PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY
PMIST

PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
think • innovate • transform

Criterion1 –Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.3	Average percentage of courses having focus on employability / entrepreneurship / skill Development offered by the Chemistry

DEPARTMENT OF CHEMISTRY

SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP / SKILL DEVELOPMENT

1. List of courses for the programmes in order of

S. No.	Programme Name
i.	Master of Science(Chemistry) (Full Time)
ii.	Bachelor of Science (Chemistry) (Full Time)

2. Syllabus of the courses as per the list.

Legend :
Words highlighted with **Blue Color** - Entrepreneurship
Words highlighted with **Red Color** - Employability
Words highlighted with **Green Color** - Skill Development

1. List of Courses

Name of the Course	Course Code	Year of introduction	Activities with direct bearing on Employability/ Entrepreneurship/ Skill development
M.Sc. –FT			
Organic Chemistry I	YCY101	2022-23	Employability-Tutorials, Seminar and Assignments
Inorganic Chemistry I	YCY102	2022-23	Employability-Tutorials, Seminar and Assignments
Physical Chemistry I	YCY103	2022-23	Employability-Tutorials, Seminar and Assignments
Inorganic Chemistry Practical I	YCY104	2022-23	Employability-Tutorials, Seminar and Assignments
Physical Chemistry Practical I	YCY105	2022-23	Employability-Tutorials, Seminar and Assignments
Industrial Chemistry	YCYE02	2022-23	Entrepreneurship-Case study
Inorganic Chemistry II	YCY201	2022-23	Employability-Tutorials, Seminar and Assignments
Physical Chemistry II	YCY202	2022-23	Employability-Tutorials, Seminar and Assignments
Physical Methods in Chemistry-I	YCY203	2022-23	Employability-Tutorials, Seminar and Assignments
Inorganic Chemistry Practical II	YCY204	2022-23	Employability-Tutorials, Seminar and Assignments
Organic Chemistry Practical -I	YCY205	2022-23	Employability-Tutorials, Seminar and Assignments
Pharmaceutical Chemistry	YCYE03	2022-23	Entrepreneurship -Tutorials, Seminar and Assignments
Organic Chemistry II	YCY301	2018-19	Employability-Tutorials and Assignments
Physical Methods in Chemistry-I	YCY302	2018-19	Employability-Tutorials and Assignments
Organic Chemistry Practical -I	YCY303	2018-19	Employability-Tutorials and Assignments
Pharmaceutical Chemistry	YCYE03	2018-19	Entrepreneurship –Tutorials and Assignments
Analytical Chemistry	YEC305	2018-19	Employability-Tutorials and Assignments
Physical Methods in Chemistry-II	YCY401	2018-19	Employability-Tutorials and Assignments
Organic Chemistry Practical-II	YCY402	2018-19	Employability-Tutorials and Assignments
Industrial Chemistry	YCYE06	2018-19	Employability-Tutorials and Assignments
Chemistry of Nano science and nanotech.	YCYE08	2018-19	Employability-Tutorials and Assignments
Dissertation–Project work	YCY405	2018-19	Employability-Tutorials and Assignments

B.Sc. FT			
Tamil – I	XGL101	2022-23	Skill Development -Group discussion
English – I	XGE102	2022-23	Skill Development -Group discussion
General Chemistry I	XCY103	2022-23	Employability-Tutorials and Assignments
Inorganic Chemistry I	XCY104	2022-23	Employability-Tutorials and Assignments
Volumetric Analysis, Practical -I	XCY105	2022-23	Employability-Tutorials and Assignments
Algebra, Trigonometry and Transform	XMG106	2022-23	Employability-Tutorials and Assignments
Human Ethics ,Values, Rights and Gender Equality	XUM107	2022-23	Skill Development -Group discussion
Tamil – II	XGL201	2022-23	Skill Development -Group discussion
English – II	XGE202	2022-23	Skill Development -Group discussion
General Chemistry II	XCY203	2022-23	Employability-Tutorials and Assignments
Physical Chemistry I	XCY204	2022-23	Employability-Tutorials and Assignments
Volumetric Analysis Practical- II	XCY205	2022-23	Employability-Tutorials and Assignments
Calculus and Differential Equations	XMG206	2022-23	Employability-Tutorials and Assignments
Environmental Studies	XES208	2022-23	Skill Development -Group discussion
Water Quality Analysis	XCY301	2018-19	Entrepreneurship-Case study
Fundamental Physics	XPG302	2018-19	Employability-Tutorials and Assignments
Inorganic Chemistry II	XCY303	2018-19	Employability-Tutorials and Assignments
Organic Chemistry II	XCY304	2018-19	Employability-Tutorials and Assignments
Fundamental Physics Practical	XPG305	2018-19	Employability-Tutorials and Assignments
Disaster Management	XUM306	2018-19	Skill Development –Group discussion
Semi Micro Inorganic Qualitative Analysis Practical III	XCY307	2018-19	Employability-Tutorials and Assignments
Pharmaceutical Chemistry	XCY401	2018-19	Entrepreneurship-Case study
Modern Physics	XCY402	2018-19	Employability-Tutorials and Assignments
Physical ChemistryII	XCY403	2018-19	Employability-Tutorials and Assignments
Inorganic Chemistry III	XCY404	2018-19	Employability-Tutorials and Assignments
Modern Physics Practical	XPH405	2018-19	Employability-Tutorials and Assignments
Inorganic Quantitative Analysis Practical IV	XCY406	2018-19	Employability-Tutorials and Assignments

Clinical Chemistry	XCY501	2019-20	Entrepreneurship-Case study
Phyto Chemistry	XCY502A	2019-20	Employability-Tutorials and Assignments
Analytical Methods in Chemistry	XCY503A	2019-20	Employability-Tutorials and Assignments
Programming in C	XCY504B	2019-20	Employability-Tutorials and Assignments
Organic Qualitative Analysis Practical VA	XCY505	2019-20	Employability-Tutorials and Assignments
Physical Chemistry Practical VB	XCY506	2019-20	Employability-Tutorials and Assignments
Renewable Energy	XCY601	2019-20	Employability-Tutorials and Assignments
Industrial Chemistry	XCY602A	2019-20	Entrepreneurship-Case study
Polymer Chemistry	XCY603B	2019-20	Employability-Tutorials and Assignments
Organic Qualitative Analysis Practical VI	XCY604	2019-20	Employability-Tutorials and Assignments
Physical Chemistry Practical VIA	XCY605	2019-20	Employability-Tutorials and Assignments
Project	XCY606	2019-20	Employability-Tutorials and Assignments

.B.Sc. CHEMISTRY

SEMESTER – I

Course Code	XGT 101	L	T	P	C
Course Name	தமிழ் - I	3	0	0	3
Prerequisite		L	T	P	H
C:P:A	3:0:0	3	0	0	3

	COURSE OUTCOMES	DOMAIN	LEVEL
After the completion of the course, students will be able to			
CO1	Recognize (அடையாளம் காணுதல்) பல்வேறு அறிஞர் பெருமக்களின் தொண்டுகளை தமிழ்மொழி மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO2	Choose (தெரிவு செய்தல்) பன்முக பரிமாணங்களின் கவிதைகளை இலக்கியங்கள் மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO3	Describe (விளக்குதல்) தமிழ் மகளிரின் உரையாடல் சிறப்பு செய்திகளை உணர்தல்.	Cognitive	Understand
CO4	Apply (விளக்குதல்) பல்வேறு கலைத்துறைச் சார்ந்த பிரிவுகள், மண்ணின் பாடல்கள் குறித்து தெளிவு பெறல்.	Cognitive	Apply
CO5	Analyze (பகுத்தல்) சிறுகதைகளின் தோற்றம் மற்றும் வளர்ச்சி நிலை நாடகங்கள் - கவிதை குறித்து தெளிவு பெறுதல்.	Cognitive	Analyze

அலகு– I	தமிழ் அறிஞர்களும் தமிழ்த்தொண்டும்	9

பாரதியார், பாரதிதாசன், நாமக்கல் கவிஞர், சி.இலக்குவனார், உ.வே.சாமிநாத அய்யர், தெ.பொ.மீனாட்சிசுந்தரம், கவிமணி தேசிய விநாயகம் பிள்ளை தொடர்பான செய்திகள், சிறந்த தொடர்கள், சிறப்பு பெயர்கள்.

அலகு– 2	கவிதைகள் (மரபுக்கவிதை, புதுக்கவிதை)	9

மரபுக்கவிதை : முடியரசன், வாணிதாசன், சுரதா, கண்ணதாசன், உடுமலை நாராயண கவி, பட்டுக்கோட்டை கல்யாண சுந்தரம், மருதகாசி தொடர்பான செய்திகள்.

புதுக்கவிதை : ந.பிச்சமூர்த்தி, சி.சு.செல்லப்பா, மு.மேத்தா, ஈரோடு தமிழன்பன், அப்துல் ரகுமான், ஞானகூத்தன், ஆலந்தூர் மோகனரங்கன் தொடர்பான செய்திகள்.

அலகு– 3	உரையாடல்கள், தமிழ் மகளிரின் சிறப்பு	9

ஜி.யு.போப் மற்றும் வீரமா முனிவரின் தமிழ்பணி, பெரியார், அண்ணா, முத்துராமலிங்க தேவர், அம்பேத்கர், காமராசர், மா.பொ.சிவஞானம், காயிதேமில்லத் சமுதாயத் தொண்டு.

அன்னிபெசண்ட் அம்மையார், மூவாலூர் ராமாமிர்தம்மாள், டாக்டர் முத்துலட்சுமி ரெட்டி, வேலு நாச்சியார், வள்ளியம்மை, ராணி மங்கம்மாள்

அலகு– 4	நாட்டுப்புறப்பாடல்	9

தாலாட்டுப்பாடல், தொழில் பாடல், ஒப்பாரி பாடல்.

அலகு– 5	இலக்கிய வரலாறு	9
உரைநடை, சிறுகதை, நாடகம், கவிதைகள்.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
45	---	---	45

பாடநூல்கள்:

1. முனைவர் கா.செல்வகுமார் (தொ.ஆ), பொதுத்தமிழ், மார்ச்-2022, துரைகோ பதிப்பகம், அரும்பாக்கம், சென்னை – 106. 9884159972.
2. முனைவர். மு.அருணாசலம் (ப.ஆ) – தமிழ் இலக்கிய வரலாறு – 2012, அருண் பதிப்பகம், தரைத்தளம், பாலாஜி நகர், SBI காலனி, கண்டோன்மெண்ட், திருச்சி-1. 9894440530
3. சு.சக்திவேல் - நாட்டுப்புற இயல் ஆய்வு, மணிவாசகர் பதிப்பகம் - 12, மேலசன்னதி வீதி, சிதம்பரம்-1.
4. முனைவர் கோ.பெரியண்ணன் - அடிப்படை எளிய தமிழ் இலக்கணம் - 2003 – வனிதா பதிப்பகம், 11- நானா தெரு, பாண்டி பஜார், தி.நகர், சென்னை-17.

