognitive Affective		Remember Responding			
CO5	<i>Apply</i> and <i>Identify</i> the various analytical methods for quantitative analysis.			Cognitive		Rememb er Apply			
UNIT - I ATOMIC STRUCTURE AND BASIC QUANTUM MECHANICS								10+3	
Atom, constituents of an atom – Bohr’s postulates – Bohr’s atom model – limitations of the Bohr’s atom model - Sommerfeld atom model. Particle and wave character of electron – de-Broglie’s equation and its derivation – The Davisson and Germer experiment – Heisenberg’s uncertainty principle. Photoelectric effect - Einstein photoelectric equation – Compton effect. Quantum theory – postulates of quantum mechanics – The Schrodinger wave equation-Quantum numbers. Aufbau principle – Hund’s rule of maximum spin multiplicity – Pauli’s exclusion principle – n + l rule – electronic configurations of elements.									
UNIT - II PERIODIC TABLE								6+3	
Modern periodic law – modern periodic table – classification of elements based on electronic configuration. Fundamental properties like atomic size, valency, ionization energy, ionic radius, electron affinity, electronegativity, metallic and nonmetallic character - variation of the above fundamental properties – explanation for the periodic variation of the fundamental properties – diagonal relationship.									
UNIT – III FUNDAMENTALS OF ORGANIC CHEMISTRY								9+3	
IUPAC Nomenclature of organic compounds Molecular weight determination of simple organic acid and bases – Silver salt and platonic chloride methods. Calculation of empirical and molecular formula using percentage composition of elements and molecular weight. Fundamental concepts - Homolytic fission and Heterolytic fission of carbon-carbon bonds - Reaction intermediates: Formation and stability of Free radicals, carbonium ions and carbanions – nucleophilic and electrophilic reagents. Types of reactions-Substitution, addition, elimination, rearrangement and polymerization with suitable examples. Inductive effect and electromeric effect: xplanation with suitable examples.									
UNIT –IV PHYSICAL PROPERTIES AND CHEMICAL CONSTITUTIONS.								10+3	

<p>Dipole moment: Definition – Experimental determination - Calculation of percentage of ionic character of HF and HCl –Dipole moment and molecular structure: CO₂, H₂O,NH₃ and CH₄. Polarizability: Definition – polarization of a molecule – molar polarization – Clausius-Mosotti equation. Magnetic properties: Paramagnetic, diamagnetic and ferromagnetic substances and their characteristics – magnetic permeability – magnetic susceptibility – specific and molar magnetic susceptibilities – determination of magnetic susceptibility by Gouy’s method.</p>
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UNIT –V ANALYTICAL METHODS				10+3
Qualitative Inorganic Analysis – Dry Test, flame test, cobalt nitrate test–wet confirmatory test for acid radicals, interfering acid radicals – elimination of interfering acid radicals. Solubility product, common ion effect, complexation, oxidationreduction reactions involved in identification of anions and cations – separation of cations into groups – Volumetric analysis – preparation of standard solutions –normality, molarity and molality by titrimetric reactions – acid base, redox, precipitation and complex metric titrations –indicators – effect of change in pH – selection of suitable indicators.				
LECTURE	TUTORIALS	PRACTICALS		TOTAL
45	15	-----		60
TEXT BOOKS				
<ol style="list-style-type: none"> 1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993). 2. Lee J.D., Concise Inorganic Chemistry, UK, Black well science (2006). 3. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993). 4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd. 				
REFERENCES				
<ol style="list-style-type: none"> 1. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976). 2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997). 3. Frank J. Welcher and Richard B. Hahn, Semi micro Qualitative Analysis, New Delhi, Affiliated East-west Press Pvt. Ltd. (1969). 4. G.D. Tuli, R.D. Madan, S.K. Basu, Satya Prakash, Advanced Inorganic Chemistry, Volume 1, (5th edition), New Delhi, S. Chand & Company Ltd, (2014) 				
E RESOURCES				
<ol style="list-style-type: none"> 1. http://www.mooc-list.com/course/chemistry-minor-saylororg 2. https://www.canvas.net/courses/exploring-chemistry 3. http://freevideolectures.com/Course/3001/Chemistry-I 4. http://freevideolectures.com/Course/3167/Chemistry-II 				

		SEMESTER I			L	T	SS	P	C
COURSE CODE		XCY105			3	1	0	0	4
COURSE NAME		INORGANIC CHEMISTRY			L	T	SS	P	H
C: P: A		2.8:0.4:0.8			3	1	0	0	4
COURSE OUTCOMES:				Domain				Level	
CO1	<i>Recall</i> and <i>Explain</i> the basic concepts of ionic bonding; <i>Display</i> the shapes of simple inorganic molecules using VSEPR theory			Cognitive Psychomotor				Remember Understand Set	
CO2	<i>Summarize</i> and <i>Report</i> extraction, properties and uses of I A and IIA group s-block elements.			Cognitive Affective				Understand Responding	
CO3	<i>Explain</i> the extraction and purification process of various metals and Interpret their physical and chemical properties.			Cognitive Affective				Understand Apply Responding	
CO4	<i>Describe</i> the concept of acids and bases and the application of various concepts.			Cognitive Psychomotor				Analysis Perception	
CO5	<i>Identify</i> the various radioactive process and their consequences			Cognitive				Remember	
UNIT - I CHEMICAL BONDING								10+3	
Ionic bond–Lattice Energy–Born–Haber Cycle–Pauling and Mulliken’s scales of electro negativity – Polarizing power and Polarisability – partial ionic character from electro negativity – Transitions from ionic to covalent character and vice versa – Fajan’s rule. VSEPR Theory – Shapes of simple inorganic molecules (BeCl ₂ , SiCl ₄ , PCl ₅ , SF ₆ , IF ₇ , NH ₃ , XeF ₆ , BF ₃ , H ₂ O) - VB Theory – Principles of hybridization – BeCl ₂ – MO Theory – Bonding and antibonding orbitals – Application of MO Theory to H ₂ , He ₂ , N ₂ , O ₂ , HF and CO – Comparison of VB and MO theories.									
UNIT - II CHEMISTRY OF S-BLOCK ELEMENTS								6+3	
Position of Hydrogen in the Periodic Table, atomic hydrogen, nascent hydrogen, occluded hydrogen and uses of hydrogen. General characteristics of s-block elements – General characteristics of Group IA – diagonal relationship between Li and Mg – Physical and Chemical properties – Uses – Preparation of NaOH, Na ₂ CO ₃ , NaHCO ₃ (Laboratory and Industrial methods) – Properties – Uses. General characteristics of Elements of Group II A – diagonal relationship between Be and Al – Physical and Chemical properties – Uses – Preparation and uses of Mg: MgCO ₃ , MgSO ₄ .									
UNIT – III BASIC PRINCIPLES OF METALLURGY								9+3	
Ores and minerals – concentrating the ore by gravity separation, froth flotation and magnetic separation – Types of furnaces -Roasting– Calcination – Smelting – Flux – Purification by electrolytic refining, zone refining and Van-Arkel vapour phase refining with suitable examples– Alumino thermic process. Group–IA: Extraction of lithium and its uses - Diagonal relationship of Lithium with Magnesium Group–IIA: Extraction of Beryllium and its uses –Diagonal relationship of Beryllium with Aluminium Group–IB: Extraction of copper and its uses – Extraction of silver and its uses. Group-VA: Nitrogen: Ammonia – manufacture, properties, uses and structure. Nitric Acid: Manufacture of Nitric acid – Action of nitric acid on metals									
UNIT –IV ACIDS AND BASES								10+3	

	Lewis concept – Classification of Lewis acids – Lux-Flood concept – Hard-Soft acid base concept and its applications. Non- aqueous solvents- Classification of solvents- Neutralization reaction and solvolysis in liquid ammonia- Metal- ammonia solutions. Neutralisation, solvolysis and redox reactions.
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UNIT –V NUCLEAR CHEMISTRY				10+3
Constitution of nuclei – stability of nuclei and (n-p) ratio – magic number– mass defect and binding energy – mass – energy relationship. Radioactivity: Natural radioactivity — Soddy’s group displacement law – Radioactivity equilibrium – Rate of radioactive disintegration – half life period and average life period– radioactive disintegration series. Nuclear fission: Theory – applications – principle of atom bomb. Nuclear fusion: Theory – Solar and Stellar energy – principle of hydrogen bomb Applications of radioactivity: medicine – agriculture – industry – structural elucidations– carbon dating– cyclotron.				
LECTURE	TUTORIALS	PRACTICALS		TOTAL
45	15	-----		60
TEXT BOOKS				
<ol style="list-style-type: none"> 1. Lee J.D., Concise Inorganic Chemistry, UK, Black well science(2006). 2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co.,(2007). 				
REFERENCES				
<ol style="list-style-type: none"> 1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co.,(2003). 2. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co.,(2005). 3. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co.Ltd. 4. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd.,(2003). 				

SEMESTER II					
Course Code	Course Name	L	T	P	C
XCY204	ORGANIC CHEMISTRY – I	3	1	0	4
C:P:A	2.8:0.4:0.8	L	T	P	H
		3	1	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	<i>Explain</i> the preparation, properties and applications of alkenes, alkynes and their derivatives.	Cognitive	Understand
CO2	<i>Describe</i> the preparation with mechanism, properties and applications of alcohols, ethers and their derivatives. <i>Estimate</i> hydroxy and alkoxy groups.	Cognitive	Remember
CO3	<i>Explain</i> the preparation with mechanism, properties and naming reactions of aldehydes, ketones & carboxylic acid and their derivatives.	Cognitive Affective	Apply Receiving
CO4	<i>Describe</i> the concepts of covalent bonding and <i>explain the structure of hybridization</i> .	Cognitive	Remember Responding
CO5	<i>Apply</i> and <i>Identify</i> the various stereo chemical concepts.	Cognitive	Apply Remember
UNIT I	COVALENT BONDING AND STRUCTURE Covalent bonding – Concept of hybridization – Structure of organic molecules based on sp ³ , sp ² and sp hybridization – Covalent bond properties of organic molecules: bond length, bond angle, bond energy, bond polarity, dipole moment, inductive, mesomeric, electromeric, resonance and hyperconjugative effects		9+3
UNIT II	ALIPHATIC HYDROCARBONS AND ALKYL HALIDES Alkenes: Ozonolysis, Hydroboration and polymerization with suitable examples. Dienes: Classification – preparation, properties and uses of Butadiene Alkynes: Acidity of alkynes Alkyl halides: S _N 1 and S _N 2 Mechanism – E ₁ and E ₂ Mechanism – Hofmann and Saytzeff's rule. Poly halogen derivatives: Halogen derivatives of unsaturated hydrocarbons: Preparation and uses of vinyl chloride, allyl chloride and allyl iodide. Synthetic applications of Grignard reagents.		9+3

UNIT III	CHEMISTRY OF CYCLOALKANES AND STREO ISOMERISM Alicyclic compounds – general methods of preparation of cycloalkanes – Baeyer’s strain theory and its modifications. Conformational analysis: differences between configuration and conformation Fischer and Sawhorse and Newman projection formulae – conformational analysis of ethane, n-butane and 1,2-dichloro ethane Geometrical isomerism – maleic acid and fumaric acid – aldoximes and ketoximes E-Z notations. Optical isomerism: definition: optical activity and optical isomerism – optical isomerism of compounds containing asymmetric carbon atom – tartaric acid – enantiomers and diastereoisomers – racemic and meso forms – racemisation – resolution of racemic mixture – Walden inversion – asymmetric synthesis – chirality – specifications of absolute configurations by R and S notations.	10+3		
UNIT IV	ALIPHATIC ALCOHOLS: Definition: Rectified spirit – Absolute alcohol – Methylated spirit – Power alcohol. Preparation, properties and uses of allyl alcohol. Polyhydric alcohol: Estimation of number of hydroxyl groups in a polyhydric alcohol. Ethers: Estimation of alkoxy groups – Zeisel’s method – preparation of chloroethane and vinyl ether. Thioalcohols and thioethers: Preparation and uses of ethyl mercaptan, diethyl ether, sulphonal and mustard gas. Phosphorous ylides – preparation and properties – Wittig reaction.	7+3		
Unit V	ALDEHYDES, KETONES AND CARBOXYLIC ACID Preparation of aldehydes and ketones from fatty acids – Rosenmund reduction – Stephen’s method – Mechanism of nucleophilic addition to Carbonyl compounds – Hemiacetal and Acetal formations – Cyanohydrin formation – Meerwein-Ponndorf-Varley reduction – Oppenauer oxidation – preparation of Acrolein, Crotonaldehyde, Chloral, Hydroxy acetone and Acetylacetone Carboxylic acids and their derivatives: Structure of carboxylic acids – acidity of carboxylic acids – effect of substituents on acidity – preparation of acrylic acid and crotonic acid. Halogen substituted acids: Preparation and properties of mono, di and tri chloro carboxylic acids – Hydroxy acids. Dicarboxylic acids: Preparation of Malonic acid and Malonic ester – Synthetic applications of diethyl malonate – Action of heat on dicarboxylic acids	10+3		
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	15	0	60

TEXT BOOKS

- Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976).
- Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).

3. Organic Chemistry – Volume I”, I.L.Finar
4. Organic Chemistry – Volume II”, I.L.Finar
5. Organic Chemistry – J.Clayden
6. Organic Chemistry – JerryMarch
7. Organic Chemistry – Mcmurray
8. Organic Chemistry”, P.L.Soni
9. Advanced Organic Chemistry”, B.S.Bahl and ArunBahl
10. Organic Chemistry”, R.T.Morrison and R.W.Boyd

REFERENCES

1. Organic Chemistry, Paula, Yurkanis and Bruice
2. Mukul C. Ray Reaction Mechanisms in Organic Chemistry
3. P.L. Kalsi, Organic Reactions and Their Mechanisms

E-REFERENCES

<https://www.mooc-list.com/course/organic-chemistry-i-saylororg>
<https://www.canvas.net/courses/exploring-chemistry>
<https://www.youtube.com/watch?v=nB9yqj-ZcAk>
<http://freevideolectures.com/Course/3001/Chemistry-1/3>
<https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/>
<http://freevideolectures.com/Course/3001/Chemistry-1>
<http://freevideolectures.com/Course/2384/Freshman-Organic-Chemistry>

SEMESTER II					
Course Code	Course Name	L	T	P	C
XCY205	PHYSICAL CHEMISTRY - I	3	1	0	4
C:P:A	2.8:0.4:0.8	L	T	P	H
		3	1	0	4

SYLLABUS:

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	<i>Classify</i> the types of Molecular velocity of gases and kinetic theory of gases; <i>Derive</i> vanderwalls equation of real gases.	Cognitive	Understand
CO2	<i>Apply</i> and <i>Identify</i> the structure and properties of solid state.	Cognitive	Remember Apply
CO3	<i>Apply</i> and <i>Identify</i> the structure and properties of liquid crystals and colloids	Cognitive Affective	Remember Apply
CO4	<i>Describe</i> the concepts of colloidal state and <i>explain the types of Emulsions</i> .	Cognitive	Remember Responding
CO5	<i>Identify</i> the principles of chemical equilibrium and <i>explain</i> the theory behind the catalysis.	Cognitive: Affective:	Remember Receive
UNIT I	GASEOUS STATE: Kinetic theory of gases – equation of kinetic theory of gases – derivation of gas laws from the equation of kinetic theory of gases. Ideal gases and real gases – deviations of real gases from ideal behaviour – Van der waal’s equation (Derivation) – Significances of van der Waal’s constants. P-V isotherms – Andrew’s experiment – critical states of gases – Definition and determination of the critical constants – relation between van der Waal’s constants and critical constants, Kinetic theory of gases: Mean free path – collision frequency – Definition and problems involving RMS velocity, Most probable velocity and Average velocity – Boltzman distribution of molecular velocities (No derivation)		9+3
UNIT II	SOLID STATE Crystallography — Definition: unit cell, crystal lattice and interfacial angle Crystallographic systems: Bravais lattices – simple, cubic, face-centered cubic and body-centered cubic systems. Types of crystals: Ionic crystal – Structure of NaCl – Molecular crystals: Structure of Ice – Covalent crystals: structure of diamond and graphite – metallic crystals. Bonding in crystals – electrical properties - Conductors, semiconductors and insulators – super conductors – simple explanation with examples – Defects in crystals.		9+3

UNIT III	LIQUID STATE, LIQUID CRYSTALS –AND ADSORPTION: Theory of liquids – free volume of liquids – Vapour pressure – Surface tension, effect of temperature on surface tension, parachor – Viscosity, effect of temperature on viscosity – hole theory – Reynolds number – structure of liquids. Trouton’s rule and its significance Classification of Liquid crystals– Transformation into the mesomorphic states – Definitions – Adsorbate, adsorbent and interface – Distinction between physisorption and chemisorption – Surfactants. Adsorption of gases on solids – Freundlich, Langmuir and BET adsorption isotherms Applications of adsorptions.	9+3		
UNIT IV	COLLOIDAL STATE: types of colloids – sols – Lyophilic sols and lyophobic sols – properties of colloids – optical property (Tyndall effect) – kinetic property (Brownian movement) – Electrical properties like electrical double layer, zeta potential, electrophoresis and electro-osmosis – stability of colloids – Coagulation – protective colloids – Gold number – flocculation values – Hofmeister series. GELS: Elastic and non-elastic gels – imbibition – syneresis – thixotropy Emulsions: Definition – types of emulsions – emulsifiers – Bancroft’s rule HLB number. Applications of colloids: Cottrell precipitator – Sewage disposals – detergent action of soaps – artificial rain – formation of delta – smoke screens.	10+3		
UNIT V	CHEMICAL EQUILIBRIUM: Reversible and irreversible reactions – statement of law of mass action – Derivation of law of mass action from kinetic theory – Relationship between K_p and K_c (derivation). Applications of Law of mass action to the equilibria involving the formation of NH_3 , dissociation of $CaCO_3$ and the dehydration of $CuSO_4 \cdot 5H_2O$. Lechatelier’s principle: statement – application to the formation of NH_3 . CATALYSIS: Homogeneous and heterogeneous catalysis – promoters and catalytic poisons – auto catalysis – Acid-base catalysis – Enzyme catalysis – Kinetics of enzymed catalysed reaction.	8+3		
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	15	0	60

TEXT BOOKS

1. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co.Ltd.
2. Principles of Physical Chemistry”, B.R.Puri and L.R.Sharma
3. Principles of Physical Chemistry”, B.R.Puri, L.R.Sharma and M.S.Pathania
4. Physical Chemistry”, N.Kundu and S.N.Jain
5. Physical Chemistry”, Peter Atkins Julio de Paula

REFERENCES

1. Physical Chemistry: A Molecular Approach Donald A. McQuarrie
2. Physical Chemistry. G.W. Ball

3. Solid state and its applications, Anthony. R. West.
4. Physical Chemistry Volume-1, A. K. Nag.

E-REFERENCES

1. https://www.youtube.com/watch?v=A1p4j_aHdbw
2. <https://www.youtube.com/watch?v=gvq2QZ38n9U>
3. <https://www.mooc-list.com/course/Physical-chemistry-i-saylororg>

COURSE NAME	Volumetric Analysis Practical-II XCY 206	L	T	P	C
PREREQUISITE	Nil	0	0	3	2
C:P:A	1: 0.8:0.2	L	T	P	H
		0	0	3	3
COURSE OUTCOMES		DOMAIN		LEVEL	
CO1	Identify the various Metals in the solution.	Cognitive Psychomotor		Remember Perception	
CO2	Estimate the amount of metal ions using volumetric method by using various internal and external indicators.	Cognitive Psychomotor		Understand Set	
CO3	Estimate the amount of metal ions in terms of complex by complexometric titrations using volumetric method.	Cognitive Psychomotor Affective		Apply Set Receiving	
VOLUMETRIC ANALYSIS LAB-II				3 hours each exp	
I. Acidimetry and Alkalimetry					
II. Permanganimetry.					
1. Estimation of Ferrous iron in Mohr's salt.					
2. Estimation of Ferrous and Ferric iron in a mixture.					
3. Estimation of Oxalic acid.					
4. Estimation of Calcium.					
III. Dichrometry					
5. Estimation of Ferrous Iron.					
6. Estimation of Ferric Iron – by using both internal and external indicators.					
IV. Iodo and Iodimetry.					
7. Estimation of Copper.					
8. Estimation of Potassium Dichromate.					
9. Estimation of Arsenious Oxide.					
V. Argentometry.					

10. Estimation of Chloride (in neutral and acid media)

VI. Complexometric Titrations.

11. Estimation of Zn, Mg and Ca ions using EDTA.

HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	0	0	30	30

TEXT BOOKS

1. B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G Smith and A.R. Tatchell., "Vogel's Textbook of practical Organic Chemistry" , (ELBS), 5th edn.,2009.
2. J. Bassett, R.C. Denney, G. H Jeffery and J. Mendham, " Vogel's text book of Quantitative Inorganic Analysis (revised)", (ELBS), 6th edn.,2007.

REFERENCE BOOKS

1. J.B. Yadav, "Advanced Practical Physical Chemistry" , (Goel Publishing House), 20th edn., 2001.
2. J.N. Gurtu and R. Kapoor, "Advanced Experimental Chemistry", Vol. I-Physical , (S. Chand & Co), 1st edn.,2000.
3. Sundaram, Krishnan, Raghavan, " Practical Chemistry (Part II)" , S. Viswanathan Co.Pvt., 1996.