பார்வை நூல்கள்:

1. முனைவர் ந.லெனின், தாலாட்டுப்பாடல், பிப்ரவரி-2015, பிருந்தா பதிப்பகம், தஞ்சாவூர்-5.
2. கோ. வெங்கடாசலம் (தொ.ஆ)- 2005, தமிழ் இலக்கிய கைவிளக்கு, அன்னை சரஸ்வதி பதிப்பகம், குடியாத்தம்.
3. முனைவர் இராஜா வரதராஜா - பயன்முறைத் தமிழ் - ஜூன் 2015, சிவகுரு பதிப்பகம், 7/40, கிழக்கு செட்டித்தெரு, பரங்கிமலை, சென்னை-16

UG: B.A.,B.Sc.,B.Com., BBA.,	PO							PSO	
	1	2	3	4	5	6	7	1	2
CO1		1							
CO2		1							
CO3		1					1		
CO4	1	2	2	1		1	2		
CO5	2	2	2	2		1	2		
Total	3	7	4	3		2	5		
Scaled Value	1	1	1	1			1		

1 – 5 -> 1 6 – 10 -> 2 11 – 15 -> 3

3–Strong Correlation, 2–Medium Correlation, 1–Low Correlation, 0–No Correlation

COURSE CODE	XGE102	L	T	P	SS	H	C
COURSE NAME	English - I	3	0	0	0	3	3
C:P:A - 3:0:0							

COURSE OUTCOMES:		Domain	Level
CO1	***Recall*** the basic grammar and using it in proper context	Cognitive	Remembering
CO2	***Explain*** the process of listening and speaking	Cognitive	Understanding
CO3	***Adapt*** important methods of reading	Cognitive	Creating
CO4	***Demonstrate*** the basic writing skills	Cognitive	Understanding

SYLLABUS		HOURS
UNIT I	**Grammar**	
i. Major basic grammatical categories ii. Notion of correctness and attitude to error correction		9
UNIT II	**Listening and Speaking**	
iii. Importance of listening skills iv. Problems of listening to unfamiliar dialects v. Aspects of pronunciation and fluency in speaking vi. Intelligibility in speaking		9
UNIT III	**Basics of Reading**	
vii. Introduction to reading skills viii. Introducing different types of texts – narrative, descriptive, extrapolative		9
UNIT IV	**Basics of Writing**	
Introduction to writing skills x. Aspects of cohesion and coherence xi. Expanding a given sentence without affecting the structure xii. Reorganizing jumbled sentences into a coherent paragraph xiii. Drafting different types of letters (personal notes, notices, complaints, appreciation, conveying sympathies etc.)		9
	Total Hours	**36**

Text books

1. Acevedo and Gower M (1999) Reading and Writing Skills. London, Longman
2. Deuter, M et.al. (2015). Oxford Advanced Learner‟s Dictionary of English (Ninth Edition). New Delhi, OUP
3. Eastwood, John (2008). Oxford Practice Grammar. Oxford, OUP
4. Hadefield, Chris and J Hadefield (2008). Reading Games. London, Longman
5. 5.Hedge, T (2005). Writing. Oxford, OUP
6. Jolly, David (1984). Writing Tasks: Stuidents‟ Book. Cambridge, CUP
7. Klippel and Swan (1984). Keep Talking. Oxford, OUP
8. Saraswati, V (2005). Organized Writing 1. Hyderabad, Orient Blackswan
9. Swan, Michael. (1980). Practical English Usage. Oxford, OUP
10. Walter and Swan (1997). How English Works. Oxford, OUP

COURSE CODE	XCY103	L	T	P	SS	C
COURSE NAME	GENERAL CHEMISTRY I	3	1	0	0	4
C: P: A	3.2:0:0.8	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES:		Domain	Level
CO1	***Explain*** the classification and IUPAC nomenclature of Organic compounds.	Cognitive	Understand
CO2	***Recall*** the types of hybridization and ***describe*** geometry Of organic molecules and the influence of electroniceffects in bonding.	Cognitive	Remember Understand
CO3	***Interpret*** the type of chemical bonding, hybridization and geometry of inorganic molecules.	Cognitive Affective	Apply Receiving
CO4	***Recognize*** the periodic properties of elements and ***Describe*** various types of Quantum numbers.	Cognitive Affective	Remember Responding
CO5	***Identify*** and ***apply*** the various atomic models and concept Of Quantum chemistry to analyze the chemical molecules.	Cognitive	Remember Apply

UNIT - I CLASSIFICATION AND NOMENCLATURE **10+3**

Classification of organic compounds - based on the nature of carbon skeleton and functional groups - classification of C and H atoms of organic compounds (primary/secondary/tertiary) - IUPAC system of nomenclature of common organic compounds (upto C-10) - alkanes, alkenes, alkynes, cycloalkanes, bicycloalkanes with and without bridges and aromatic compounds - **Naming of organic compounds with one functional group - halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives, cyano compounds, amines, nitro compounds (Both aliphatic and aromatic) - Naming of compounds with two functional groups - naming of compounds with more than one carbon chain - Naming of heterocyclic compounds containing one and two hetero atoms present in five/six membered rings**

UNIT - II BONDING IN ORGANIC MOLECULES **6+3**

Hybridization and geometry - bond angle, bond length, bond strength of C-H and C-C bonds -Van der Waal‟s interactions, Inter & Intra molecular forces and their effects on physical properties - Electronic effects - inductive effect, resonance effect - drawing of resonance structures - conditions for resonance - stability of resonance structures, hyper conjugation, electromeric effect, steric effect - steric overcrowding - steric inhibition of resonance - steric relief (with examples). Dissociation of bonds - homolysis and heterolysis - radicals, carbocations, carbanions - electrophiles and nucleophiles - Influence of electronic effects - dipole moment - relative strengths of acids and bases - stability of olefins - stability of radicals, carbocations and carbanions.

UNIT – III CHEMICAL BONDING **9+3**

Ionic bond – Properties of ionic compounds, factors favoring the ionic compounds ionization potential – electron affinity – electronegativity – Lattice energy – Born-Haber Cycle – Pauling and Mulliken‟s scales of electronegativity – Polarizing power and Polarizability – Partial ionic character from electronegativity. Transition from ionic to covalent character and vice versa – Covalent character of ionic compounds – Fajan‟s rules – Covalent bond – structure and bonding of homo and heteronuclear molecules – Hydrogen bonding – Its nature, types, effect on properties – Intermolecular forces – London forces and van der Waals forces – ion dipole-dipole interactions VSEPR Theory – Principles and hybridization- Shapes of simple inorganic molecules (BeCl2, BF3, SiCl4, PCl5, SF6, IF7,H2O, NH3, XeF6) – MO Theory –Bonding and anti-bonding orbitals – Applications of MO theory H2, He, N2, O2, HF and CO molecules – Comparison of VB and MO Theories

UNIT –IV PERIODIC PROPERTIES **10+3**

Atomic orbitals - Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance - principles governing the occupancy of electrons in various quantum levels- Pauli‟s exclusion principle – Hund‟s rule- Aufbau Principle, (n+1) rule Stability of half-filled and completely filled orbitals- inert pair effect. Periodic properties – classification of elements as s, p, d and f-block elements – variation of atomic volume – atomic and ionic radii – ionization potential – electron affinity and electro negativity along period and groups – variation of metallic characters - Factors affecting the periodic properties. Periodic table anomalies and variations in atomic radius, ionic radius, electronic configuration, electron affinity and electro negativity, ionization energy and

metallic character of elements along the group and periods and their influences on stability, colour, coordination number, geometry, physical and chemical properties.

UNIT –V ATOMIC STRUCTURE **10+3**

Planck‟s quantum theory - Photoelectric effect, Compton effect, Bohr‟s model of hydrogen atom (no derivation), Wave particle duality, de Broglie equation, Heisenberg uncertainty principle - Eigen function and Eigen value - Postulates of Quantum mechanics - Schrodinger‟s time independent wave equation (no derivation), wave functions and its physical properties -Normalization and Orthogonal function.

LECTURE	TUTORIALS	PRACTICALS	SELF STUDY	TOTAL
45	15	0	0	60

TEXT BOOKS

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, (23rdedition), New Delhi, Shoban Lal Nagin Chand & Co., (1993).
4. Glasstone S., Lewis D.,Elements of Physical Chemistry, London, Mac Millan & Co.Ltd.
5. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, 22ndedn, S Chand & Company, 2016.

REFERENCES

Reference Books:

1. R. T. Morrison, R. N. Boyd and S.K.Bhattacharjee, Organic chemistry, 7thedn, Pearson Education
2. Asia, 2010. 2. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry, Part A and B, 5 thedn, pringer Publishers, 2008. .
3. I. L. Finar, Organic Chemistry Vol-1& 2, 6thedn, Pearson Education Asia, 2004.
4. P. Y.Bruice, Organic Chemistry, Vol-1 & 2, 7thedn, Pearson Education Asia, 2012.
5. J.Clayden, N. Greeves, S. Warren, Organic Chemistry, 2ndedn, Oxford, 2012.
6. R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint 2014.
7. P.L. Soni, Text book of Ionrganic Chemistry, 20thedn, Sultan chand& Sons, 2000.
8. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rdedn, New Delhi, ShobanLal Nagin Chand & Co., 1993.
9. Sp. Banerjee, Advanced Inorganic Chemistry 2ndedn,Vol-1, Arunabha Sen, Books and Allied (P)

E RESOURCES

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

COURSE CODE	XCY104	L	T	P	SS	C
COURSE NAME	INORGANIC CHEMISTRY I	3	1	0	0	4
C: P: A	2.8:0.4:0.8	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES:		Domain	Level
CO1	***Recall*** and ***explain*** the chemistry of d & f- block elements and its complexes	Cognitive Psychomotor	Remember Understand Set
CO2	***Summarize*** and ***report*** *the* nomenclature and theories of coordination compounds.	Cognitive Affective	Understand Responding
CO3	***Explain*** the extraction and purification process of various metals and Interpret their physical and chemical properties.	Cognitive Affective	Understand Apply Responding

CO4	***Describe*** the concept of acids and bases and the application of various concepts.	Cognitive Psychomotor	Analysis Perception
CO5	***Identify*** the various radioactive process and their consequences	Cognitive	Remember

UNIT - I d-BLOCK & f-BLOCK ELEMENTS	**10+3**

Chemistry of d-block elements –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 Important uses of transition metals and their alloys. oxides, mixed oxides, halides, and oxohalides of transition metals. General characteristics of f-block elements – comparative account of lanthanides and actinides – lanthanide series – separation by ion exchange and solvent extraction methods – lanthanide contraction – actinide series – separation of actinides – oxidation states and general properties

UNIT - II COORDINATION CHEMISTRY I	**6+3**

IUPAC nomenclature - theories of coordination compounds -Werner, Sidgwick, valence bond, Crystal Field theory. Crystal field splitting in octahedral, tetrahedral and square planar fields – factors influencing the magnitude of crystal field splitting – CFSE in weak and strong fields calculations; pairing energy. Jahn-Teller distortion. Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of dn ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment

UNIT – III METALLLURGY	**9+3**

Occurrence of metals –basic metallurgical operations and metallurgy process – General methods involved in extraction of metals- concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process. Extraction processes – Chemical reduction – electrolytic reduction – metal displacement – refining methods – distillation – fractional crystallization – electrolysis. Zone reining – van Arkel de Boer methods – electrolytic refining – ion exchange method – muffle furnace – chemical properties – important compounds and uses o Cr, Mn, Co, Ni and Zn.

UNIT –IV ACIDS AND BASES	**10+3**

Acid Base Chemistry: Theories of acids and bases – Arrhenius, Bronsted-Lowry theory proton donor - acceptor system, Usanovich concept, 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. Neutralization, solvolysis and redox reactions.**

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	SELFSTUDY	TOTAL
45	15	0	0	60

TEXT BOOKS

1. Lee J.D.,Concise Inorganic Chemistry, UK, Black well science (2006).

2. W. U. Malik, G. D. Tuli, and R. D. Madan: Selected Topic in Inorganic Chemistry, S. Chand & Company Ltd, New Delhi, 1998.

REFERENCES

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. P.L. Soni, Text book of Ionrganic Chemistry, 20thedn, Sultan chand& Sons, 2000
3. R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint 2014.

COURSE CODE	XCY105	L	T	P	SS	C
COURSE NAME	Volumetric Analysis Practical I	0	0	4	0	2
C:P:A	1: 0.8:0.2	L	T	P	SS	H
		0	0	4	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify*** the various Metals in the solution.	Cognitive Psychomotor	Remember Perception
CO2	***Estimate*** the amount of acids using volumetric method.	Cognitive Psychomotor	Understand Set
CO3	***Estimate*** the amount of bases using volumetric method.	Cognitive Psychomotor Affective	Apply Set Receiving

VOLUMETRIC ANALYSIS LAB-1 — **2 hours each exp**

1. Estimation of HCl by NaOH using a standard oxalic acid solution
2. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution
3. Estimation of oxalic acid by $KMnO_4$ using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by $KMnO_4$ using a standard Mohr‟s salt solution.
5. Estimation of Ca (II) by $KMnO_4$ using a standard oxalic acid solution.
6. Estimation of $KMnO_4$ by thio using a standard $K_2Cr_2O_7$ solution.
7. **Estimation of hydrogen peroxide**
8. **Estimation of Iodine**

HOURS	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
	0	30	0	0	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.