E Resources - MOOCs:

1. <http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques>
2. <https://www.youtube.com/watch?v=gzAgIIjHyqI>
3. <https://www.youtube.com/watch?v=3AS9Jwdpui4>

SEMESTER III

COURSE CODE	COURSE NAME	L	T	SS	P	C
XCY301	Water Quality Analysis	1	0	1	2	2
C:P:A	1:0.8:0.2	L	T	SS	P	H
		1	0	1	2	4

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	<i>Ensure</i> the quantity and quality of water with respect to standards and their relation to public health	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO2	<i>Identify</i> the sources of water and <i>illustrate</i> the water transport and distribution	Cognitive	Understanding Applying
CO3	<i>Classify</i> the cycles of decomposition of sewage and <i>Examine</i> the characteristics of sewage	Cognitive Psychomotor	Understanding Manipulation
CO4	<i>Describe</i> the function and principles of various water and waste water treatment units.	Cognitive Affective	Understanding Responding
CO5	<i>Select</i> the disposal methods for sewage and <i>classify</i> the different treatment methods for sludge.	Cognitive	Understanding
UNIT -I	Water Technology Hardness of Water: types and estimation of hardness (problems) - internal treatment, external treatment – demineralization process – desalination using reverse osmosis–		6
UNIT -II	Sources and Transmission of Water Public water supply schemes, Forms and properties of water –per capita demand - population forecasts - variation in demand pattern – water quality – BIS and ISO specifications– water borne diseases – planning of public water supplies.		6
UNIT-III	Water Treatment Layout of Treatment plants for conventional water treatment plant. Principles and Functions of Screen, Flash Mixer, Flocculator, Sedimentation Tank, Slow and Rapid Sand Filters, and Disinfection Process- advanced water treatment techniques.		6
UNIT-IV	Waste Water Treatment oxidation Characteristics and composition of sewage - cycles of decomposition of organic wastes - D.O, BOD and COD and their significance. Treatment methods - Layout of waste water treatment plant- Activated sludge process and its modifications; Trickling filters and Rotating biological pond		6
UNIT -V	Disposal Options Land disposal - sewage farming practice - dilution - discharge into rivers, - oxygen sag - self-purification - eutrophication. - sludge treatment - properties and characteristics of sludge - sludge digestion and		6

	drying beds			
	<p>Any five experiments decided by the course teacher</p> <ol style="list-style-type: none"> 1. Determination of pH, turbidity and conductivity. 2. Determination of the available chlorine in bleaching powder and estimation of the residual chlorine. 3. Determination of optimum dosage of coagulant 4. Determination of Iron and Fluoride. 5. Determination of Phosphorous 6. Determination of hardness of water. 7. Determination of Total Solids and Suspended solids. 8. Determination of Biochemical Oxygen Demand. 9. Determination of Chemical Oxygen Demand. 10. Determination of Ammonia Nitrogen. <p>Demonstration of Bacteriological analysis of water.</p>			30
	LECTURE	SS	PRACTICAL	TOTAL
	15	15	30	60
Text Books				
<ol style="list-style-type: none"> 1. Gurucharan Singh, "Water supply and Sanitary Engineering", Standard Publishers Distributors, 2009 2. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007 3. S.K. Garg, Wastewater Engineering, Khanna Publishers, New Delhi, 2007 4. CPHEEO Manual on Water Supply And Treatment, 1999 5. CPHEEO Manual on Sewerage And Sewage Treatment, 1993 				
Refernces				
<ol style="list-style-type: none"> 1. Karia G L & Christian R A, "Wastewater Treatment", Prentice Hall of India, New Delhi, 2013. 2. Rangwala, "Water Supply and Sanitary Engineering PB, 24/e, Charotar Publishing house Pvt. Ltd.-Anand, 2011 3. B.C. Punmia, Wastewater Engineering, Volume – II, Laxmi Publication 2008 4. Linvil G. Rich, Unit operations of Sanitary Engineering, Tata Mcgraw Hill, New Delhi, 2007 5. Standard methods for the Examination of Water and wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 1989. 				

COURSE CODE	COURSE NAME	L	T	P	C
XCY303	Inorganic Chemistry II	3	1	0	4
C:P:A	3.2:0:0.8	L	T	P	H
		3	1	0	4

SYLLABUS:

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	<i>Explain</i> the various compounds of halogens and carbon.	Cognitive	Understanding
CO2	<i>Describe</i> the properties structure of peracids.	Cognitive	Remember
CO3	<i>Recognize</i> the general characteristics and properties of transition elements.	Cognitive Affective	Apply Receiving
CO4	<i>Identify</i> the general characteristics and properties of Lanthanides and Actinides.	Cognitive Affective	Remember Responding
CO5	<i>Apply</i> and <i>Identify</i> the various properties and bonding of organo metallic compounds.	Cognitive	Apply Remember

UNIT I	<p>Halogens, Carbon and Noble gas compounds</p> <p>Halogens -General trends in the properties of halogens – deviation of fluorine from other elements of the group. Preparation of fluorine – properties of fluorine – hydrogen fluoride – oxides of halogens – preparation properties and uses of hydrogen halides, oxy acids of halogens – freons. Interhalogen Compounds: XY, XY₃, XY₅ and XY₇ types and their structure. Pseudohalogens and pseudohalides definition with exmples.</p> <p>Inorganic Carbon Compounds:Types of carbides - Covalent, ionic and interstitial carbides with suitable examples – oxides of carbon – oxy acids of carbon – carbonates – fullerenes.</p> <p>Noble gas compounds: preparation and properties of xenon fluorides and oxyfluoride and kryptonfluoride.</p>	10+3
UNIT II	<p>Peracids and persalts: preparation, properties and structure of permonosulphuric acid, perdisulphuric acid and potassium perdisulphate. Preparation and properties of permonocarbonic acid, perdicarbonic acid and perdicarbonates.</p>	6+3
UNIT III	<p>Unit III: Transition Elements - Group Study</p> <p>Transition elements-position in the periodic table General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. Chemistry of titanium</p>	9+3

	dioxide, titanium tetrachloride, vanadium penta oxide-ammonium vanadate, ammonium molybdate, molybdenum blue, tungsten oxide, tungsten bronze, zirconium halide.			
UNIT IV	<p>Unit IV: Lanthanides and Actinides Position of lanthanides actinides in the periodic table – Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction – actinide contraction.</p> <p>Occurrence and general methods of extraction of lanthanides by reducing the trihalides, ion exchange and valence exchange methods. Isolation of thorium from monazite – Preparation properties and uses of oxides, oxy acids, hydrides and halides of cerium and lanthanum.</p> <p>Organometallic compounds of lanthanoids – optical properties –magnetic properties of lanthanides - Applications of lanthanides and actinides.</p>	10+3		
Unit V	<p>Organo Metallic compounds Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).</p>	10+3		
	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	-	60

Books for Reference:

1. "Inorganic Chemistry", P.L.Soni
2. "Inorganic Chemistry", Puri and Sharma
3. "Advanced Inorganic Chemistry", R.D.Madan

Reference Books

1. "Basic Inorganic Chemistry", F.A. Cotton and Wilkins
2. "In-organic Chemistry", Shriver and Atkins
3. "Inorganic Chemistry", James E. Huheey
4. "Concise Inorganic Chemistry", J.D.Lee
5. "Fundamentals of Inorganic Chemistry", Gilreath

COURSE CODE	COURSE NAME	L	T	P	C
XCY304	Organic Chemistry II	3	1	0	4
C:P:A	3.2:0:0.8	L	T	P	H
		3	1	0	4

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

SYLLABUS:

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	<i>Explain</i> the principle of atomic structure and its substitution reaction.	Cognitive	Understanding
CO2	<i>Describe</i> the phenol, ethers and aryl halides reactions with some naming reactions.	Cognitive	Remember
CO3	<i>Identify</i> the compounds of amines and diazonium salts.	Cognitive Affective	Apply Receiving
CO4	<i>Recognise</i> the various structures of amino acids, peptides and proteins	Cognitive Affective	Understanding Responding
CO5	<i>Describe</i> the general properties of carbohydrates.	Cognitive	Remember
UNIT I	<p>Aromatic Compounds Aromatic compounds: Aromatic hydrocarbons – aromaticity and Huckel’s rule – Simple applications. Aromatic substitution: Electrophilic substitution with suitable examples – Mechanism of Halogenation, Nitration, Sulphonation and Friedel-Craft’s reactions – nucleophilic and free radical substitution with suitable examples.</p> <p>Directive influence of substituents: Orientation – Effect of substituents – activating and deactivating groups – Rules of disubstitution and trisubstitution in benzene – steric hindrance</p>		9+3
UNIT II	<p>Phenols, Ethers and Aryl Halides (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten – Baumann Reaction. Ethers (aromatic): Cleavage of ethers with HI.</p> <p>Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH₂/NH₃ (or</p>		10+3

	NaNH ₂ /NH ₃). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. preparation and uses of DDT.			
UNIT III	Unit III Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO ₂ . Electrophilic substitution (case aniline): nitration, bromination, sulphonation. Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes. Derivatives of phthalic acid: preparation and properties of phthalic anhydride and phthalimide. Preparation of the following compounds and their uses –phenylacetic acid, mandelic acid, cinnamic acid, aspirin and methylsalicylate.			9+3
UNIT IV	Amino Acids, Peptides and Proteins Amino Acids, Peptides and Proteins: Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of –COOH group, acetylation of –NH ₂ group, complexation with Cu ²⁺ ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C activating groups and Merrifield solid-phasesynthesis.			9+3
Unit V	Carbohydrates Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation. Oils and fats: definition – determination and application – saponification value – iodine value – Reichert-Meissel value – acid value.			8+3
	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	-	60

Text Books

1. "Organic Chemistry", P.L.Soni
2. "Advanced Organic Chemistry", B.S.Bahl and ArunBahl
3. "Organic Chemistry", R.T.Morrison and R.W.Boyd

Reference Books

1. "Organic Chemistry – Volume I", I.L.Finar
2. "Organic Chemistry – Volume II", I.L.Finar
3. "Reaction Mechanism of Organic Compounds" – JerryMarch
4. "Organic Chemistry" – J.Clayden

5. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi(2009).
6. Mahan, B.H. University Chemistry, 3rd Ed. Narosa(1998).
7. Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co.: New York(1985).
8. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7thEd.,
9. W. H. Freeman. Berg, J.M., Tymoczko, J.L.& Stryer, L. Biochemistry, W.H. Freeman,2002.

COURSE CODE	XCY307	L	T	P	C
CORSE NAME	SEMI MICRO INORGANIC QUALITATIVE ANALYSIS – PRACTICAL-III	0	0	4	2
		L	T	P	H
C:P:A	1.0: 0.8:0.2	0	0	4	4
COURSE OUTCOMES		DOMAIN		LEVEL	
CO1	Ability to <i>Identify</i> the ions in a given Inorganic mixture	Cognitive Psychomotor		Remember Perception	
CO2	<i>Analyse</i> the individual cations and anions present in a given mixture and <i>explain</i> the characteristic properties of cations.	Cognitive Psychomotor Affective		Understand Analyse Perception Receive	
CO3	<i>Use</i> the principle behind the analysis of ions.	Cognitive		Apply	
Programmes to be exercised					2
Semi-micro qualitative analysis using H ₂ S of mixtures - not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:					
Cations : NH ₄ ⁺ , Pb ²⁺ , Ag ⁺ , Bi ³⁺ , Cu ²⁺ , Cd ²⁺ , Sn ²⁺ , Fe ³⁺ , Al ³⁺ , Co ²⁺ , Cr ³⁺ , Ni ²⁺ , Mn ²⁺ , Zn ²⁺ , Ba ²⁺ , Sr ²⁺ , Ca ²⁺ , K ⁺					
Anions : CO ₃ ²⁻ , S ²⁻ , SO ₄ ²⁻ , S ₂ O ₃ ²⁻ , NO ₃ ⁻ , CH ₃ COO ⁻ , Cl ⁻ , Br ⁻ , I ⁻ , NO ₂ ⁻ , SO ₄ ²⁻ , PO ₄ ³⁻ , BO ₃ ³⁻ , C ₂ O ₄ ²⁻ , F ⁻ (Spot tests should be carried out wherever feasible)					
	LECTURE	TUTORIAL	PRACTICAL	TOTAL	
	0		30	30	
TEXT BOOK					
<ol style="list-style-type: none"> 1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons(1997) 2. Frank J. Welcher and Richard B. Hahn, Semimicro Qualitative Analysis, New Delhi, Affiliated East-west Press Pvt. Ltd. (1969). 					