REFERENCES

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

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	XMG106	L	T	P	SS	C
COURSE NAME	ALGEBRA, TRIGONOMETRY AND TRANSFORM	4	1	0	0	5
PREREQUISITES	BASIC CONCEPTS OF MATRICES, DIFFERENTIATION AND INTEGRATION	L	T	P	SS	H
C:P:A	5:0:0	4	1	0	0	5

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Find*** the roots of the polynomials equations with real coefficients. ***Explain*** the transformation of equation and to ***solve*** the reciprocal equation using Newton‟s method.	Cognitive	Remembering Understanding Applying
CO2	***Find*** eigen values and eigen vectors of the matrices and ***Apply*** Cayley Hamilton theorem to find the inverse of a matrix.	Cognitive	Remembering Applying
CO3	***Expand*** the trigonometric functions, hyperbolic and inverse hyperbolic functions and to ***find*** the series of trigonometric functions.	Cognitive	Remembering Understanding
CO4	***Find*** the Laplace transforms and inverse Laplace transforms of standard functions and to ***find*** the Laplace transforms of tf(t), f(t)/t and derivatives.	Cognitive	Remembering
CO5	***Apply*** Laplace transforms to ***solve*** the differential equations of first and second order and to ***find*** Fourier series of a functions.	Cognitive	Remembering Applying

UNIT I - THEORY OF EQUATIONS	15
Polynomial Equations with real coefficients irrational roots, complex roots - symmetric function of roots – Transformation of equations by increasing or decreasing roots by a constant – Reciprocal Equations - Newton‟s method to find a root approximately.	
UNIT II - MATRICES	**15**
Eigen Values and eigen vectors, Cayley-Hamilton theorem (without proof) – Verification and computation of inverse.	
UNIT III - TRIGONOMETRY	**15**
Expansion in Series – Expansion of $\cos^n\theta$, $\sin^n\theta$, in a series of cosines and sines of multiples of θ – Expansions of cos nθ and sin nθ in powers of sines and cosines - Hyperbolic functions and inverse hyperbolic functions.	
UNIT IV - LAPLACE TRANSFORMS	**15**
Definition – Laplace Transform of Standard functions – Linearity property – First shifting theorem – Transform of tf(t), f(t) / t and derivatives – Inverse Laplace transforms of standard functions.	
UNIT V - APPLICATIONS OF LAPLACE TRANSFORMS AND FOURIER SERIES	**15**
Applications of Laplace transforms of differential equations of first and second order – Finding the Fourier series of functions.	

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	30	0	0	75

TEXT BOOKS

1. Kandasamy. P, Thilagavathi. K, Allied Mathematics, Volume I and II, S.Chand and Company Ltd, New Delhi, 2004.

COURSE CODE	XUM107	L	T	P	SS	C
COURSE NAME	HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY	1	0	0	2	1
C:P:A	2.7:0:0.3	L	T	P	SS	H
		1	0	0	2	3

COURSE OUTCOMES		Domain	Level
CO1	***Relate*** and ***Interpret*** the human ethics and human relationships	Cognitive	Remember, Understand
CO2	***Explain*** and ***Apply*** gender issues, equality and violence against women	Cognitive	Understand, Apply
CO3	***Classify*** and ***Develop*** the identify of women issues and challenges	Cognitive & Affective	Analyze Receive
CO4	***Classify*** and ***Dissect*** human rights and report on violations.	Cognitive	Understand, Analyze
CO5	***List*** and **respond** to family values, universal brotherhood, fight against corruption by common man and good governance.	Cognitive & Affective	Remember, Respond

UNIT I - HUMAN ETHICS AND VALUES	**7**
Human Ethics and values - Understanding of oneself and others- motives and needs- Social service, Social Justice, Dignity and worth, Harmony in human relationship: Family and Society, Integrity and Competence, Caring and Sharing, Honesty and Courage, WHO‟s holistic development - Valuing Time, Co-operation, Commitment, Sympathy and Empathy, Self- respect, Self-Confidence, character building and Personality.	
UNIT II - GENDER EQUALITY	**9**
Gender Equality - Gender Vs Sex, Concepts, definition, Gender equity, equality, and empowerment. Status of Women in India Social, Economical, Education, Health, Employment, HDI, GDI, GEM. Contributions of Dr.B.R. Ambethkar, Thanthai Periyar and Phule to Women Empowerment.	
UNIT III - WOMEN ISSUES AND CHALLENGES	**9**
Women Issues and Challenges- Female Infanticide, Female feticide, Violence against women, Domestic violence, Sexual Harassment, Trafficking, Access to education, Marriage. Remedial Measures – Acts related to women: Political Right, Property Rights, and Rights to Education, Medical Termination of Pregnancy Act, and Dowry Prohibition Act.	
UNIT IV - HUMAN RIGHTS	**9**
Human Rights Movement in India – The preamble to the Constitution of India, Human Rights and Duties, Universal Declaration of Human Rights (UDHR), Civil, Political, Economical, Social and Cultural Rights, Rights against torture, Discrimination and forced Labour, Rights and protection of children and elderly. National Human Rights Commission and other statutory Commissions, Creation of Human Rights Literacy and Awareness. - Intellectual Property Rights (IPR). National Policy on occupational safety, occupational health and working environment.	
UNIT V - GOOD GOVERNANCE AND ADDRESSING SOCIAL ISSUES	**11**
Good Governance - Democracy, People‟s Participation, Transparency in governance and audit, Corruption, Impact of corruption on society, whom to make corruption complaints, fight against corruption and related issues, Fairness in criminal justice administration, Government system of Redressal. Creation of People friendly environment and universal brotherhood.	

	LECTURE	SELF STUDY	TOTAL
	15	30	45

REFERENCES

1. Aftab A, (Ed.), Human Rights in India: Issues and Challenges, (New Delhi: Raj Publications, 2012).
2. Bajwa, G.S. and Bajwa, D.K. Human Rights in India: Implementation and Violations (New Delhi: D.K. Publications, 1996).
3. Chatrath, K. J. S., (ed.), Education for Human Rights and Democracy (Shimala: Indian Institute of Advanced Studies, 1998).
4. Jagadeesan. P. Marriage and Social legislations in Tamil Nadu, Chennai: Elachiapen Publications, 1990).
5. Kaushal, Rachna, Women and Human Rights in India (New Delhi: Kaveri Books, 2000)
6. Mani. V. S., Human Rights in India: An Overview (New Delhi: Institute for the World Congress on Human Rights, 1998).
7. Singh, B. P. Sehgal, (ed) Human Rights in India: Problems and Perspectives (New Delhi: Deep and Deep, 1999).
8. Veeramani, K. (ed) Periyar on Women Right, (Chennai: Emerald Publishers, 1996)
9. Veeramani, K. (ed) Periyar Feminism, (Periyar Maniammai University, Vallam, Thanjavur: 2010).
10. Planning Commission report on Occupational Health and Safety

E RESOURCES

1. http://planningcommission.nic.in/aboutus/committee/wrkgrp12/wg_occup_safety.p
2. Central Vigilance Commission (Gov. of India) website: http://cvc.nic.in/welcome.html.
3. Weblink of Transparency International: https://www.transparency.org/
4. Weblink Status report: https://www.hrw.org/world-report/2015/country-chapters/india

SEMESTER – II

COURSE CODE	XGT201	L	T	P	SS	H	C
COURSENAME	தமிழ்-II	2	1	0	0	3	3
C:P:A- 3:0:0							

COURSE OUTCOMES: இப்படிப்பை முடித்த பிறகு, கற்பவர்கள் மென்மேலும் விரிவான திறன்களைப் பெற்றிட முடியும்.		களம்	நிலை
CO1	அடையாளம் காணுதல் - பல்வேறு இலக்கணக் குறிப்புகள், கலைச்சொல்லாக்க உத்திகள் போன்றவற்றைச் தமிழ்மொழி மூலம் அறிந்து கொள்ளல்.	அறிதல்	அறிதல் நினைவு கூர்தல்
CO2	தெரிவு செய்தல் - வேர்ச்சொற்கள், ஒலி வேறுபாடறிந்து, பழந்தமிழ் இலக்கியங்கள் மூலம் அறிந்து கொள்ளல்.	புரிதல்	அறிதல் நினைவு கூர்தல்
CO3	விவரித்தல் - திருக்குறள் மூலம் அறச் செய்திகளை உணர்தல்.	உணர்தல்	அறிதல் நினைவு கூர்தல்
CO4	பயனாக்கம் - பல்வேறு அலுவல் சார்ந்த கடிதப் பிரிவுகள், குறித்துத் தெளிவு பெறல்.	பயனாக்கம்	ஆக்கம் ஆளுமை
CO5	விவரித்தல் - கலைகளின் தோற்றம் மற்றும் வளர்ச்சிநிலை சமுதாயப் பங்கு குறித்துத் தெளிவு பெறுதல்.	விவரித்தல்	அறிதல் நினைவு கூர்தல்

SYLLABUS		HOURS
அலகு-1	இலக்கணம்	6+3+0=9

பொருத்துதல்: பொருத்தமான பொருளைத் தேர்வு செய்தல், புகழ் பெற்ற நூல் மற்றும் நூலாசிரியர், தொடரால் குறிக்கப்பெறும் சான்றோர், அடைமொழியால் குறிக்கப்பெறும் நூல்கள்.
பிரித்து எழுதுக: எதிர்ச்சொல்லை எடுத்து எழுதுக, பொருந்தாச் சொல்லைக் கண்டறிதல், பிழைத் திருத்தம். சந்திப்பிழையை நீக்குதல், ஒருமை பன்மை பிழைகளை நீக்குதல், மரபுப் பிழைகள் - வழூஉச்சொல் - பிறமொழிச் சொற்களை நீக்குதல்.

அலகு-2	வேர்ச்சொல் அறிதல்	6+3+0=9

ஆங்கிலச் சொல்லுக்கு நேரான தமிழ்ச் சொல்லை அறிதல் - ஒலி வேறுபாடறிந்து சரியான பொருளை அறிதல், ஒரெழுத்து ஒருமொழிக்குரிய பொருளைக் கண்டறிதல் - வேர்ச்சொல் வினைமுற்று–வினையெச்சம் - தொழிற்பெயர், அகர வரிசைப்படுத்துதல்.

அலகு-3	இலக்கியம்	6+3+0=9

திருக்குறள் தொடர்பான செய்திகள் மேற்கோள்கள் தொடரை நிரப்புதல், அன்பு, பண்பு, கல்வி, கேள்வி, அறிவு, அடக்கம், ஒழுக்கம், பொறை, நட்பு, கேள்வி - வாய்மை, காலம், ஊக்கமுடைமை, இன்னா செய்யாமை.
அறநூல்கள்: நாலடியார், நான்மணிக்கடிகை, பழமொழி, திரிகடுகம், இன்னா நாற்பது பாடல்கள் தொடர்பான செய்திகள்

அலகு-4	பயன்பாட்டுத்தமிழ்	6+3+0=9

அலுவல்கள் கடிதம், ஆசிரியர் கடிதம், நூலாக்கப் பணி, மெய்ப்புத் திருத்தல், விளம்பரத் தமிழ்		
அலகு-5	**பல்வேறு கலைகளில் கல்விச் சிந்தனை**	**6+3+0=9**
மொழியியல் கல்வி, சமுதாயக் கல்வி, சேய்மைக் கல்வி, இக்காலக் கல்வி, கலை அறிவியல் எனவைற்றின் விளக்கங்கள்		
L=30 / T=15	**Total Hours**	**45**
Tutorial Activities 1) **தமிழ் இலக்கண ஆளுமை பயிற்சி** 2) **பிழையின்றி கடிதம் எழுதும் பயிற்சி** 3) **பல்வேறு போட்டித்தேர்வுக்கான பயிற்சி**		
பாட நூல்கள் 1. கா.பட்டாபிராமன், மொழிப் பயண்பாடு, நியூ செஞ்சுரி புக் ஹவுஸ் (பி) லிட்., 41,பி., சிட்கோ இண்டஸ்ட்ரியல் எஸ்டேட், அம்பத்தூர், சென்னை. 2. முனைவர் கா.செல்வகுமார், (தொ.) 2022. துரைகோ பதிப்பகம், அரும்பாக்கம், சென்னை - 106. 3. முனைவர் ந.லெனின், மார்ச் - 2016, முகில் தமிழ் இலக்கிய இலக்கண வினா-விடைகள். பிருந்தா பதிப்பகம், தஞ்சாவூர் - 5. 4. முனைவர் இராஜா வரதராஜா - பயன்முறைத் தமிழ் - ஜூன் 2015, சிவகுரு பதிப்பகம். 7/40, கிழக்குச் செட்டித்தெரு, பரங்கிமலை, சென்னை - 16 **பார்வை நூல்கள்:** 1. முனைவர் இராஜ.வரதராஜா - பயன்முறைத் தமிழ் 2. டாக்டர் வா.செ.குழந்தைசாமி - அறிவியல் தமிழ் - ஜூன் 2006 (ஏழாம் பதிப்பு) –பாரதி பதிப்பகம் - 126/108, உஸ்மான் சாலை, தி.நகர், சென்னை - 17. 3. முனைவர் கோ.பெரியண்ணன் - அடிப்படை எளிய தமிழ் இலக்கணம் - 2003 –வனிதா பதிப்பகம், 11- நானா தெரு, பாண்டி பஜார், தி.நகர், சென்னை - 17.		