SEMESTER IV

COURSE CODE	COURSE NAME	L	T	SS	P	C
XCY401	Pharmaceutical Chemistry	1	0	1	2	2
C:P:A	0.6:0.8:0.6	L	T	SS	P	H
		1	0	1	2	4
COURSE OUTCOMES		DOMAIN			LEVEL	
CO1	<i>Explain</i> the basic concepts and aims of pharmaceutical chemistry	Cognitive			Understanding	
CO2	<i>Identify</i> the role of drugs and its preparation.	Cognitive Affective			Apply Receiving Responding	
CO3	<i>Describe</i> the antibiotics role pharmaceuticals in our life.	Cognitive				
CO4	<i>Recognise</i> fermentation Aerobic and anaerobic fermentation in daily process.	Cognitive Affective			Understanding	
CO5	<i>Describe</i> the important medicinal plant and its actions..	Cognitive			Remember Understanding	

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

SYLLABUS:

UNIT I	Basic concepts of pharmaceutical chemistry Basic concepts and aims of pharmaceutical chemistry- Terms and Definitions - drug, pharmacophore, pharmacology, pharmacopoeia, chemotherapy – Biological activities and examples -bacteria, virus, and vaccine-	6
UNIT II	Drugs Classification of drugs, Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, antiinflammatory agents (Aspirin, paracetamol, ibuprofen) Practical 1. Preparation of Aspirin and its analysis. 2. Preparation of magnesium bisilicate (Antacid). 3. Preparation of Acetanilide	6
UNIT III	Pharmaceuticals Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine). Practical : Preparation of nitro benzene.	6
UNIT IV	Fermentation Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and	6

	Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C. Practical : Separation of Amino Acids	
Unit V	Medicinal plants Medicinal plants origin, function and uses-Tulasi, Neem, Kizhanelli, Alovera, Semparuthi, Nilavembu, Adadodai and Thoothvelai. Anticancer plants: harmine- taxol-colchicines. Practical :separation of plant pigments	6
		30

	LECTURE	SS	PRACTICAL	TOTAL HOURS
Hours	15	15	30	60

References

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press,UK.
2. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, VallabhPrakashan, Pitampura, NewDelhi.
3. William O. Foye, Thomas L., Lemke , David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. NewDelhi.

COURSE CODE	COURSE NAME	L	T	P	C
XCY403	Physical Chemistry II	3	1	0	4
C:P:A	3.6:0:0.4	L 3	T 1	P 0	H 4

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

SYLLABUS:

CO1	<i>Explain</i> the principle thermodynamics and its laws applications.	Cognitive	Understanding
CO2	<i>Apply</i> the rate and its half life for the chemical reactions..	Cognitive Affective	Apply Receiving
CO3	<i>Describe</i> the various concepts and laws of solutions.	Cognitive	Understanding
CO4	<i>Identify</i> the various component system and its equilibrium.	Cognitive Affective	understanding
CO5	<i>Describe</i> the basic concepts in electro chemistry and <i>application</i> of conductance and for finding the emf of the cell..	Cognitive	Apply Remember
UNIT I	Unit I Thermodynamics – Chemical Energetics Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.		9+3
UNIT II	Chemical kinetics Rate of reactions – rate constant – order and molecularity of reactions – first order and pseudo unimolecular reactions (definition and examples) – derivation of rate constant for the inversion of cane sugar. Second order reactions – definition – examples – derivation of rate constant (same concentration and different concentration) and half life period – application to saponification of ester. Third order reactions: definition and examples. Methods of determination of order of reactions. Zero order reactions – definition and examples – derivation of rate constant. Theory of reaction rates – collision theory of bimolecular reactions – unimolecular reactions – Lindemann's hypothesis – theory of absolute reaction rates		10+3

UNIT III	Unit III: Solutions Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature, composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.	8 +3		
UNIT IV	Unit IV: Ionic Equilibrium and Phase Equilibrium Ionic Equilibria: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, Solubility and Solubility product-common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Phase Equilibrium Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver only).	9+3		
Unit V	Unit V: Electrochemistry and Conductance Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG , ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. Potentiometric titrations Conductance Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte. Conductometric titrations (only acid base).	9+3		
	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	-	60

Text Books

1. "Principles of Physical Chemistry", B.R.Puri and L.R.Sharma
2. "Principles of Physical Chemistry", B.R.Puri, L.R.Sharma and M.S.Pathania

3. "Physical Chemistry", N.Kundu and SN.Jain

Reference Books

1. "Textbook of Physical Chemistry", S.Glasstone
2. "Physical Chemistry", G.M.Barrow
3. "Advanced Physical Chemistry", P.W.Atkins
4. "Chemical Kinetics", K.J.Laidler
5. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co.Ltd
6. Barrow, G.M. Physical Chemistry Tata McGraw-Hill(2007).
7. Castellan, G.W. Physical Chemistry 4th Ed. Narosa(2004).
8. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi(2009).
9. Mahan, B.H. University Chemistry 3rd Ed. Narosa(1998).
10. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York(1985).
11. Cotton, F.A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
12. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
13. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt.Ltd.

COURSE CODE	COURSE NAME	L	T	P	C
XCY404	Inorganic Chemistry III	3	1	0	4
C:P:A	3.6:0:0.4	L	T	P	H
		3	1	0	4

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

SYLLABUS:

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	<i>Identify</i> the stability of complexes and its isomerism.	Cognitive	Understanding
CO2	<i>Describe</i> the various bonding and theories of metal and ligands.	Cognitive Affective	Understanding Receiving
CO3	<i>Apply</i> the concept of stability in metal carbonyls and understand the principle of complexometric titrations.	Cognitive Affective	Apply Receiving
CO4	<i>Identify</i> the role of alkali, alkaline earth and transition metals in bio inorganic chemistry.	Cognitive Affective	understanding
CO5	<i>Describe</i> the properties and applications of silicones and zeolites.	Cognitive	Apply Remember
UNIT I	<p>Unit I CO-ORDINATION CHEMISTRY Ligands, classification of ligands, IUPAC nomenclature of coordination compounds, Co-ordination number, Sidgwick's electronic interpretation of coordination compounds and the concept of effective atomic number (EAN). Isomerism – geometric isomerism in coordination number 4 and 6 compounds, optical isomerism and conditions for optical isomerism, optical isomerism in coordination number 4 and 6 compounds. Stability of complexes – definition of labile and inert complexes – factors affecting stability of complexes.</p>		9+3
UNIT II	<p>Unit II Theories of metal – ligand bonding in complexes: Werner's coordination theory, limitations of Werner's theory. Valence bond theory (VBT) – formation of inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). – application of VBT to octahedral complexes, square planar and tetrahedral complexes, limitations of VBT. crystal field theory (CFT) – crystal field splitting in tetrahedral, square planar and octahedral complexes, strong and weak ligands,</p>		10+3

	<p>spectrochemical series – high – spin and low – spin complexes, magnetic properties of octahedral and tetrahedral complexes, crystal field stabilization energy (CFSE) and its uses Comparison of CFSE for Oh and Td complexes, limitations of CFT - comparison of VBT and CFT. Ligand field theory – application of LFT to octahedral and tetrahedral complexes – metal ligand π – bonding. Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.</p>			
UNIT III	<p>Unit III: Metal carbonyls, complexometric Titrations and cluster compounds Metal carbonyls – classification with suitable examples – metal carbonyls and EAN rule – stability of metal carbonyls – applications. Chelates – application of chelates. Applications of co- ordination compounds in qualitative and quantitative analysis: Separation of silver and mercury ions, copper and cadmium ions, identification of aluminium, chromium, nickel, zinc, manganese and potassium, Complexometric titrations – principle and applications – quantitative estimation of nickel using DMG, aluminium using oxine – structure of EDTA complexes. Cluster compounds: Boranes – carbaboranes – carbonyl clusters.</p>	8+3		
UNIT IV	<p>Unit IV: Bio – inorganic chemistry Essentiality (significance) of metal and metal ions in biological systems. Role of alkaline and alkaline earth metal ions in biological systems. Na/K pump. Role of iron in biological systems – structure of haemoglobin (structural elucidation not required) – oxygen transportation by haemoglobin (elementary study) Structure of chlorophyll – photosynthesis. Role of zinc in biological systems. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones). Hydrogenase- Metal poisoning – cadmium and mercury poisoning.</p>	9+3		
Unit V	<p>Unit V: Silicones (polysiloxanes) and Silicates Types of silicones – structure of silicones – versatile properties of silicones. Preparation and properties of dimethyl, methylphenyl and diphenyl siloxanes. Applications of silicones – desired properties – sealants and adhesives – rubber – paints and coatings – health care – Automotive – aerospace – household – defoaming drycleaning electronics lubricants personal care – construction. Zeolites – types of zeolites - uses like ion- exchangers water softeners, molecular sieves dehydrating agents, adsorbents and catalysts,</p>	9+3		
	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	-	60

Text Books

1. "Inorganic Chemistry", P.L.Soni
2. "Advanced Inorganic Chemistry", R.D.Madan
3. "Inorganic Chemistry", Puri and Sharma

Reference Books

1. "Basic Inorganic Chemistry", F.A. Cotton and Wilkins
2. "A Textbook of quantitative Inorganic Analysis", Arthur.I.Vogel
3. "Inorganic Chemistry", James E. Huheey
4. "Concise Inorganic Chemistry", J.D.Lee
5. "Fundamentals of Inorganic Chemistry", Gilreath
6. "Engineering Chemistry", B.C.Jain and Monica Jain
7. "In-organic Chemistry", Shriver and Atkins

COURSE NAME	Inorganic Quantitative Analysis PracticalIV	L	T	P	C
		0	0	4	2
COURSE CODE	XCY406	L	T	P	H
C:P:A	1.0: 0.8:0.2	0	0	4	4
COURSE OUTCOMES		DOMAIN		LEVEL	
CO1	Ability to <i>Identify</i> the various inorganic complexes	Cognitive Psychomotor		Remember Perception	
CO2	<i>Analyse</i> the quantity of individual metal present in a given mixture and <i>explain</i> the characteristic properties of the complexes.	Cognitive Psychomotor Affective		Understand Analyse Perception Receive	
CO3	<i>Use</i> the principle behind the gravimetric analysis.	Cognitive		Apply	
Experiments					
<ol style="list-style-type: none"> 1. Estimation of Lead as leadchromate. 2. Estimation of Barium as bariumchromate. 3. Estimation of Nickel as Nickel - DMGcomplex. 4. Estimation of Copper as copper (I)thiocyanate 5. Estimation of Magnesium as magnesiumoxinate 6. Estimation Calcium as calcium oxalate monohydrate 7. Estimation of Barium as bariumsulphate. 8. Estimation of Iron as Iron (III)oxide. 					
		LECTURE	PRACTICAL	TOTAL	
		0	30	30	
TEXT BOOK					
1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2 nd edition, New Delhi, Sultan Chand & sons(1997)					

SEMESTER V

COURSE CODE	COURSE NAME	L	T	P	SS	C
XCY501	CLINICAL CHEMISTRY	1	0	2	1	2
		L	T	P	SS	H
		1	0	2	1	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>				DOMAIN		LEVEL
CO1	<i>Identify</i> the mechanism of different types of metabolism.	Cognitive		Remember		
CO2	<i>Explain</i> the important concepts of various techniques used in clinical chemistry.	Cognitive		Understand		
CO3	<i>Analyse</i> the various molecular entities known as vitamins and nutrition values.	Cognitive		Analyze		
CO4	<i>Interpret</i> the methods of testing of various organs of body and the diagnostic roles of related enzymes.	Cognitive		Understand		
CO5	<i>Illustrate</i> the various methods for cardiac profile, glucose and cholesterol estimation.	Cognitive		Analyze		
SYLLABUS:						
UNIT - IMETABOLISM						3+3
Distribution of fluids in the body, ECF & ICF, water metabolism, de hydration, mineral metabolism, macronutrients (principal mineral elements) & trace elements. Carbohydrate metabolism, Protein metabolism, Lipid metabolism, Bile pigment metabolism.						
UNIT - II TECHNIQUES USED IN CLINICAL CHEMISTRY						3+3
Photometry- Definition, laws of photometry, absorbance, transmittance, absorption maxima, instruments, parts of photometer, types of photometry–colorimetry, spectrophotometry, flame photometry, fluorometry, choice of appropriate filter, measurements of solution, calculation of formula, applications.						
UNIT – III VITAMINS AND NUTRITION						2+3
Classification of vitamins, Chemistry, properties, biological importance and deficiency manifestations of fat soluble vitamins. Chemistry, properties, biological importance, deficiency manifestations and coenzyme functions of water soluble vitamins.						
UNIT –IV ORGAN FUNCTION TESTS AND DIAGNOSTIC ENZYMES						5+3
Organ function tests: Evaluation of organ function tests: Assessment and clinical manifestations of renal, pancreatic, gastric and intestinal functions. Clinical importance of bilirubin. Enzyme tests in determination of myocardial infarction. Enzymes of pancreatic origin and biliary tract.						
UNIT –V APPLICATIONS OF CLINICAL CHEMISTRY						2+3
Cardiac Profile - In brief Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases, Different methods of Glucose Estimation and Cholesterol Estimation, Principle advantage and disadvantage of different methods.						