COURSE CODE	XGE202	L	T	P	SS	H	C
COURSE NAME	ENGLISH II	3	0	0	0	3	3
C:P:A- 3:0:0							

COURSEOUTCOMES:		Domain	Level
CO1	***Explain*** the basic grammar and using it in proper context	Cognitive	Understand
CO2	***Categorize*** the process of listening and speaking	Cognitive	Analyze
CO3	***Examine*** the important methods of reading	Cognitive	Evaluate
CO4	***Compose*** the basic writing skills	Cognitive	Create

SYLLABUS		HOURS
UNIT-I	**Advanced Reading**	
i. Reading texts of different genres and of varying length ii. Different strategies of comprehension iii. Reading and interpreting non-linguistic texts iv. Reading and understanding in complete texts (Cloze of varying lengths and gaps; distorted texts.)		12
UNIT-II	**Advanced Writing**	
v. Analysing a topic for an essay or a report vi. Editing the drafts arrived at and preparing the final draft vii. Re-draft a piece of text with a different perspective (Manipulation exercise) viii. Summarize a piece of prose or poetry ix. Using phrases, idioms and punctuation appropriately		11
UNIT-III	**Principles of communication and communicative competence**	
x. Introduction to communication– principles and process xi. Types of communication–verbal and non-verbal xii. Identifying and overcoming problems of communication xiii. Communicative competence		11
UNIT-IV	**Cross Cultural Communication**	
xiv.Cross-cultural communication		11
	Total Hours	**45**

Textbooks

1) Bailey, Stephen(2003).Academic Writing. London and New York, Routledge.
2) Department of English, Delhi University (2006).Fluency in English Part II. New Delhi, OUP
3) Grellet,F (1981).Developing Reading Skills :A Practical Guide to Reading Skills. New York, CUP
4) Hedge,T.(2005). Writing. London, OUP
5) Kumar,S and Pushp Lata (2015).Communication Skills. New Delhi, OUP
6) Lazar,G.(2010).Literature and Language Teaching. Cambridge, CUP
7) Nuttall,C(1996).Teaching Reading Skills in a Foreign Language. London, Macmillan
8) Raman,Meenakshi and Sangeeta Sharma(2011).Technical Communication: Principles and Practice. New Delhi, OUP

COURSE CODE	XCY203	L	T	P	SS	C
COURSE NAME	GENERAL CHEMISTRY II	3	1	0	0	4
C:P:A	2.8:0.4:0.8	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Explain*** the preparation, properties and applications of Alkenes, alkynes and their derivatives.	Cognitive	Understand
CO2	***Describe*** the synthesis, reactions, stability and significance of alicyclic compounds.	Cognitive	Remember
CO3	***Explain*** the chemistry of s & p - block elements and their compounds	Cognitive Affective	Apply Receiving
CO4	***Describe*** the gas laws , physical properties of liquids and the classification of liquid crystals.	Cognitive	Remember Responding
CO5	***Apply*** law of mass action to the equilibria involving in various chemical reactions	Cognitive	Apply Remember

UNIT I – ALIPHATIC COMPOUNDS	**9+3**

Alkanes - preparations, physical properties, reactions, reactions with radical mechanism for substitution reaction - cracking - Alkenes: Preparation from alcohol, haloalkane, dihaloalkanes and alkynes - reactions of alkenes - mechanisms involved in addition of hydrogen, halogen, hydrogen halide, hypohalous acid, water, hydroboration, hydroxylation, ozonolysis and epoxidation - peroxide effect - allylic substitution, oxidation by KMnO4 and polymerization - **Application in the synthesis of following molecules - Dibenzyl (from toluene), cis and trans 2-butene, propanal and 1-methyl cyclohexanol. Akynes: preparation, reactions - addition of hydrogen, halogen, hydrogen halide, water, HCN, CH_3COOH, hydroboration - dimerisation and cyclisation - acidity of terminal alkynes**

UNIT II - ALICYCLIC COMPOUNDS	**9+3**

Cycloalkanes: Preparation (small, medium & large ring compounds) - reactions - cycloaddition, dehalogenation, pyrolysis of calcium salt of dicarboxylic acid - Wurtz reaction - stability of cycloalkanes - Baeyer‟s strain theory. Cycloalkenes: Preparation and reactions of cycloalkenes - Preparation of conjugate dienes - reactions - 1,2 and 1,4 addition, polymerization and Diels-Alder reaction - Application in the synthesis of following molecules - trans 2-chlorocyclopentanol, trans-2 methylcyclopentanol, cis and trans 1,2 cyclohexanediol, cyclohexene, 2,3-butanedione and adipic acid.

UNIT III – S & P BLOCK ELEMENTS	**10+3**

General characteristics of s – block elements – Compounds of s-block metals – oxides, peroxides, superoxide‟s-preparation and properties –Anomalous behavior of Li and Be- General characteristics of p – block elements General characteristics of boron family –Physical and chemical properties of Boron, uses – compounds of boron – Borax and Diborane,. General characteristics of carbon family, uses – Allotropic forms of carbon – Chemistry of charcoal. General characteristics of nitrogen – uses – Chemistry of some compounds of nitrogen – hydrazine and hydroxylamine. General characteristics of oxygen. – Structure and allotropy of elements, ozone. Types of oxides, peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides, neutral oxides. Oxoacids of nitrogen, phosphorus and sulphur.

UNIT I - GAS AND LIQUID STATE	**9+3**

Kinetic theory of gases - derivation of gas laws – Maxwell‟s distribution of molecular velocities - Types of molecular velocities - Expansivity and compressibility – collision diameter – collision frequency – mean free path. Behaviour of real gas – Vander Waals equation of state – Boyle temperature – Virial equation of state – critical constants of gas. Liquid state: Physical properties – vapour pressure – Trouton‟s rule – surface tension – Effect of temperature on surface tension – viscocity – effect of pressure and temperature – refraction – refractive index – specific and molar refraction. Liquid crystals: Vapour pressure temperature diagram – thermography – classification of thermotropic liquid crystals – nematic, smetic and cholesteric liquid crystals with examples

UNIT V - CHEMICAL EQUILIBRIUM					8+3
Reversible and irreversible reactions – statement of law of mass action – Derivation of law of mass action from kinetic theory – Relationship between Kp and Kc (derivation). Applications of Law of mass action to the equilibria involving the formation of NH_3, dissociation of $CaCO_3$ and the dehydration of $CuSO_4.5H_2O$. 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.**					
	LECTURE	**TUTORIAL**	**PRACTICAL**	**SELF STUDY**	**TOTAL**
HOURS	**45**	**15**	**0**	**0**	**60**

TEXT BOOKS

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. B.R.Puri, L.R.Sharma and M.S.Pathania, Principles of Physical Chemistry, 47th edition, Vishal Publishing Co, 2016.
4. B.R. Puri and L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co,1990

REFERENCES

1. I. L. Finar, Organic Chemistry Vol-1& 2, 6thedn, Pearson Education Asia, 2004
2. G.M.Barrow, Physical Chemistry, 6th edn, McGraw-Hill Inc., US, 1996.
3. R.D.Madan, “Advanced Inorganic Chemistry”

E RESOURCES

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-I/3
https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/
http://freevideolectures.com/Course/3001/Chemistry-I
http://freevideolectures.com/Course/2384/Freshman-Organic-Chemistry

COURSE CODE	XCY204	L	T	P	SS	C
COURSE NAME	PHYSICAL CHEMISTRY I	3	1	0	0	4
C:P:A	2.8:0.4:0.8	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Classify*** the different phase rule systems and ***explain*** the physical properties of solutions	Cognitive	Understand
CO2	***Apply the*** first law of thermodynamics and ***Identify*** type of thermodynamic process exists in a system.	Cognitive	Remember Apply
CO3	***Apply*** and ***Identify*** the different types of adsorption mechanisms.	Cognitive Affective	Remember Apply
CO4	***Describe*** the concepts of colloidal state and ***explain*** the types of Emulsions.	Cognitive	Remember Responding
CO5	***Identify*** the nature of electrochemical conductance and the type of electrolytes.	Cognitive Affective	Remember Receive

UNIT I PHASE RULE AND SOLUTION

Phase Rule: Concepts of phase, component and degrees of freedom, with examples. Gibb‟s phase rule – derivation. One-component system: Phase diagrams: Water and sulphur systems. Two component system: (i) Simple eutectic: Lead-silver system- Formation of compound with congruent melting point: Ferric chloride – water system. Ideal solutions: Ideal solutions and Raoult‟s law, deviations from Raoult‟s law – non-ideal solutions. Distillation of solutions. Azeotropes. Partial miscibility of liquids- Critical solution temperature; effect of impurity on partial miscibility of liquids - Principle of steam distillation. Nernst distribution law and its applications. Colligative properties- elevation of boiling point, depression in freezing point – Abnormal behavior of solutions of electrolytes.

UNIT II - FIRST LAW OF THERMODYNAMICS AND ITS APPLICATIONS **9+3**

Intensive and extensive variables; state and path functions; isolated, closed and open systems-Zeroth law of thermodynamics. First law of thermodynamics-mathematical form- Heat capacity, relation between CP and CV. Joule- Thomson effect-derivation of Joule- Thomson coefficient for ideal gases and real gases, inversion temperatures. Second law of thermodynamics –statements of Second law - Carnot theorem, Carnot cycle – Efficiency of heat engine. Concept of entropy –Gibbs free energy – Work function – Variation of free energy change with temperature and pressure. Criteria for spontaneity – Gibbs Helmholtz equation Third law of thermodynamics – Nernst heat theorem – statement of third law – Determination of absolute entropies of solids, liquids and gases.

UNIT III – CATALYSIS AND ADSORPTION **9+3**

Catalysis- characteristics- - different types-homogeneous-heterogeneous-acid-base catalysis auto catalysis-theories of catalysis-intermediate compound formation theory and adsorption theory- kinetics of enzyme catalysis – Michaelis Menton equation. – applications of catalysis Adsorption-definition- - physisorption and chemisorptions - factors influencing adsorption of gases on solids - Langmuir adsorption isotherm – BET theory - Applications of adsorption

UNIT IV - COLLOIDAL STATE **10+3**

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: Cottrel precipitator – Sewage disposals – detergent action of soaps – artificial rain – formation of delta – smoke screens.