PRACTICALS				30hrs
Estimation of glucose using Fehling's solution Estimation of cholesterol using ferric chloride Estimation of ferric ion by colorimetric method Iodometric determination of vitamin C Estimation of carbohydrate in mixture by qualitative method.				
TEXT BOOKS				
1. Lehninger Principles of Biochemistry 4th Ed By David L. Nelson and Michael M.Cox, WH Freeman and Company. 2. Principles of Biochemistry (Hardcover) By Geoffrey Zubay. Publisher: McGraw Hill College. 3. Harper's Biochemistry (Lange Medical Books) (Paperback) By Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange. 4. K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange. 5. Bioenergetics By David G. Nicholls and Stuart J. Ferguson. Academic Press. 6. Bioenergetics at a Glance: An Illustrated Introduction (At a Glance) By D.A. Harris. Publisher: Wiley Blackwell				
REFERENCE BOOKS				
1. Biochemistry By Lubert Stryer. WH Freeman and Co. 2. Principles of Biochemistry By Robert Horton, Laurence A Moran, Gray Scrimgeour, Marc Perry and David Rawn. Pearson Education. 3. Harper's Biochemistry By RK Murray, DK Granner, PA Mayes and VW Rodwell. Appelton and Lange, Stanford.				
LECTURE	TUTORIAL	SELF-STUDY	PRACTICAL	TOTAL HOURS
15	----	15	30	60

COURSE CODE	COURSE NAME	L	T	P	C
XCY502A	PHYTOCHEMISTRY	3	1	0	4
		L	T	P	H
		3	1	0	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>		DOMAIN			LEVEL
CO1	Identify new biologically important molecular components from natural origin.	Cognitive			Remember
CO2	Explain various steps in isolation and separation of plant extracts from natural sources.	Cognitive			Understand
CO3	Analyse the various molecular entities in the plant extracts using various spectral and solvent extraction methods.	Cognitive			Analyze
CO4	Interpret the mode of action of various drugs extracted from herbals.	Cognitive			Understand
CO5	Illustrate the structure- functional activities of various herbs to make attempt to cure challengeable disease.	Cognitive			Analyze
SALLYBUS:					
UNIT - I NATURAL PRODUCTS					9+3
Natural products – importance-phytochemicals- classification- diversity of structures- preliminary phytochemical screening- bioassay- in vitro and in vivo studies- antimicrobial activity- pharmacological studies like anti-inflammatory, anti-diabetic, analgesic and hepato protective.					
UNIT-II PHYTOCHEMICAL ISOLATION TECHNIQUES					9+3
Phytochemical isolation techniques- solvent extraction- qualitative chemical examination- detection of phyto constituents- use of chromatographic techniques- TLC, HPLC and GC- detection of volatile oils by hydrodistillation methods.					
UNIT – III PHYTOCHEMICAL IMPORTANCE OF DRUGS					7+3
Sources, chemical structures (structure only), chemical test for identification, phytochemical and pharmacological importance - nicotine, caffeine, theophylline, theobromine and cocaine- Flavonoids - quercetin and kaempferol.					
UNIT –IV TERPINOIDS ,STEROIDS AND ANTI-CANCER PLANTS					11+3
Sources, chemical structures (structure only), chemical test for identification, - Terpinoids menthol, camphor, citral, limonene-carotenoids lycopene and beta carotene–Steroids stigmasterol and cholesterol – anti-cancer plants – cytostatics- harmine, taxol and colchicines					
UNIT –V SPECTROSCOPIC TECHNIQUES					9+3
Structural elucidation of the compounds by spectroscopic techniques like UV, IR, MS, NMR (¹ H, ¹³ C) for simple organic compounds.					
TEXT BOOKS					
1. Kalsi, P.S., Spectroscopy of organic compounds, New age publishers, New Delhi, 2000.					

2. Lindsey, K. , Transgenic Plant Research, Harwood Acad. Pub.1997.
3. D. L. Pavia, G. M. Lampmann, G. S. Kriz, Introduction to Spectroscopy, Thomson, 3rd edition, 2001.
4. Silverstein and Webster, Spectrometric Identification of Organic Compounds, Sixth Edition, Wiley,1998.

REFERENCE BOOKS

1. W C Evans, Pharmacognosy , 15th edition,2002.
2. Gunnar Samuelsson ,A Textbook of Pharmacognosy, English edition, Swedish Pharmaceutical Press, Stockholm,1992.
3. Gupta, P.K., Cytogenetics, Rastogi and Company , Meerut.1995.
4. Swanson, C.P.. Cytology and Cytogenetics. Macmillan India Ltd. New Delhi,1972.
5. Gupta, P.K. Elements of Biotechnology, Rastogi , Meerut,1972.

E Resources - MOOCs:

1. <http://freevidelectures.com/Course/3218/Advance-Analytical-Course>
2. <http://freevidelectures.com/Course/2908/Green-Chemistry-An-Interdisciplinary-Approach-to-Sustainability#>

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
	45	15	0	60

COURSE CODE	COURSE NAME	L	T	P	C
XCY502B	FORENSIC SCIENCE	3	1	0	4
		L	T	P	H
		3	1	0	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>			DOMAIN		LEVEL
CO1	<i>Identify</i> the methods of analyzing trace amounts of petroleum products in crime scene evidence.	Cognitive		Remember	
CO2	<i>Explain</i> the method of searching, collecting, preserving and analyzing arsonevidence	Cognitive		Understand	
CO3	<i>Analyse</i> the various types of explosives, including the synthesis and characterization of representative analogs and the techniques of locating hidden explosives.	Cognitive		Analyze	
CO4	<i>Interpret</i> the importance of chromatographic and spectroscopic techniques in processing crime scene evidence.	Cognitive		Understand	
CO5	<i>Illustrate</i> the significance of microscopy in visualizing trace evidence and comparing it with control samples.	Cognitive		Analyze	
SALLYBUS:					
UNIT - I PETROLEUM AND PETROLEUM PRODUCTS					9+3
Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits. Comparison of petroleum products. Adulteration of petroleum products.					
UNIT - II CASES INVOLVING ARSON					9+3
Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence. Analysis of fire debris. Analysis of ignitable liquid residue. Post-flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.					
UNIT – III EXPLOSIVES					7+3
Classification of explosives –low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents. Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves. Bomb scene management. Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.					
UNIT –IV INSTRUMENTATION					15+3
Sample preparation for chromatographic and spectroscopic evidence. Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography. Spectroscopic methods. Fundamental principles and forensic applications of Ultraviolet-visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy, atomic emission spectroscopy and mass spectroscopy. X-ray spectrometry. Colorimetric analysis and Lambert-Beer law. Electrophoresis –fundamental principles and forensic applications. Neutron activationanalysis – fundamental principles and forensic applications.					
UNIT –V MICROSCOPY					5+3

Fundamental principles. Different types of microscopes. Electron microscope. Comparison Microscope. Forensic applications of microscopy.

TEXT BOOKS

1. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth (1992).
2. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, Hampshire(1991).
3. J.D. DeHaan, Kirk's Fire Investigation, 3rd Edition, Prentice Hall, New Jersey(1991).
4. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's, Techniques of Crime Scene Investigation, CRC Press, Boca Raton(2013).
5. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in Forensic Science, D.H. Ubelaker (Ed.), Wiley-Blackwell, Chichester (2013)

REFERENCE BOOKS

1. J.W. Robinson, Undergraduate Instrumental Analysis, 5th Edition, Marcel Dekker, Inc., New York (1995)
2. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York(1995).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey(2004).

E Resources - MOOCs:

1. <https://www.mooc-list.com/course/introduction-forensic-science-futurelearn>
2. <https://www.mooc-list.com/course/forensic-engineering-learning-failures-edx>
3. <https://www.class-central.com/tag/forensic%20science>

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
	45	15	0	60

COURSE CODE	COURSE NAME	L	T	P	C
XCY503A	ANALYTICAL METHODS IN CHEMISTRY	3	1	0	4
		L	T	P	H
		3	1	0	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>		DOMAIN		LEVEL	
CO1	Identify the concepts of qualitative and quantitative analysis and also to find out the errors, accuracy and precision in data analysis.	Cognitive		Remember	
CO2	Explain the principles and methods of analyzing chemical compounds with the help of various spectroscopies.	Cognitive		Understand	
CO3	Analyse the various types of thermal methods of analysis including TGA, DTA, DSC etc.	Cognitive		Analyze	
CO4	Interpret the importance of electroanalytical techniques in analysis of different parameters of chemical compounds and solutions..	Cognitive		Understand	
CO5	Illustrate the significance of separation techniques in visualizing trace elements and comparing it with control samples.	Cognitive		Analyze	
SYLLYBUS:					
UNIT - I QUALITATIVE AND QUANTITATIVE ASPECTS OF ANALYSIS					5+3
Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.					
UNIT-II OPTICAL METHODS OF ANALYSIS					15+3
Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution. Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.					
UNIT – III THERMAL METHODS OF ANALYSIS					5+3
Theory of thermogravimetry (TG), basic principle of instrumentation. Principles, instrumentation and applications of TGA, DTA, DSC. Techniques for quantitative estimation of Ca and Mg from their mixture.					