UNIT V ELECTRICAL CONDUCTANCE AND TRANSFERENCE

Metallic and electrolytic conductors – specific, equivalent and molar conductance –variation of conductance with dilution for strong and weak electrolytes. Transport number and its determination by Hittorff and moving boundary method – effect of temperature and concentration- Kohlrausch‟s law and its applications – **Applications of conductivity measurements – degree of hydrolysis, solubility product and conductometric titrations. Theory of strong electrolytes – Debye Huckel-Onsager theory.**

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**45**	**15**	**0**	**0**	**60**

TEXT BOOKS

1. Puri B.R., Sharma L.R and Pathania M.S., Principles of Physical Chemistry, 47thed., Vishal Publishing Company, 2016
2. Sharma .K.K, Sharma.L.K. A Text book on physical Chemistry, 6thed., Sultan Chand, 2016.
3. Maron S.H.and Lando J.B. Fundamentals of Physical Chemistry, Macmillan.
4. Glasstone S. and Lewis. D., Elements of Physical Chemistry. Macmillan.

1.

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 RESOURCES

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 CODE	XCY205	L	T	P	C
COURSE NAME	Volumetric Analysis Practical-II	0	0	4	2
C:P:A	1: 0.8:0.2	L	T	P	H
		0	0	4	4

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.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	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.

REFERENCES

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

E RESOURCES

1. http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques
2. https://www.youtube.com/watch?
3. https://www.youtube.com/watch?

COURSE CODE	XMG206	L	T	P	C
COURSE NAME	CALCULUS AND DIFFERENTIAL EQUATIONS	4	1	0	5
PREREQUISITE	BASIC CONCEPTS OF MATRICES, NUMBERS, DIFFERENTIATION AND INTEGRATION	L	T	P	H
C:P:A	4:0:0	4	1	0	5

COURSE OUTCOMES	Domain	Level
After the completion of the course, students will be able to		
CO1: Compute radius of curvature, centre of curvature andcircle of curvature. Change the order of integration and to compute the double integral. Apply double to find the area between curves.	Cognitive	Understanding Applying
CO2. Use Beta and Gamma function computing the Multiple integrals and explain the relationbetween them.	Cognitive	Understanding Applying
CO3.Solve the linear homogeneous and non-homogeneous differential equation with constant and variable coefficients.	Cognitive	Applying
CO4: Define general, complete and particular solutions and tosolve standard forms of partial differential equations.	Cognitive	Understanding Applying
CO5: Compute gradient, divergence and curl of vectors. Apply theorem to evaluate line, surface andvolume integral.	Cognitive	Remembering Understanding Applying

UNIT I	**15**
Curvature – Radius of curvature – center of curvature – circle of curvature – Evaluation of double integrals - change of order of integration in double integrals- Application of double integral to find the area between curves.	
UNIT II	**15**
Evaluation of triple integrals – Beta and Gamma functions – relations between them – Evaluation of multiple integrals using Beta and Gamma functions.	
UNIT III	**15**
Solving second order linear differential equations with constant coefficients whose R.H.S is of the form ve^{mx}, where v is any function of x - Linear equations with variable coefficients.	
UNIT IV	**15**
Formation of partial differential equations by elimination of arbitrary constants and functions -Definitions of general, particular and complete solutions-solving standard forms f(p,q) = 0,f(x,p,q) = 0, f(y,p,q) = 0, f(z, p, q) = 0, f(x,p) = f(y,q), z = px +qy + f(p,q) - Lagrange‟s Differential equations Pp+Qq = R.	
UNIT V	**15**
Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl – Integration of vectors – line integral – surface integral – Green‟s theorem in the plane – Gauss divergence theorem – Stokes theorem – (Statements only).	

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	30	0	0	75

TEXT BOOKS
1. Kandasamy. P, Thilagavathi. K "Mathematics for B.Sc. Branch I", Volume II, III and IV, S.Chand and Company Ltd, New Delhi, 2004.
REFERENCE
1. Narayan .S and Manicavachagam Pillay T.K. "Ancillary Mathematics", Viswanathan Publishers and Printers, 2004.
E REFERENCES
www.nptel.ac.in 1. Advanced Engineering Mathematics Prof. Jitendra Kumar Department of Mathematics Indian Institute of Technology, Kharagpur

COURSE CODE	XES208	L	T	SS	P	C
COURSE NAME	ENVIRONMENTAL STUDIES	2	0	1	0	2
C:P:A	1.4: 0.3 : 0.3	L	T	SS	P	H
		2	0	1	0	3

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Describe*** the significance of natural resources and ***explain*** anthropogenic impacts.	Cognitive	Remember Understand
CO2	***Illustrate*** the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.	Cognitive	Understand
CO3	***Identify*** the facts, consequences, preventive measures of major pollutions and ***recognize*** the disaster phenomenon	Cognitive Affective	Remember Receive
CO4	***Explain*** the socio-economic, policy dynamics and ***practice*** the control measures of global issues for sustainable development.	Cognitive	Understand Apply
CO5	***Recognize*** the impact of population and the concept of various welfare programs, and ***apply*** the modern technology towards environmental protection.	Cognitive	Understand Analysis

UNIT - I INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY — **12**

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies – Water resources: Use and over-utilization of surface and ground water, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: renewable and non-renewable energy sources – Land resources: Land as a resource, land degradation, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT – II ECOSYSTEMS AND BIODIVERSITY — **7**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – **Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystem – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.**

UNIT – III ENVIRONMENTAL POLLUTION — **10**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.

UNIT –IV SOCIAL ISSUES AND THE ENVIRONMENT — **10**

Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT –V HUMAN POPULATION AND THE ENVIRONMENT — **6**

Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and human health.

Population growth, variation among nations – Population explosion – Family welfare programme

Environment and human health – Human rights – Value education - HIV / AIDS – Women and Child welfare programme– Role of Information Technology in Environment and human health – Case studies.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**30**	**0**	**0**	**15**	**45**

TEXT BOOKS

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.
1. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003
2. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.
3. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006.
4. Introduction to International disaster management, Butterworth Heinemann, 2006.
5. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.

REFERENCE BOOKS

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012.
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003.
5. Sundar, Disaster Management, Sarup & Sons, New Delhi, 2007.
6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006.

E RESOURCES

1. http://www.e-booksdirectory.com/details.php?ebook=10526
2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science
3. https://www.free-ebooks.net/ebook/What-is-Biodiversity
4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4
5. http://bookboon.com/en/pollution-prevention-and-control-ebook
6. http://www.e-booksdirectory.com/details.php?ebook=8557
7. http://www.e-booksdirectory.com/details.php?ebook=6804
8. http://bookboon.com/en/atmospheric-pollution-ebook
9. http://www.e-booksdirectory.com/details.php?ebook=3749
10. http://www.e-booksdirectory.com/details.php?ebook=2604
11. http://www.e-booksdirectory.com/details.php?ebook=2116
12. http://www.e-booksdirectory.com/details.php?ebook=1026
13. http://www.faadooengineers.com/threads/7894-Environmental-Science

SEMESTER III						
COURSE CODE	**XCY301**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME	**WATER QUALITY ANALYSIS**	**1**	**0**	**2**	**1**	**2**
C:P:A	**1:0.8:0.2**	**L**	**T**	**P**	**SS**	**H**
		1	**0**	**2**	**1**	**4**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Ensure*** the quantity and quality of water with respect to standards and their relation to public health.	Cognitive Psychomotor Affective	Understanding Manipulation Responding
CO2	***Identify*** the sources of water and ***illustrate*** the water transport and distribution	Cognitive	Understanding Applying
CO3	***Classify*** the cycles of decomposition of sewage and ***Examine*** the characteristics of sewage	Cognitive Psychomotor	Understanding Manipulation
CO4	***Describe*** the function and principles of various water and waste water treatment units.	Cognitive Affective	Understanding Responding
CO5	***Select*** the disposal methods for sewage and ***classify*** the different treatment methods for sludge.	Cognitive	Understanding

UNIT I - WATER TECHNOLOGY **6**

Hardness of Water: types and estimation of hardness (problems) - internal treatment, external treatment – demineralization process – desalination using reverse osmosis.

UNIT II - SOURCES AND TRANSMISSION OF WATER **6**

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.

UNIT III - WATER TREATMENT **6**

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.

UNIT IV - WASTE WATER TREATMENT **6**

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; Tricking filters and Rotating biological pond.

UNIT V - DISPOSAL OPTIONS **6**

Land disposal - sewage farming practice - dilution - discharge into rivers, - oxygen sag - self-purification - eutrophication. - sludge treatment - properties and characteristics of sludge - sludge digestion and drying beds.

Any five experiments decided by the course teacher

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.

Demonstration of Bacteriological analysis of water.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**SELF STUDY**	**TOTAL**
HOURS	**15**	**0**	**30**	**15**	**60**

TEXT BOOKS

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

REFERENCES

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. LinvilG.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	XPG302	L	T	P	SS	C
COURSE NAME	FUNDAMENTAL PHYSICS	3	1	0	0	4
C:P:A	3:0:0	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Recall*** and ***Explain*** the basic principle simple harmonic motion and circular motion.	Cognitive	Remember , Understand, Analyze
CO2	***Understand***the properties of sound, reverberation time and methods of production of ultrasonic waves.	Cognitive	Remember , Analyze
CO3	***Understand and determine***Young's modulus,rigidity modulus, viscosity and explain surface tension and excess pressure inside a drop.	Cognitive	Analyze , Understand, Application
CO4	***Recall***the basic concepts and basic laws of thermal physics and ***determine***the thermal conductivity of a bad conductor and solar constant.	Cognitive	Remember , Analyze, Application
CO5	***Acquire knowledge*** on interference, diffraction; be able to determine wavelength of mercury source; understand LASER action and production; propagation of fibre optics.	Cognitive	Understand, evaluation

UNIT I - Simple Harmonic Motion and Circular Motion	**9+3**
Time period - Amplitude - Phase - Spring mass system - Simple pendulum - Composition of two simple harmonic motions along a straight line and at right angles - Lissajous figures - Damping force - Damped harmonic oscillator - Uniform circular motion - Acceleration of a particle in a circle - Centripetal and centrifugal forces - Banking on curved tracks - Motion of a bicycle and a car around a circle.	
UNIT II - Sound Uniform circular motion	**9+3**
Classification of sound - Characteristics of musical sound - Loudness - Weber Fechner law - Decibel - Absorption co-efficient - Reverberation - Reverberation time - Ultrasonic waves - Properties - Production : Magnetostriction and Piezo-electric method and uses.	
UNIT III - Properties of Matter	**9+3**
Elasticity - Elastic constants - Bending of beams - Young's modulus by non-uniform bending - Torsion in a wire - Determination of rigidity modulus of torsional pendulum - Viscosity - Coefficient of viscosity by Poiseuelle's method - Stoke's law - Terminal velocity - Surface Tension - Molecular theory of surface tension - Excess pressure inside a drop and bubble - Surface tension by drop weight method.	
UNIT IV - Thermal Physics	**9+3**
Kinetic theory of gases - Basic postulates - Ideal gas equation - Vanderwaal's equation of states - Laws of thermodynamics - Entropy - Change of entropy in reversible and irreversible processes - Lee's disc method for conductivity of bad conductor - Stefan's law of radiation - Solar Constant - temperature of the sun.	

UNIT V – Optics **9 + 3**

Interference in thin films - Air wedge - Diffraction - Theory of plane transmission grating (normal incidence only) - LASER - Population inversion - Pumping - Laser action - Nd-YAG laser - CO_2 laser - Fibre optics - Principle and propagation of light in optic fibres - Numerical aperture and acceptance angle.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**45**	**15**	**0**	**0**	**60**

TEXT

1. Allied Physics I - A Sundaravelusamy - Priya Publications, 2009.
2. I B.Sc. Ancillary Physics - R. Murugesan, S. Chand & Co., 2010.

REFERENCES

1. Sound - Saigal - S. Chand & Co., Delhi.
2. Elements of properties of matter - Brijlal and Subramanian, S. Chand Limited, 1974.
3. Heat and Thermodynamics by Brijlal and Subramanian, S. Chand Limited.
4. Optics - Brijlal and Subramanian, S. Chand Limited.

COURSE CODE	**XCY303**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME	**INORGANIC CHEMISTRY II**	**3**	**1**	**0**	**0**	**4**
C:P:A	**3.2:0:0.8**	**L**	**T**	**P**	**SS**	**H**
		3	**1**	**0**	**0**	**4**

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

UNIT I - HALOGENS, CARBON AND NOBLE GAS COMPOUNDS **10+3**

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, XY_3, XY_5 and XY_7 types and their structure. Pseudohalogens and pseudohalides definition with exmples.