UNIT –IV ELECTROANALYTICAL METHODS	5+3
Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pK _a values.	
UNIT –V SEPARATION TECHNIQUES	15+3
Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media. Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Paper, column, Thin layer chromatography and HPLC	
TEXT BOOKS	
<ol style="list-style-type: none"> 1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. <i>Vogel's Textbook of Quantitative Chemical Analysis</i>, John Wiley & Sons, 1989. 2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. <i>Instrumental Methods of Analysis</i>, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988. 3. Christian, G.D; <i>Analytical Chemistry</i>, 6th Ed. John Wiley & Sons, New York, 2004. 4. Harris, D. C. <i>Exploring Chemical Analysis</i>, Ed. New York, W.H. Freeman, 2001. 	
REFERENCE BOOKS	
<ol style="list-style-type: none"> 1. Khopkar, S.M. <i>Basic Concepts of Analytical Chemistry</i>. New Age, International Publisher, 2009. 2. Skoog, D.A. Holler F.J. & Nieman, T.A. <i>Principles of Instrumental Analysis</i>, Cengage Learning India Ed. 3. Mikes, O. <i>Laboratory Hand Book of Chromatographic & Allied Methods</i>, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979. 	
E Resources - MOOCs:	
<ol style="list-style-type: none"> 1. https://www.mooc-list.com/course/basic-analytical-chemistry-edx 2. https://www.mooc-list.com/course/analytical-chemistry-instrumental-analysis-coursera 3. https://www.mooc-list.com/course/analytical-chemistry-saylororg 	

COURSE CODE	COURSE NAME	L	T	P	C
XCY503B	AGRICULTURAL CHEMISTRY	3	1	0	4
		L	T	P	H
		3	1	0	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>		DOMAIN		LEVEL	
CO1	<i>Identify</i> the chemical composition and soils of the earth's crust.	Cognitive		Remember	
CO2	<i>Explain</i> the concept of soil fertility, soil productivity and application of various types of fertilizers	Cognitive		Understand	
CO3	<i>Analyze</i> the various types of radioisotopes in soil and plants.	Cognitive		Analyze	
CO4	<i>Interpret</i> the importance of remote sensing and GIS techniques in agriculture.	Cognitive		Understand	
CO5	<i>Illustrate</i> the significance of Analysis of soil extracts, nutrients, plants extracts and irrigation waters and interpretation of results..	Cognitive		Analyze	
SALLYBUS:					
UNIT - I SOIL CHEMISTRY					7+3
Chemical (elemental) composition of the earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. Soil organic matter – classification, fractionation of soil organic matter and different fractions, genesis and nature of soil organic matter and humus formation, humus decomposition, separation of humus from soil particles, clay-organic interactions. The soil polysaccharides					
UNIT - II SOIL FERTILITY AND FERTILIZER USE					8+3
Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients – functions and deficiency symptoms. Law of soil fertility soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation; nitrogenous fertilizers and their fate in soils; management of nitrogenous fertilizers.					
UNIT – III RADIOISOTOPES IN SOIL AND PLANT STUDIES					7+3
Principles and use of radiation monitoring instruments – proportional, Geiger Muller counter, solid and liquid scintillation counters; neutron moisture meter. Isotopic dilution techniques used in soil and plant research; use of stable isotopes; application of isotopes in studies on organic matter, nutrient transformations, ion transport, rooting pattern and fertilizer use efficiency; carbon dating.					
UNIT –IV TECHNIQUES FOR SOIL, WATER AND CROP STUDIES					8+3
Introduction and history of remote sensing; sources, propagation of radiations in atmosphere; interactions with matter. Sensor systems - camera, microwave radiometers and scanners; fundamentals of aerial photographs and image processing and interpretations. Application of remote sensing techniques - land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, land identification and management.					
UNIT –V ANALYTICAL TECHNIQUES IN SOIL AND PLANT ANALYSIS					15+3
Preparation of solutions for standard curves, analytical and qualitative reagents, indicators and standard solutions for acid-base, oxidation-reduction titration; soil, water and plant sampling techniques their					

processing and handling. Nutrient potentials and potential buffering capacities of soils. Determination of lime and gypsum requirement of soil

TEXT BOOKS

1. Agricultural Chemistry V.V Publications.
2. Soil analysis. Beckmann
3. Bear RE. 1964. Chemistry of the Soil. Oxford and IBH.
4. Bolt GH & Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.
5. Comer CL. 1955. Radioisotopes in Biology and Agriculture: Principles and Practice. Tata McGraw Hill.
- Elangovan K. 2006. GIS Fundamentals, Applications and Implementations. New India Publ. Agency.
- Lillesand TM & Kiefer RW. 1994. Remote Sensing and Image Interpretation. 3rd Ed. Wiley
6. Hesse P. 1971. Textbook of Soil Chemical Analysis. William Clowes & Sons.
7. Jackson, M.L. 1967. Soil Chemical Analysis. Prentice Hall of India.
8. Singh D, Chhonkar PK & Pandey RN. 1999. Soil Plant Water Analysis – A Methods Manual. IARI, New Delhi.

REFERENCE BOOKS

1. Greenland DJ & Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons
2. Glasstone S. 1967. Source Book on Atomic Energy. East West Press.
3. Michael FL & Annunziata. 2003. Handbook of Radioactivity Analysis. Academic Press.
4. Kenneth Helrich 1990. Official Methods of Analysis. Association of Official Analytical Chemists.
5. Page, A.L., Miller RH & Keeney DR. 1982. Methods of Soil Analysis. Part II. SSSA, Madison.
6. Piper CS. Soil and Plant Analysis. Hans Publ.

E Resources - MOOCs:

1. <http://nptel.ac.in/courses/126104002/>

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
	45	15	0	60

COURSE CODE	COURSE NAME	L	T	P	C
XCY504A	COMPUTER APPLICATIONS IN CHEMISTRY	3	1	0	4
		L	T	P	H
		3	1	0	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>		DOMAIN		LEVEL	
CO1	Identify the components and formats of computer operations.	Cognitive		Remember	
CO2	Explain the elements, operators, programming of basic language.	Cognitive		Understand	
CO3	Analyse the various types of Numerical methods for roots of equations and simultaneous equation.	Cognitive		Analyze	
CO4	Interpret the importance of remote sensing and GIS techniques in agriculture.	Cognitive		Understand	
CO5	Illustrate the significance of molecular modeling and data handling.	Cognitive		Analyze	
SALLYBUS:					
UNIT - I INTRODUCTION TO COMPUTERS APPLICATIONS					7+3
Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions.					
UNIT - II ELEMENTS OF THE BASIC LANGUAGE					7+3
Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.					
UNIT – III ROOTS OF EQUATIONS AND SIMULTANEOUS EQUATIONS					7+3
Numerical methods for roots of equations: Quadratic formula, iterative method, Newton-Raphson method, Binary bisection and Regula-Falsi. Matrix manipulation: addition, multiplication. Gauss-Siedal method.					
UNIT –IV DIFFERENTIAL AND INTEGRAL CALCULUS					12+3
Numerical differentiation, Numerical integration (Trapezoidal and Simpson’s rule), probability distributions and mean values.					
UNIT –V CONCEPTUAL BACKGROUND OF MOLECULAR MODELLING					12+3
Handling of experimental data. Potential energy surfaces. Elementary ideas of molecular mechanics and practical MO methods.					
TEXT BOOKS					
<ol style="list-style-type: none"> Harris, D. C. <i>Quantitative Chemical Analysis</i>. 6th Ed., Freeman (2007) Chapters3-5. Levie, R. de, <i>How to use Excel in analytical chemistry and in general scientific data analysis</i>, Cambridge Univ. Press (2001) 487pages. Noggle, J. H. <i>Physical chemistry on a Microcomputer</i>. Little Brown & Co.(1985). Venit, S.M. <i>Programming in BASIC: Problem solving with structure and style</i>. Jaico Publishing House: Delhi(1996). 					

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
	45	15	0	60

COURSE CODE	COURSE NAME	L	T	P	C
XCY504B	PROGRAMMING IN C	3	1	0	4
		L	T	P	H
		3	1	0	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>		DOMAIN		LEVEL	
CO1	Identify simple applications in C using basic constructs	Cognitive		Remember	
CO2	Explain the design and implement applications using arrays and strings	Cognitive		Understand	
CO3	Analyse the development and implementation applications in C using functions and pointers	Cognitive		Analyze	
CO4	Interpret the importance of structures in developing applications in C.	Cognitive		Understand	
CO5	Illustrate the designing of applications using sequential and random access file processing.	Cognitive		Analyze	
SALLYBUS:					
UNIT - I BASICS OF C PROGRAMMING					9+3
Introduction to programming paradigms -Structure of C program -C programming: Data Types – Storage classes-Constants–Enumeration Constants–Keywords–Operators: Precedence and Associativity–Expressions Input/ Output statements, Assignment statements–Decision making statements-Switch statement-Looping statements – Pre-processor directives -Compilation process.					
UNIT - II ARRAYS AND STRINGS					9+3
Introduction to Arrays: Declaration, Initialization – One dimensional array–Example Program: Computing Mean, Median and Mode-Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.					
UNIT – III FUNCTIONS AND POINTERS					9+3
Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers –Pointer operators – Pointer arithmetic – Arrays and pointers –Array of pointers –Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference –Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.					
UNIT –IV STRUCTURES					6+3
Structure -Nested structures –Pointer and Structures –Array of structures –Example Programusing structures and pointers –Self referential structures –Dynamic memory allocation-Singly linkedlist.					
UNIT –V FILE PROCESSING					12+3
Files –Types of file processing: Sequential access, Random access –Sequential access file –Example Program: Finding average of numbers stored in sequential access file -Random access file –Example Program: Transaction processing using random access files –Command line arguments.					
TEXT BOOKS					
1. Reema Thareja, —Programming in C , Oxford University Press, Second Edition, 2016.					

2. Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition, Pearson Education, 2006

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, —C How to Program, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, —Programming in C, CENGAGE Learning India Pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
	45	15	0	60

COURSE CODE	COURSE NAME	L	T	P	C
XCY505	ORGANIC QUALITATIVE ANALYSIS PRACTICALVA	0	0	4	2
		L	T	P	H
		0	0	4	4

SALLYBUS:

CO1	<i>Identify</i> the monofunctional groups in various types of organic compound.	Cognitive Psychomotor	Remember Perception
CO2	<i>Estimate</i> the extra elements in a combination of two or more organic compounds.	Cognitive Psychomotor	Understand Set
CO3	<i>Estimate</i> the R _f value by separating the mixtures of organic compounds by chromatography and effect of different parameters on amino acids and carbohydrates.	Cognitive Psychomotor Affective	Apply Set Receiving

PRACTICALS

60 hrs

1. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of onederivative.
2. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extraelements)

Reference Books:

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

COURSE CODE	COURSE NAME	L	T	P	C
XCY506	PHYSICAL CHEMISTRY PRACTICALVB	0	0	4	2
		L	T	P	H
		0	0	4	4

CO1		Cognitive Psychomotor	Remember Perception
CO2	<i>Estimate</i> the viscosity of liquid and its variation with respect to concentration of a solute.	Cognitive Psychomotor	UnderstandSet
CO3	<i>Estimate</i> the kinetics of different reactions using Initial rate method and Integrated rate method.	Cognitive Psychomotor Affective	Apply Set Receiving

SALLYBUS:

PRACTICALS	60 hrs
1. Electrochemistry practicals-Estimation of ferrous ion by potentiometric titration. 2. Study the kinetics of the following reactions. a) Initial rate method: Iodide-persulphate reaction b) Integrated rate method: (i) Acid hydrolysis of methyl acetate with hydrochloric acid. (ii) Saponification of ethyl acetate. 3. Compare the strengths of HCl and H ₂ SO ₄ by studying kinetics of hydrolysis of methyl acetate	
Reference Books:	
5. Svehla, G. <i>Vogel's Qualitative Inorganic Analysis</i> , Pearson Education, 2012. 6. Mendham, J. <i>Vogel's Quantitative Chemical Analysis</i> , Pearson, 2009. 7. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., <i>Textbook of Practical Organic Chemistry</i> , Prentice-Hall, 5th edition, 1996. 8. Mann, F.G. & Saunders, B.C. <i>Practical Organic Chemistry</i> Orient-Longman, 1960.	

		SEMESTER VI			L	T	SS	P	C
COURSE CODE	XCY601	1	0	1	2	2			
COURSE NAME	RENEWABLE ENERGY	L	T	SS	P	H			
C: P: A	1.4:0:0.6	1	0	1	2	4			
COURSE OUTCOMES: : On the successful completion of the course, students will be able to		Domain			Level				
CO1	<i>Describe</i> the reserves of renewable energy and demand of energy needs.methodologies / technologies for effective utilization of renewable energy sources.	Cognitive			Remember				
CO2	<i>Explain</i> the methodology to harness solar energy and its applications.	Cognitive Affective			Understand Apply Receive				
CO3	<i>Examine</i> the potential of wind energy and its techniques.	Cognitive Affective			Understand Receive				
CO4	<i>Recognize</i> the significance of bio energy generation .	Cognitive Affective			Apply Respond				
CO5	<i>Interpret</i> the effective technology of various renewable energy resources.	Cognitive			Understand				
UNIT I	INTRODUCTION TO ENERGY						3+6+3		
World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials – Achievements / Applications – Economics of renewable energy systems.									
UNIT II	SOLAR ENERGY						3+6+3		
Solar Radiation – Measurements of Solar Radiation – Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation – Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.									
UNIT III - WIND ENERGY							3+6+3		
Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.									
UNIT IV - BIO – ENERGY							3+6+3		
Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration – Biomass Applications									
UNIT V - OTHER RENEWABLE ENERGY SOURCES							3+6+3		
Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage – Fuel Cell Systems – Hybrid Systems.									
LECTURE	TUTORIALS	SELF STUDY	PRACTICALS			TOTAL			
15	0	15	30			60			
TEXT BOOKS									
1. Rai. G.D., “Non Conventional Energy Sources”, Khanna Publishers, New Delhi,(2011). 2. Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK,(2006).									
REFERENCES									

1. Sukhatme. S.P., “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., NewDelhi, (1997).
2. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, OxfordUniversity Press, U.K.,(1996).
3. Tiwari. G.N., Solar Energy – “Fundamentals Design, Modelling & Applications”,Narosa

- Publishing House, New Delhi, (2002).
4. Freris. L.L., “Wind Energy Conversion Systems”, Prentice Hall, UK,(1990).
 5. Johnson Gary, L. “Wind Energy Systems”, Prentice Hall, New York,(1985).
 6. David M. Mousdale – “Introduction to Biofuels”, CRC Press, Taylor & Francis Group,USA, (2010).
 7. Chetan Singh Solanki, Solar Photovoltaics, “Fundamentals, Technologies andApplications”, PHI Learning Private Limited, New Delhi,(2009).

COURSE CODE	XCY602A	L	T	P	SS	C
COURSE NAME	INDUSTRIAL CHEMISTRY	3	1	0	0	4
PREREQUISITE	NIL	L	T	P	SS	H
C:P:A	3.2:0:0.8	3	1	0	0	4
COURSE OUTCOMES: : <i>On the successful completion of the course, students will be able to</i>		DOMAIN		LEVEL		
CO1	<i>Describe</i> the utilization of the raw materials in chemical industry.	Cognitive		Remember		
CO2	<i>Explain</i> the manufacturing process of cement, ceramics, glass and fertilizers.	Cognitive		Understand		
CO3	<i>Recognize</i> the technologies used in small scale chemical industries.	Cognitive		Understand		
CO4	<i>Interpret</i> the various toxic chemicals used in agro industries and synthesis of sugar	Cognitive Affective		Remember Receive		
CO5	<i>Examine</i> the various pollutants and gain awareness about industrial pollution.	Cognitive Affective		Analyze Respond		
UNIT I	RAW MATERIALS AND ENERGY FOR CHEMICAL INDUSTRY				9+3	
Raw materials – Characteristics of raw materials and their resources – methods of raw material concentrations – integral utilization of raw materials. Energy for chemical industry – Fuels – classification of fuels – coal – fuel gases and liquid fuels – petroleum – cracking – Octane number – cetane number – composition and uses of coal gas, water gas, producer gas, oil gas and gobar gas.						
UNIT II	CEMENT, CERAMICS, GLASS AND FERTILIZERS				9+3	
Cement: Manufacture – Wet Process and Dry process. Types, Analysis of major constituents, setting of cement, reinforced concrete. Cement industries in India. Ceramics: Important clays and feldspar, glazing and verification. Glass: Types, Composition, manufacture of Optical glass, colored glasses, lead glass and neutron absorbing glass. Fertilizers: Fertilizer industries in India, Manufacture of ammonia, ammonium salts, urea, superphosphate, triple superphosphate and nitrate salts.						
UNIT III	SMALL SCALE CHEMICAL INDUSTRIES				9+3	
Electrothermal and electrochemical industries: electroplating – surface coating industries – oils, fats and waxes – Textiles industry-soaps and detergents – cosmetics. Match industries and fire works: manufacture of some industrially important chemicals like potassium chlorate, and red phosphorus – metal powders.						
UNIT IV	SUGAR AND AGRO CHEMICAL				9+3	
Sugar: Cane sugar manufacture, recovery of sugar from molasses, sugar estimation, sugar industries in India. Agrochemical industries: Important categories of insecticides, fungicides, herbicides. Mode of action and synthesis of common pesticides like Gammexane, DDT, alathrin, Parathion, Malathion, Baygon, DDVP, Warfarin.						
UNIT V	INDUSTRIAL POLLUTION & CHEMICAL TOXICOLOGY				9+3	
Introduction – causes of industrial pollution – thermal power plants – nuclear power reactors– fertilizers and chemical industry – pulp and paper industries – agro based industries – cement industry. Toxic Chemicals in the environment – biochemical effects of arsenic, cadmium, lead, mercury and cyanide.						

LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL
45	15	0	0	60
TEXT BOOKS				
1. B.K Sharma – Industrial chemistry – Goel publishinghouse. 2. B.N.Chakrabarty,Industrial Chemistry,Oxford&IBH Publishing Co.,New Delhi,(1981). 3. P.P.Singh, T.M.Joseph, R.G.Dhavale, College Industrial Chemistry, Himalaya PublishingHouse, Bombay, 4 th edn., (1983).				
REFERENCES				
1. I.Mukhlyonov(ed.),Chemical Technology,Vol.1,Mir publication, Moscow, III edn., (1979). 2. A.K.De., Environmental Chemistry, Wiley Eastern Ltd.,11 edn., Meerut(1989). 3. R.Norris Shreve and J.A.Brink, Jr. Chemical Process Industries. IV edn., McGraw Hill,Tokyo, (1977). 4. B.K.Sharma and H.Kaur,Environmental Chemistry, Krishna Prakashan,Meerut,1997. 5. A.K. De, Envionment Chemistry, Wiley Eastern Ltd., Meerut1994, 6. A.K. Mukherjee, Environmental Pollution and Health Hazards – Causes and Control Galgotia Press, New Delhi1986.				

COURSE CODE	XCY602B	L	T	P	SS	C
COURSE NAME	MATERIAL CHEMISTRY	3	1	0	0	4
PREREQUISITES	Nil	L	T	P	SS	H
C:P:A	3.4:0:0.6	3	1	0	0	4
COURSE OUTCOMES: : <i>On the successful completion of the course, students will be able to</i>		DOMAIN		LEVEL		
CO1	<i>Explain</i> the basic concept of Structure of matter and their various properties.	Cognitive		Understand		
CO2	<i>Recall</i> the laws and rules in the diffusion and phase behavior of materials.	Cognitive		Remember Apply		
CO3	<i>Recognize</i> the significance of mechanical and electrical properties of materials.	Cognitive		Remember Understand		
CO4	<i>Describe</i> the importance of magnetic, optical and thermal properties of materials.	Cognitive Affective		Understand Receive		
CO5	<i>Interpret</i> the various techniques used in the characterization of materials.	Cognitive Affective		Remember Apply Respond		
UNIT I	STRUCTURE OF MATTER				9+3	
Atomic structure: Wave mechanical model; electronic configurations; ionic, covalent, metallic and secondary bond. Space lattices and crystallographic systems; influence of radius ratio on coordination, structure of common metallic, semi conducting, ionic, polymeric and ceramic materials. Use of X-ray diffraction for determination of simple structures, point, line and surface defects; geometry of edge and screw dislocations. Burger's vector; grain and twin boundaries.						
UNIT II	MECHANICAL BEHAVIOUR OF MATERIALS				9+3	
Mechanical properties Elastic, anelastic and viscoelastic behaviours of materials, atomic model of elastic behaviours, rubber – like elasticity, relaxation processes, displacement model for viscoelasticity, plastic deformation, slip systems in crystals, critical resolved shear stress, work hardening, strengthening mechanism, ductile and brittle fracture, Griffith's criterion; failure of materials due to creep and fatigues, deformation behaviours of polymers and ceramics.						
UNIT III	ELECTRICAL PROPERTIES OF MATERIALS				9+3	
Electrical Properties Electrical / Electronic behaviours of materials, electronic and ionic conductivity; free electron and band theory of solids; intrinsic and extrinsic semiconductors, conduction mechanisms, junctions and devices, viz-diodes, rectifiers, transistors and solar cells; super conductivity. Dielectric behaviours of materials Polarization phenomena, polarizability, frequency and temperature dependence of dielectric constant.						
UNIT IV	MAGNETIC, OPTICAL AND THERMAL PROPERTIES OF MATERIALS				9+3	
Magnetic properties Magnetic behaviours of materials: JMR materials- dia, para, ferro and ferri magnetisms, soft and hard magnetic materials including ceramic magnets,						

Optical Properties Optical properties of materials, elementary ideas about absorption, transmissions and reflection refractive index, lasers and their application, optoelectronic devices.				
Thermal properties Thermal properties of materials, specific heat, thermal conductivity and thermal expansions..				
UNIT V	TECHNIQUES			9+3
Thin film deposition techniques Introduction – CVD, PVD, Spray pyrolysis, Sputtering, Molecular beam epitaxy Electroplating and Electroless plating methods.				
Materials characterization techniques Materials characterization techniques such as XRD, ESC A, XPS, AES, FTIR and Laser Raman spectroscopy. Microscopic techniques – SEM, AFM and TEM. Thermal analysis – TG/DTA and DSC.				
LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL
45	15	0	-	60
TEXT BOOKS				
1. Kandasamy. P, Thilagavathi. K, Allied Mathematics, Volume I and II, S.Chand and Company Ltd, New Delhi, 2004.				
REFERENCES				
1. T.K.Manichavasagam Pillai and S.Narayanan, Trigonometry, Viswanathan Publishers and Printers Pvt. Ltd.				
2. S. Narayan and T.K. Manicavachagam Pillay, Ancillary Mathematics, Viswanathan Publishers and Printers Pvt.Ltd.				
E REFERENCES				
WWW. NPTEL .ac.in				

COURSE CODE	XCY603A	L	T	P	SS	C
COURSE NAME	FOOD CHEMISTRY	3	1	0	0	4
PREREQUISITES	NIL	L	T	P	SS	H
C:P:A	3.7:0:0.3	3	1	0	0	4
COURSE OUTCOMES : <i>On the successful completion of the course, students will be able to</i>		DOMAIN	LEVEL			
CO1	<i>Describe</i> the basics of food.	Cognitive	Remember Understand			
CO2	<i>Interpret</i> the colloidal types, properties of food.	Cognitive	Understand Apply			
CO3	<i>Explain</i> the formation of emulsion of food.	Cognitive Affective	Analyze Receive			
CO4	<i>Identify</i> the role of water in food.	Cognitive	Understand			
CO5	<i>Recognize</i> the chemical reaction of food.	Cognitive Affective	Remember Receive			
UNIT I	INTRODUCTION TO FOOD					7 +3
Definitions – Food, nutrients, principle components of foods, functions of foods, classification of foods, properties of foods, physical, chemical, functional and kinetic properties.						
UNIT II	COLLOIDAL PROPERTIES OF FOOD					9+3
Colloidal system in foods – meaning, types, properties. Sols – meaning, types, properties: gels – meaning, type, properties, theory of gel formation, factors influencing gel formation.						
UNIT III	FOOD EMULSION					9+3
Emulsion – meaning, types, properties, emulsifying agents, natural and synthetic emulsifier, functions of emulsifying agent, common food emulsions: foams – meaning, methods of foam formation, theory of foam formation, properties – factors influencing foam formation, factors affecting stability of foam, foaming agents – natural and synthetic.						
UNIT IV	ROLE OF WATER IN FOOD					9+3
Water – forms and types of water, hydrogen bonding in water, water and ice properties, functions of water in food, intermediate moisture foods, water activity – definition, measurement and control of water activity, estimation of moisture in foods.						
UNIT V	CHEMICAL REACTION IN FOOD					11+3
Heat transfer operation in foods – conduction, convection, radiation, gelatinization, retro gradation, dextrinisation of starches, enzymatic and non enzymatic browning reaction in foods, rancidity – types and prevention.						
LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL		
45	15	0	0	60		
TEXT BOOKS						
1. Food science, Chemistry and Experimental foods by M.Swaminathan. 2. Food Science by Norman.N.Potter 3. Experimental study of Foods by Griswold R.M.						