Inorganic Carbon Compounds: Types of **c**arbides - Covalent, ionic and interstitial carbides with suitable examples – oxides of carbon – oxy acids of carbon – carbonates – fullerenes.

Noble gas compounds: preparation and properties of xenon fluorides and oxyfluoride and kryptonfluoride.

UNIT II - PERACIDS AND PERSALTS **6+3**

Preparation, properties and structure of permonosulphuric acid, perdisulphuric acid and potassium perdisulphate. Preparation and properties of permonocarbonic acid, perdicarbonic acid and perdicarbonates.

UNIT III - TRANSITION ELEMENTS - GROUP STUDY **9+3**

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 dioxide, titanium tetrachloride, vanadium penta oxide-ammonium vanadate, ammonium molybdate, molybdenum blue, tungsten oxide, tungsten bronze, zirconium halide.

UNIT IV - LANTHANIDES AND ACTINIDES **10+3**

Position of lanthanides actinides in the periodic table – Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction – actinide contraction.

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.

Organometallic compounds of lanthanoides – optical properties – magnetic properties of lanthanides - Applications of lanthanides and actinides

UNIT V - ORGANO METALLIC COMPOUNDS **10+3**

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).

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**45**	**15**	**0**	**0**	**60**

TEXT BOOKS

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

REFERENCES

1. "Basic Inorganic Chemistry", F.A. Cotton and Wilkinosn
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	XCY304	L	T	P	SS	C
COURSE NAME	ORGANIC CHEMISTRY II	3	1	0	0	4
C:P:A	3.2:0:0.8	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Explain*** the principle of atomic structure and and its substitution reaction.	Cognitive	Understanding
CO2	***Describe*** the phenol, ethers and aryl halides reacrtions with some naming reactions.	Cognitive	Remember
CO3	***Identify*** the compounds of amines and diazonium salts.	Cognitive Affective	Apply Receiving
CO4	***Recognise*** the various structures of amino acids, peptides and proteins	Cognitive Affective	Understanding Responding
CO5	***Describe*** the general properties of carbohydrates.	Cognitive	Remember

UNIT I - AROMATIC COMPOUNDS **9+3**

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.

Directive influence of substituents: Orientation – Effect of substituents – activating and deactivating groups – Rules of disubstitution and trisubstitution in benzene – steric hinderance.

UNIT II - PHENOLS, ETHERS AND ARYL HALIDES **10+3**

(Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. ReimerTiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction. Ethers (aromatic): Cleavage of ethers with HI.

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: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. preparation and uses of DDT.

UNIT III - AMINES AND DIAZONIUM SALTS **9+3**

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 methyl salicylate.**

UNIT IV - AMINO ACIDS, PEPTIDES AND PROTEINS **9+3**

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 –NH2 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-phase synthesis.

UNIT V - CARBOHYDRATES **8+3**

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.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	15	0	0	60

TEXT BOOKS

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

REFERENCES

1. “Organic Chemistry – Volume I”, I.L.Finar
2. “Organic Chemistry – Volume II”, I.L.Finar
3. “Reaction Mechanism of Organic Compounds” – Jerry March
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 7th Ed.,
9.W. H. Freeman. Berg, J.M., Tymoczko, J.L.& Stryer, L. Biochemistry, W.H. Freeman, 2002.

COURSE CODE	XPG305	L	T	P	SS	C
COURSE NAME	FUNDAMENTAL PHYSICS PRACTICAL	0	0	4	0	2
C:P:A	0.4:1:0.6	L	T	P	SS	H
		0	0	4	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Recall*** the ***usage*** of laboratory instruments and ***measure*** the Young‟s modulus of Non – uniform pending	Cognitive Psychomotor	Understand Mechanism
CO2	***Explain*** and ***demonstrate*** the behavior of rigidity modulus of a wire	Psychomotor Affective	Set Valuing
CO3	***Manipulate*** and ***measure*** the thickness of a thin wire using Air wedge	Cognitive Psychomotor	Apply Mechanism
CO4	***Compare*** and ***explain*** the Calibration of voltmeter	Affective Psychomotor	Organization Set
CO5	***Describe*** the Band gap of the semiconductor	Psychomotor Affective	Perception Organization

FUNDAMENTAL PHYSICS PRACTICAL — **3 hours for each experiment**

1. Non-uniform Bending - Pin and Microscope Method.
2. Torsional pendulum - Determination of rigidity modulus of a wire
3. Co-efficient of viscosity of Liquid using graduated burette.
4. Spectrometer - Refractive index of solid prism (A, D and μ)
5. Post Office Box - Determination of Band gap of a semi-conductor.
6. Air wedge - determination of thickness of thin wire.
7. Potentiometer - Calibration of voltmeter
8. LASER grating - Determination of wavelength of LASER and size of the micro-particle.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	0	0	30	0	30

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCE BOOKS

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.

3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

COURSE CODE	XUM306	L	T	P	SS	C
COURSE NAME	DISASTER MANAGEMENT	3	0	0	0	3
C:P:A	3 : 0 : 0	L	T	P	SS	H
		3	0	0	0	3

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Understanding*** the concepts of application of types of disaster preparedness	Cognitive	Apply
CO2	***Infer*** the end conditions & ***Discuss*** the failures due to disaster.	Cognitive	Analyse
CO3	***understanding*** of importance of seismic waves occurring globally	Cognitive	Analyse
CO4	***Estimate*** Disaster and mitigation problems.	Cognitive	Apply
CO5	Keen ***knowledge*** on essentials of risk reduction	Cognitive	Apply

UNIT I - INTRODUCTION **9**

Introduction – Disaster preparedness – Goals and objectives of ISDR Programme- Risk identification – Risk sharing – Disaster and development: Development plans and disaster management–Alternative to dominant approach – disaster – development linkages - Principle of risk partnership.

UNIT II - APPLICATION OF TECHNOLOGY IN DISASTER RISK REDUCTION **9**

Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems – Intranets and extranets – video teleconferencing. Trigger mechanism – Remote sensing-an insight – contribution of remote sensing and GIS - Case study.

UNIT III - AWARENESS OF RISK REDUCTION **9**

Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness.

UNIT IV - DEVELOPMENT PLANNING ON DISASTER **9**

Implication of development planning – Financial arrangements – Areas of improvement – Disaster preparedness – Community based disaster management
– Emergency response.

UNIT V - SEISMICITY **9**

Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	0	0	0	45

TEXT BOOKS

1. Siddhartha Gautam and K Leelakrisha Rao, “Disaster Management Programmes and Policies”, Vista International Pub House, 2012

Arun Kumar, “Global Disaster Management”, SBS Publishers, 2008

REFERENCES

1. Encyclopaedia Of Disaster Management, Neha Publishers & Distributors, 2008
2. Pardeep Sahni, Madhavi malalgoda and ariyabandu, “Disaster risk reduction in south asia”, PHI, 2002
3. Amita sinvhal, “Understanding earthquake disasters” TMH, 2010.
4. Pardeep Sahni, Alka Dhameja and Uma medury, “Disaster mitigation: Experiences and reflections”, PHI, 2000

COURSE CODE	XCY307	L	T	P	SS	C
COURSE NAME	SEMI MICRO INORGANIC QUALITATIVE ANALYSIS – PRACTICAL-III	0	0	4	0	2
C:P:A	1.0: 0.8:0.2	L	T	P	SS	H
		0	0	4	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Ability to ***Identify*** the ions in a given Inorganic mixture	Cognitive Psychomotor	Remember Perception
CO2	***Analyse*** the individual cations and anions present in a given mixture and ***explain*** the characteristic properties of cations.	Cognitive Psychomotor Affective	Understand Analyse Perception Receive
CO3	***Use*** the principle behind the analysis of ions.	Cognitive	Apply

SEMI MICRO INORGANIC QUALITATIVE ANALYSIS PRACTICAL-III	3 hours for each experiment

Semi-micro qualitative analysis using H_2S 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^{2-}, $S_2O_3^{2-}$, NO_3^- , CH_3COO^- , Cl^- , B^{r-} , I^- , $NO3^-$,SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $C2O4^{2-}$, F^- (Spot tests should be carried out wherever feasible)

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	0	0	30	0	30

TEXT BOOKS

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, Semi micro Qualitative Analysis, New Delhi, Affiliated East-west Press Pvt. Ltd. (1969).

SEMESTER IV

COURSE CODE	XCY401	L	T	P	SS	C
COURSE NAME	PHARMACEUTICAL CHEMISTRY	1	0	2	1	2
C:P:A	0.6:0.8:0.6	L	T	P	SS	H
		1	0	2	1	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Explain*** the basic concepts and aims of pharmaceutical chemistry	Cognitive	Understanding
CO2	***Identify*** the role of drugs and its preparation.	Cognitive Affective	Apply Receiving Responding
CO3	***Describe*** the antibiotics role pharmaceuticals in our life.	Cognitive	
CO4	***Recognise*** fermentation Aerobic and anaerobic fermentation in daily process.	Cognitive Affective	Understanding
CO5	***Describe*** the important medicinal plant and its actions.	Cognitive	Remember Understanding

UNIT I - BASIC CONCEPTS OF PHARMACEUTICAL CHEMISTRY	6
Basic concepts and aims of pharmaceutical chemistry- Terms and Definitions -drug, pharmacophore, pharmacology, pharmacopoeia, chemotherapy – Biological activities and examples -bacteria, virus, and vaccine	
UNIT II - DRUGS	**6**

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, lbuprofen

Practical

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (Antacid).
3. Preparation of Acetanilide

UNIT III - PHARMACEUTICALS	**6**

Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT-Zidovudine). **Practical :** Preparation of nitro benzene.

UNIT IV - FERMENTATION	**6**

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Practical : Separation of Amino Acids

UNIT V - MEDICINAL PLANTS	**6**

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

	LECTURE	**TUTORIAL**	**PRACTICAL**	**SELF STUDY**	**TOTAL**
HOURS	**15**	**0**	**30**	**15**	**60**

TEXT BOOKS

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK.
2. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi.

REFERENCES

1. William O. Foye, Thomas L., Lemke , David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi.

COURSE CODE	XCY402	L	T	P	SS	C
COURSE NAME	MODERN PHYSICS	3	1	0	0	4
C:P:A	2.8:0.4:0.8	L	T	P	SS	H
PREREQUISITE:	Basic Physics at School level	3	1	0	0	4

COURSE OUTCOMES *On the successful completion of the course, students will be able to*		DOMAIN	LEVEL
CO1	***Define, explain*** Atom models ***and demonstrate*** Franck and Hertz method; ***discuss*** the phenomenon of Excitation and ionization potentials.	Cognitive Psychomotor	Remember Understand Mechanism
CO2	Acquire solid knowledge of crystal ***Analyze*** number of atoms, atomic radius coordination number in crystal structure and determine d spacing in cubic lattice ***using*** Miller indices.	Cognitive	Analyze Apply
CO3	***Understand*** elementary particle, ***explain*** radioactive decay and fission, fusion.	Cognitive Affective	Understand Receive
CO4	***Identify*** the basics of electric field, magnetic field, ***explain*** Ampere‟s circuital law and Faraday‟s law.	Cognitive	Remember
CO5	***Understand*** the fundamental phenomena in electronics and ***describe*** the working principle and application of IC‟s.	Cognitive Affective	Understand Receive

UNIT - I ATOMIC PHYSICS **7+ 3**

Atom models - Sommerfield and Vector atom models - Electron, spin quantum numbers - Pauli's exclusion principle - Excitation and ionization potentials - Experimental determination - Franck and Hertz method.

UNIT -II CRYSTAL PHYSICS **8 + 3**

Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in a cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for SC, BCC, FCC and HCP structures.

UNIT –III NUCLEAR PHYSICS **10 + 3**

Nucleus - Nuclear size - Charge - Nuclear energy - Mass defect - Binding energy - Radioactivity - Alpha, Beta, Gamma radiation - Law of radioactive decay - Decay constant - Half life - Mean life - Fission and Fusion - Elementary particles and their classifications.