REFERENCES

1. Food Science by HelenCharley.
2. Foundation of Food Preparation by A.G.Peckam.
3. Modern Cookery for teaching and trade, volume I&II ,Thangam Philip. OrientLongmansLtd.
4. Food Fundamentals by MacWiliams, John Willy and son"s, NewYork.
5. Food Facts & Principles by Shakunthala manay &Shadakhraswamy.
6. Food Science by Srilakshmi , second edition,(2002).

COURSE CODE	XCY603B	L	T	P	SS	C
COURSE NAME	POLYMER CHEMISTRY	3	1	0	0	4
PREREQUISITES	NIL	L	T	P	SS	H
C:P:A	3.4:0:0.6	3	1	0	0	4
COURSE OUTCOMES: <i>On the successful completion of the course, students will be able to</i>		DOMAIN			LEVEL	
CO1	Explain the chemistry of polymerization.	Cognitive			Understand	
CO2	Describe the preparation of individual polymers	Cognitive Affective			Understand Respond	
CO3	Interpret their physical properties of polymers and explain the molecular weight and size of polymers.	Cognitive Affective			Understand Apply Respond	
CO4	Recognize the polymerization techniques and Classify the uses of polymers.	Cognitive			Analyze	
CO5	Summarize the processing of polymers	Cognitive			Remember Understand	
UNIT I	CLASSIFICATION OF POLYMERS AND CHEMISTRY OF POLYMERISATION					10+3
<p>Classification of Polymers, linear polymers, non-linear or branched polymers, cross – linked polymers, homo chain hetero chain, homopolymers co-polymers block polymers and graft polymers.</p> <p>Chemistry of polymerization: Types of polymerization – mechanism – chain, growth, coordination, ring opening, metathetical, group transfer, polyaddition and polycondensation polymerizations.</p>						
UNIT II	INDIVIDUAL POLYMERS					10+3
<p>Individual Polymers: Monomers required general methods of preparation, repeat units and uses of the following polymers and resins, polystyrene, polyacrylonitrile, polymethyl, methacrylate, Polytetra – fluoroethylene, polybutadienes and polychloroprene, polyesters, polycarbonates, polyimides, polyamides (Kevlar), polyurethanes, polyethylene, glycols, phenol – formaldehyde, urea – formaldehyde, melamine – formaldehyde and epoxy resins.</p>						
UNIT III	PROPERTIES OF POLYMERS					10+3
<p>Intrinsic properties – processing properties – basic idea of isomerism of polymers – configuration of polymer chain – geometrical structure – syndiotactic, isotactic and atactic polymers.</p> <p>Glass transition temperature: Definition – factors affecting glass transition temperature – relationships between glass transition temperature and (a) molecular weight, (b) melting point and (c) plasticizer – importance of glass transition temperature – heat distortion temperature.</p> <p>Molecular weight and size of polymers: Number average, weight average, sedimentation and viscosity average molecular weights – molecular weights and degree of polymerization – polydispersity – molecular weight distribution in polymers – size of polymer molecules – kinetics of polymerization.</p>						
UNIT IV	POLYMERISATION TECHNIQUES DEGRADATION AND USES OF POLYMERS					8+3
<p>Polymerisation Techniques: Bulk, solution, suspension, emulsion, melt condensation and interfacial polycondensation polymerizations, Degradation: Types of degradation – thermal, mechanical, ultrasonic and photodegradation – photo stabilizers – oxidative degradation – antioxidants – hydrolytic degradation. Uses of polymers in electronics and biomedicine.</p>						

UNIT V	POLYMER PROCESSING				7+3
Polymer processing: Plastics (thermo and thermosetting), elastomers, fibres,compounding, plasticizers, colorants, flame retardants. Compression and injection mouldings – film extrusion and calendaring – die casting and rotational casting – thermofoaming –reinforcing.					
LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL	
45	15	0	0	60	
TEXT BOOKS					
<ol style="list-style-type: none"> 1. Seymour, R.B. & Carraher, C.E. Polymer Chemistry: An Introduction, Inc. New York,(1981). 2. Odian, G. Principles of Polymerization, 4th Ed. Wiley,(2004). 3. Billmeyer, F.W. Textbook of Polymer Science, 2nd Ed. Wiley Interscience,(1971).. 4. Ghosh, P. Polymer Science & Technology, Tata McGraw-Hill Education,(1991). 5. Lenz, R.W. Organic Chemistry of Synthetic High Polymers, Interscience Publishers, New York, (1967). 					
REFERENCES					
<ol style="list-style-type: none"> 1. M.P.Stevens,<i>PolymerChemistry:AnIntroduction</i>,3rdEdition,OxfordUniversityPress, (1991). 2. H.R. Allcock, F.W. Lampe & J.E. Mark, <i>Contemporary Polymer Chemistry</i>, 3rd edition, (2003). 3. F.W. Billmeyer, <i>Textbook of Polymer Science</i>, 3rd ed. Wiley-Interscience,(1984). 4. J.R. Fried, <i>Polymer Science and Technology</i>, 2nd ed. Prentice-Hall(2003) 5. P. Munk & T.M. Aminabhavi, <i>Introduction to Macromolecular Science</i>, 2nd ed. John Wiley & Sons(2002). 6. L. H. Sperling, <i>Introduction to Physical Polymer Science</i>, 4th ed. John Wiley & Sons (2005). 7. M.P. Stevens, <i>Polymer Chemistry: An Introduction</i> 3rd ed. Oxford University Press,(2005). 8. Seymour/ Carraher’s Polymer Chemistry, 9th ed. by Charles E. Carraher, Jr.(2013). 					

COURSE CODE	XCY604	L	T	P	S	C
COURSE NAME	ORGANIC QUALITATIVE ANALYSIS PRACTICAL VI	0	0	4	0	2
PREREQUISITE	Nil	L	T	P	S	H
C:P:A	1: 0.8:0.2	0	0	4	0	4
COURSE OUTCOMES		DOMAIN			LEVEL	
CO1	<i>Identify</i> the various Metals in the present in the given organic mixture and analyses the respective groups.	Cognitive Psychomotor			Remember Perception	
CO2	<i>Estimate</i> the amount of acids using volumetric method the fundamentals of group separation and chemical reaction takes place in the confirmation test.	Cognitive Psychomotor			Understand Set	
CO3	<i>Estimate</i> the amount of bases using volumetric method and <i>Interpret</i> the results and differentiate the various groups and cations/ aniond present in the mixture.	Cognitive Psychomotor Affective			Appl y Set Receiving	
					3 hours each exp	
I. Organic Estimation						
1. Estimation ofphenol						
2. Estimation ofaniline						
3. Estimation ofglucose						
II. OrganicAnalysis						
Substances to be analysed:						
1. Aromatic acid (mono carboxylic acid)						
2. Aromatic ester (mono functionalgroup)						
3. Aromaticaldehyde						
4. Aromaticketone						
5. Phenol						
6. Carbohydrate (Glucoseonly)						
7. Aliphatic amide(urea)						
8. Aromaticamide						
9. Aromatic amine(Aniline)						
10. Aromatic nitrocompound						
HOURS		LECTURE	TUTORIAL	PRACTICAL	TOTAL	
		0	0	60	60	

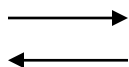
TEXT BOOKS

- 3 B.S.Furniss,A.J.Hannaford,V.Rogers,P.W.GSmithandA.R.Tatchell.,“Vogel’sTextbook of practical Organic Chemistry” , (ELBS), 5th edn.,2009.
- 4 J.Bassett,R.C.Denney,G.HJefferyandJ.Mendham,“Vogel’s textbookofQuantitative Inorganic Analysis (revised)”, (ELBS), 6th edn., 2007.

E Resources - MOOCs:

1. <http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques>
2. <http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011>
3. <http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques>

COURSE CODE	XCY605	L	T	P	S	C
COURSE NAME	PHYSICAL CHEMISTRY PRACTICAL VIA	0	0	4	0	2
PREREQUISITE	Nil	L	T	P	S	H
C:P:A	1: 0.8:0.2	0	0	4	0	4
COURSE OUTCOMES		DOMAIN			LEVEL	
CO1	Determine the molecular weight and critical solution temperature.	Cognitive Psychomotor			Remember Perception	
CO2	Estimate relative strength of acids and partial coefficient.	Cognitive Psychomotor			Understand Set	
CO3	Interpret the electrochemistry and thermochemistry titrations and examine the complexometric titration.	Cognitive Psychomotor Affective			Apply Set Receiving	
PHYSICAL CHEMISTRY PRACTICAL VIA					3 hours each exp	



1. Phasediagram:

- a. Simpleeutectic
- b. Compoundformation

2. Determination of molecular weight:

- a. Rast-macro method (using naphthalene assolvent)
- b. Transition temperature (using sodium thio sulphate penta hydrate as salthhydrate)

3. Critical solutiontemperature

- a. CST of phenol – watersystem
- b. Estimation of sodium chloride by studying the CST of phenol-watersystem

4. Kinetics

Determination of relative strength of acids by acid catalysed hydrolysis of ester

5. Partition co-efficient

- a. Study of equilibrium $KI + I_2 \rightleftharpoons KI_3$ by studying the partition co-efficient of iodine between water and carbon tetrachloride.
- b. Determination of association factor of benzoic acid in benzene

6. Electrochemistry

Conductometric titration between an acid and a base (HCl Vs NaOH)

- b. Potentiometric method – Potentiometric titration between 1. an acid and a base (HCl Vs NaOH) and 2. $KMnO_4$ Vs FAS

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VI. Complexometric Titrations

Estimation of Zn, Mg and Ca ions using EDTA and estimation of silver by argentometry.

LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
0	0	60	0	60
TEXT BOOKS				
1. Venkateswaran V, Veeraswamy R., Kulandaively A.R., Basic principles of practical chemistry, 2nd edition, New Delhi, sultan chand & sons, (1997).				
REFERENCE				
1. J.B. Yadav; "Advanced Practical Physical Chemistry" 6 th Edn., Goel Publications, Meerut, 1986.				