UNIT –IV ELECTRICITY AND MAGNETISM **10 + 3**

Kirchoff's laws - Wheatstone network - Condition for bridge balance - potentiometer - internal resistance of a cell and thermo emf measurement - Magnetic field due to a current carrying conductor - Biot Savart's law - field along the axis of a coil - Force on a current carrying conductor in a magnetic field - Ampere's circuital law - Faraday's law - Maxwell equations in free space.

UNIT- IV ELECTRONICS **10+3**

Basic electronics - Junction diode - Voltage regulation - Zener diode - Junction transistor (PNP) - Digital electronics - AND, OR, NOT gates - NAND and NOR universal gates - Boolean algebra - De Morgan's theorem - verification - Elementary ideas of IC's.

TEXT BOOKS

1. Allied Physics I - A Sundaravelusamy, Priya Publications, 2009.
2. I B.Sc. Ancillary Physics - R Murugesan, S. Chand & Co., 2010.

REFERENCE BOOKS

1. Introduction to Solid State Physics - C Kittel - 8th edition, Wiley Eastern Ltd., 2005.
2. Electricity and Magnetism - Narayanamoorthy and Nagarathinam
3. Modern Physics by R Murugesan, S. Chand & Co., 2004
4. Digital principles and their applications - Malvino and Leach, Tata Mc Graw Hill, 2010.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	15	0	0	60

COURSE CODE	XCY403	L	T	P	SS	C
COURSE NAME	PHYSICAL CHEMISTRY II	3	1	0	0	4
C:P:A	3.6:0:0.4	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Explain*** the principle thermodynamics and its laws applications.	Cognitive	Understanding
CO2	***Apply*** the rate and its half life for the chemical reactions..	Cognitive Affective	Apply Receiving
CO3	***Describe*** the various concepts and laws of solutions.	Cognitive	Understanding
CO4	***Identify*** the various component system and its equilibrium.	Cognitive Affective	Understanding Receiving
CO5	***Describe*** the basic concepts in electro chemistry and ***application*** of conductance and for finding the emf of the cell**..**	Cognitive	Apply Remember

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.

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.

UNIT III - SOLUTIONS **8 +3**

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.

UNIT IV - IONIC EQUILIBRIUM AND PHASE EQUILIBRIUM **9+3**

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).

UNIT V - ELECTROCHEMISTRY AND CONDUCTANCE **9+3**

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).

LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL

HOURS	45	15	0	0	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

REFERENCES

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	XCY404	L	T	P	SS	C
COURSE NAME	INORGANIC CHEMISTRY III	3	1	0	0	4
C:P:A	3.6:0:0.4	L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify*** the stability of complexes and its isomerism.	Cognitive	Understanding
CO2	***Describe*** the various bonding and theories of metal and ligands.	Cognitive Affective	Understanding Receiving
CO3	***Apply*** the concept of stability in metal carbonyls and understand the principle of complexometric titrations.	Cognitive Affective	Apply Receiving
CO4	***Identify*** the role of alkali, alkaline earth and transition metals in bio inorganic chemistry.	Cognitive Affective	Understanding
CO5	***Describe*** the properties and applications of silicones and zeolites.	Cognitive	Apply Remember

UNIT I - CO-ORDINATION CHEMISTRY **9+3**

Ligands, classification of ligands, IUPAC nomenclature of coordination compounds, Co-ordination number, Sedgwick‟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. Postulates- sp^3, dsp^2 & sp^3d^2 hybridisation with example and limitation.

UNIT II - THEORIES OF METAL – LIGAND BONDING IN COMPLEXES **10+3**

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, 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.

UNIT III - METAL CARBONYLS, COMPLEXOMETRIC TITRATIONS AND CLUSTER COMPOUNDS	8+3

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.

UNIT IV - BIO – INORGANIC CHEMISTRY	9+3

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.

UNIT V - SILICONES (POLYSILOXANES) AND SILICATES	9+3

Types of silicones – structure of silicones – versatile properties of silicones. Preparation and properties of dimethyl, methylphenyl and diphenyl siliconesanes. Applications of silicones – desired properties – sealants and adhesives – rubber – paints and coatings – health care – Automotive – aerospace – household – defoaming drycleaning electronics lubricants personalcare – construction.
Zeolites – types of zeolites - uses like ion- exchangers water softeners, molecular sieves dehydrating agents, adsorbents and catalysts**.**

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**45**	**15**	**0**	**0**	**60**

TEXT BOOKS

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

REFERENCES

1. “Basic Inorganic Chemistry”, F.A. Cotton and Wilkinosn
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 CODE	XPH405	L	T	P	SS	C
COURSE NAME	MODERN PHYSICS PRACTICAL	0	0	4	0	2
C:P:A	0.4:1:0.6	L	T	P	SS	H
		0	0	4	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Recall*** the usage of laboratory instruments and ***measure*** the young‟s modules of uniform bending.	Cognitive Psychomotor	Understand Mechanism
CO2	***Explain*** and ***demonstrate*** the thermal conductivity of bad conductor.	Psychomotor Affective	Set Valuing
CO3	***Manipulate*** and ***measure*** resistance and specific resistance of a wire.	Cognitive Psychomotor	Apply Mechanism
CO4	***Compare*** and ***explain*** the calibration of ammeter.	Affective Psychomotor	Organization Set
CO5	***Describe*** the characteristics of the semi conductor diode.	Psychomotor Affective	Perception Organization

MODERN PHYSICS PRACTICAL	3 hours each experiment

1. Uniform Bending - Pin and Microscope Method.
2. Lee's Disc - Thermal Conductivity of Bad Conductor.

3. Spectrometer - Grating- Normal incidence method.
4. Spectrometer - id curve.
5. AND, OR and NOT logic gates - verification of truth table.
6. Potentiometer - Calibration of ammeter.
7. Semiconductor Diode - Forward and Reverse bias characteristics.
8. Metre Bridge - Determination of resistance and specific resistance of a wire.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**0**	**0**	**30**	**0**	**30**

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCE BOOKS

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

COURSE CODE	**XCY406**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME	**INORGANIC QUANTITATIVE ANALYSIS PRACTICAL IV**	**0**	**0**	**4**	**0**	**2**
C:P:A	**1.0: 0.8:0.2**	**L**	**T**	**P**	**SS**	**H**
		0	**0**	**4**	**0**	**4**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	Ability to ***Identify*** the various inorganic complexes	Cognitive Psychomotor	Remember Perception
CO2	***Analyse*** the quantity of individual metal present in a given mixture and ***explain*** the characteristic properties of the complexes.	Cognitive Psychomotor Affective	Understand Analyse Perception Receive
CO3	***Use*** the principle behind the gravimetric analysis.	Cognitive	Apply
Inorganic Quantitative Analysis Practical IV			**2 hours each expt**

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate.
3. Estimation of Nickel as Nickel - DMG complex.
4. Estimation of Copper as copper (I) thiocyanate
5. Estimation of Magnesium as magnesium oxinate
6. Estimation Calcium as calcium oxalate monohydrate
7. Estimation of Barium as barium sulphate.
8. Estimation of Iron as Iron (III) oxide.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**0**	**0**	**30**	**0**	**30**

TEXT BOOKS

Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997).

SEMESTER V							
COURSE CODE	**XCY501**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME	**CLINICAL CHEMISTRY**	**1**	**0**	**2**	**1**	**2**
C:P:A		**L**	**T**	**P**	**SS**	**H**
		1	**0**	**2**	**1**	**4**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Identify*** the mechanism of different types of metabolism.	Cognitive	Remember
CO2	***Explain*** the important concepts of various techniques used in clinical chemistry.	Cognitive	Understand
CO3	***Analyse*** the various molecular entities known as vitamins and nutrition values.	Cognitive	Analyze
CO4	***Interpret*** the methods of testing of various organs of body and the diagnostic roles of related enzymes.	Cognitive	Understand
CO5	***Illustrate*** the various methods for cardiac profile, glucose and cholesterol estimation.	Cognitive	Analyze

UNIT I - METABOLISM	**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	**30 hrs**
1. Estimation of glucose using Fehling‟s solution 2. Estimation of cholesterol using ferric chloride 3. Estimation of ferric ion by colorimetric method 4. Iodometric determination of vitamin C 5. Estimation of carbohydrate in mixture by qualitative method.	

	LECTURE	**TUTORIAL**	**SELF STUDY**	**PRACTICAL**	**TOTAL**
HOURS	**15**	**0**	**15**	**30**	**60**

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
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

REFERENCES

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.

COURSE CODE	XCY502A	L	T	P	SS	C
COURSE NAME	PHYTO CHEMISTRY	3	1	0	0	4
C:P:A		L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		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

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, theophilline, 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 stigmosterol 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.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	15	0	0	60

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.

REFERENCES

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. Macm illan India Ltd. New Delhi, 1972.
5. Gupta, P.K. Elements of Biotechnology, Rastogi , Meerut,1972.

E RESOURCES

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

COURSE CODE	XCY502B	L	T	P	SS	C
COURSE NAME	FORENSIC SCIENCE	3	1	0	0	4
C:P:A		L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify*** the methods of analyzing trace amounts of petroleum products in crime scene evidence.	Cognitive	Remember
CO2	***Explain*** the method of searching, collecting, preserving and analyzing arson evidence	Cognitive	Understand
CO3	***Analyse*** the various types of explosives, including the synthesis and characterization of representative analogs and the techniques of locating hidden explosives.	Cognitive	Analyze
CO4	***Interpret*** the importance of chromatographic and spectroscopic techniques in processing crime scene evidence.	Cognitive	Understand
CO5	***Illustrate*** the significance of microscopy in visualizing trace evidence and comparing it with control samples.	Cognitive	Analyze

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 activation analysis – fundamental principles and forensic applications.

UNIT V - MICROSCOPY **5+3**

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

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	0	15	0	60

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)

REFERENCES

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

1. https://www.mooc-list.com/course/introduction-forensic-science-futurelearn
2. https://www.mooc-list.com/course/forensic-engineering-learning-failures-edx

COURSE CODE	XCY503A	L	T	P	SS	C
COURSE NAME	ANALYTICAL METHODS IN CHEMISTRY	3	1	0	0	4
C:P:A		L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		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 electro analytical 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

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 electro analytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used

for the determination of pKa 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.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	15	0	0	60

TEXT BOOKS

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of Quantitative Chemical Analysis*, John Wiley & Sons, 1989.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, G.D; *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. *Exploring Chemical Analysis*, Ed. New York, W.H. Freeman, 2001.

REFERENCES

1. Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age, International Publisher, 2009.
2. Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
3. Mikes, O. *Laboratory Hand Book of Chromatographic & Allied Methods*, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.

E RESOURCES

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	XCY503B	L	T	P	C
COURSE NAME	AGRICULTURAL CHEMISTRY	3	1	0	4
C:P:A	Nil	L	T	P	H
		3	1	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify*** the chemical composition and soils of the earth"s crust.	Cognitive	Remember
CO2	***Explain*** the concept of soil fertility, soil productivity and application of various types of fertilizers	Cognitive	Understand
CO3	***Analyse*** the various types of radioisotopes in soil and plants.	Cognitive	Analyze
CO4	***Interpret*** the importance of remote sensing and GIS techniques in agriculture.	Cognitive	Understand
CO5	***Illustrate*** the significance of Analysis of soil extracts, nutrients, plants extracts and irrigation waters and interpretation of results.	Cognitive	Analyze

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.

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.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	**45**	**0**	**15**	**60**

TEXT BOOKS

1. Agricultural Chemistry V.V Publications.
2. Soil anlaysis. 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.

REFERENCES

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

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

COURSE CODE	XCY504A	L	T	P	SS	C
COURSE NAME	COMPUTER APPLICATIONS IN CHEMISTRY	3	1	0	0	4
C:P:A		L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		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

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.	

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	15	0	0	60

TEXT BOOKS

1. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.
2. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge Univ. Press (2001) 487 pages.
3. Noggle, J. H. Physical chemistry on a Microcomputer. Little Brown & Co. (1985).
4. Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing, House: Delhi (1996).

COURSE CODE	XCY504B	L	T	P	SS	C
COURSE NAME	PROGRAMMING IN C	3	1	0	0	4
C:P:A		L	T	P	SS	H
		3	1	0	0	4

COURSE OUTCOMES		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

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 Program using structures and pointers –Self referential structures –Dynamic memory allocation-Singly linked list.

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.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	15	0	0	60

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

REFERENCES

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

COURSE CODE	XCY505	L	T	P	SS	C
COURSE NAME	ORGANIC QUALITATIVE ANALYSIS PRACTICAL VA	0	0	4	0	2
C:P:A		L	T	P	SS	H
		0	0	4	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify*** the monofunctional groups in various types of organic compound.	Cognitive Psychomotor	Remember Perception
CO2	***Estimate*** the extra elements in a combination of of two or more organic compounds.	Cognitive Psychomotor	Understand Set
CO3	***Estimate*** 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

Organic qualitative analysis practical VA — **60 hours**

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

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	0	0	60	0	60

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.

Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

COURSE CODE	XCY506	L	T	P	SS	C
COURSE NAME	PHYSICAL CHEMISTRY PRACTICAL VB	0	0	4	0	2
C:P:A		L	T	P	SS	H
		0	0	4	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify*** the surface tension of liquid or a detergent solution.	Cognitive Psychomotor	Remember Perception
CO2	***Estimate*** the viscosity of liquid and its variation with respect to concentration of a solute.	Cognitive Psychomotor	Understand Set
CO3	***Estimate*** the kinetics of different reactions using Initial rate method and Integrated rate method.	Cognitive Psychomotor Affective	Apply Set Receiving

Physical chemistry practical VB — **60 hours**

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 H2SO4 by studying kinetics of hydrolysis of methyl Acetate.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	0	0	60	0	60

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.
Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

SEMESTER VI		L	T	P	SS	C
COURSE CODE	**XCY601**	**1**	**0**	**2**	**1**	**2**
COURSE NAME	**RENEWABLE ENERGY**	**L**	**T**	**P**	**SS**	**H**
C: P: A	**1.4:0:0.6**	**1**	**0**	**2**	**1**	**4**

COURSE OUTCOMES		**Domain**	**Level**
CO1	***Describe*** the reserves of renewable energy and demand of energy needs. methodologies / technologies for effective utilization of renewable energy sources.	Cognitive	Remember
CO2	***Explain*** the methodology to harness solar energy and its applications.	Cognitive Affective	Understand Apply Receive
CO3	***Examine*** the potential of wind energy and its techniques.	Cognitive Affective	Understand Receive
CO4	***Recognize*** the significance of bio energy generation **.**	Cognitive Affective	Apply Respond
CO5	***Interpret*** 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., New Delhi, (1997).
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University 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 and Applications", 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

URSE OUTCOMES		DOMAIN	LEVEL
CO1	***Describe*** the utilization of the raw materials in chemical industry.	Cognitive	Remember
CO2	***Explain*** the manufacturing process of cement, ceramics, glass and fertilizers.	Cognitive	Understand
CO3	***Recognize*** the technologies used in small scale chemical industries.	Cognitive	Understand
CO4	***Interpret*** the various toxic chemicals used in agro industries and synthesis of sugar	Cognitive Affective	Remember Receive
CO5	***Examine*** 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	PRACTICAL	SELF STUDY	TOTAL

45	15	0	0	60

TEXT BOOKS

1. B.K Sharma – Industrial chemistry – Goel publishing house.
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 Publishing House, Bombay, 4th 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., Meerut 1994,
6. A.K. Mukherjee, Environmental Pollution and Health Hazards – Causes and Control Galgotia Press, New Delhi 1986.

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		DOMAIN	LEVEL
CO1	***Explain*** the basic concept of Structure of matter and their various properties.	Cognitive	Understand
CO2	***Recall*** the laws and rules in the diffusion and phase behavior of materials.	Cognitive	Remember Apply
CO3	***Recognize*** the significance of mechanical and electrical properties of materials.	Cognitive	Remember Understand
CO4	***Describe*** the importance of magnetic, optical and thermal properties of materials.	Cognitive Affective	Understand Receive
CO5	***Interpret*** the various techniques used in the characterization of materials.	Cognitive Affective	Remember Apply Respond

UNIT I - STRUCTURE OF MATTER — **9+3**

Atomic structure: Electronic configurations; ionic, covalent, metallic, and secondary bond. Space lattices and crystallographic systems; influence of radius ratio on coronation, structure of crystalline materials (metallic, semi conducting, ionic, and ceramic materials) and non-crystalline materials (amorphous, glasses, polymers materials)

Defects and dislocations: Point, line, and surface defects ; Edge, and screw dislocations ; Burger‟s vector ; Grain and twin boundaries. Brief on experimental techniques, such as X-ray diffraction, SEM, TEM, etc., for determining crystalline structures and their defects.

UNIT II - BEHAVIOUR OF MATERIALS — **9+3**

Diffusion Behaviour

Mechanism of diffusion Fick‟s laws, solution to Fick‟s second law; surface and grain boundary diffusion; experimental determination of diffusion coefficient.

Phase behavior

Solid Solutions: Intermediate phases and intermetallic compounds, phase rule, binary phase diagrams like Cu-Ni, Pb-Sn, Cu-Zn and Fe-C, transformation in steels. Nucleation and growth phenomena, solidification including directional solidification, crystal growth, zone melting and purification.

UNIT III - MECHNICAL AND ELECTRICAL PROPERTIES OF MATERIALS — **9+3**

Mechanical properties

Ductility, brittleness; Work hardening: Tempering, and Annealing ; Fracture toughness ; Stiffness: Elastic, anelastic and viscoelastic behaviours of materials ; Failure of materials due to creep, and fatigues, deformation of behaviours of polymers, and ceramics

Electrical Properties

Types of Electrical / Electronic behaviours of materials viz., Insulators, Semi-conductors, and Conductors ; 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: dia, para, ferro and ferri magnetisms, soft and hard magnetic materials ; magnetic storage materials

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 Electro-plating and Electroless plating methods.

Materials characterization techniques

Materials characterization techniques such as XRD, ESC A, XPS, AES, FTIR and Laser Raman spectroscopy. Microscopictechniques – SEM, AFM and TEM. Thermal analysis – TG/DTA and DSC.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**SELF STUDY**	**TOTAL**
HOURS	**45**	**15**	**0**	**0**	**60**

TEXT BOOKS

1. Shriver, D. F, and Atkins, P. W, Inorganic Chemistry, Oxford University Press
2. Ashcroft, N. W, and Mermin, N. D, Solid State Physics, Harcourt College Publishers
3. Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons

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.

EFERENCES

1. WWW. NPTEL .ac.in

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		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**

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.
Chemistry of polymerization: Types of polymerization – mechanism – chain, growth, co-ordination, ring opening, metathetical, group transfer, polyaddition and polycondensation polymerizations.

UNIT II - INDIVIDUAL POLYMERS **10+3**

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.

UNIT III - PROPERTIES OF POLYMERS **10+3**

Intrinsic properties – processing properties – basic idea of isomerism of polymers – configuration of polymer chain – geometrical structure – syndiotatic, isotatic and atatic polymers.
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.
Molecular weight and size of polymers: Number average, weight average, sedimentation and viscosity average molecular weights – molecular weights and degree of polymerization – poly dispersity – molecular weight distribution in polymers – size of polymer molecules – kinetics of polymerization.

UNIT IV - POLYMERISATION TECHNIQUES DEGRADATION AND USES OF POLYMERS **8+3**

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.

UNIT V - POLYMER PROCESSING **7+3**

Polymer processing: Plastics (thermo and thermosetting), elastomers, fibres, compounding, plasticizers, colorants, flame retardants. Compression and injection moudlings – film extrusion and calendaring – die casting and rotational casting – thermofoaming – reinforcing.

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	45	15	0	0	60

TEXT BOOKS

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

1. M.P. Stevens, *Polymer Chemistry: An Introduction*, 3rd Edition, Oxford University Press, (1991).
2. H.R. Allcock, F.W. Lampe & J.E. Mark, *Contemporary Polymer Chemistry*, 3rd edition, (2003).
3. F.W. Billmeyer, *Textbook of Polymer Science*, 3rd ed. Wiley-Interscience, (1984).
4. J.R. Fried, *Polymer Science and Technology*, 2nd ed. Prentice-Hall (2003)
5. P. Munk & T.M. Aminabhavi, *Introduction to Macromolecular Science*, 2nd ed. John Wiley & Sons (2002).
6. L. H. Sperling, *Introduction to Physical Polymer Science*, 4th ed. John Wiley & Sons (2005).
7. M.P. Stevens, *Polymer Chemistry: An Introduction* 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**	**SS**	**C**
COURSE NAME	**ORGANIC QUALITATIVE ANALYSIS PRACTICAL VI**	0	0	4	0	**2**
C:P:A	**1: 0.8:0.2**	**L**	**T**	**P**	**SS**	**H**
		0	0	4	0	4

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Identify*** the various Metals in the present in the given organic mixture and analyses the respective groups.	Cognitive Psychomotor	Remember Perception
CO2	***Estimate*** 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	***Estimate*** the amount of bases using volumetric method and ***Interpret*** the results and differentiate the various groups and cations/ aniond present in the mixture.	Cognitive Psychomotor Affective	Apply Set Receiving

Organic qualitative analysis practical VI	3 hours each exp

I. Organic Estimation

1. Estimation of phenol
2. Estimation of aniline
3. Estimation of glucose

II. Organic Analysis

Substances to be analysed:

1. Aromatic acid (mono carboxylic acid)
2. Aromatic ester (mono functional group)
3. Aromatic aldehyde
4. Aromatic ketone
5. Phenol
6. Carbohydrate (Glucose only)
7. Aliphatic amide (urea)
8. Aromatic amide
9. Aromatic amine (Aniline)
10. Aromatic nitro compound

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	0	0	60	60

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.

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	SS	C
COURSE NAME	PHYSICAL CHEMISTRY PRACTICAL VIA	0	0	4	0	2
C:P:A	1: 0.8:0.2	L	T	P	SS	H
		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 thermo chemistry titrations and ***examine*** the complexometric titration.	Cognitive Psychomotor Affective	Apply Set Receiving

PHYSICAL CHEMISTRY PRACTICAL VIA	3 hours each exp

1. Phase diagram:

a. Simple eutectic
b. Compound formation

2. Determination of molecular weight:

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

3. Critical solution temperature

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

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 tetra chloride.

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

VI. Complexometric Titrations

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

	LECTURE	TUTORIAL	PRACTICAL	SELF STUDY	TOTAL
HOURS	**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"6th Edn.,Goel Publications,Meerut, 1986.

M.Sc Chemistry

COURSE CODE	COURSE NAME	L	T	P	C
YCY101	ORGANIC CHEMISTRY- I	4	1	0	5
C:P:A	4.5: 0 : 0.5				
		L	T	P	H
		4	1	0	5

Learning Objectives:

1. To learn the concept of organic reactive intermediates.
2. To learn and understand the theories and mechanism of aliphatic nucleophilic substitution reactions.
3. To learn and understand the theories and mechanism of aromatic electrophilic substitution reactions.
4. To understand the concepts of addition and elimination reactions.
5. To learn and understand the concept of stereochemistry and conformational analysis

COURSE OUTCOMES- On the successful completion of the course, students will be able to		DOMAIN	LEVEL
CO1	***Identify*** the various types of reactive intermediates and ***explain*** their reactivity in organic reactions.	Cognitive	Remember Understand
CO2	***Describe*** the mechanism of nucleophilic substitution reaction	Cognitive	Understand
CO3	***Illustrate*** the mechanism of electrophilic substitution reactions.	Cognitive	Understand
CO4	***Explain*** the fundamental concepts of various addition and elimination reactions	Cognitive Affective	Understand Receive
CO5	***Describe*** and ***give*** example of stereo chemistry of organic compounds	Cognitive	Remember Understand

UNIT I -REACTIVE INTERMEDIATES **15**

Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, carbenoids, benzynes and nitrenes.

UNIT II - NUCLEOPHILIC SUBSTITUTION REACTIONS **15**

Aliphatic nucleophilic substitution – mechanisms – SN1, SN2, SNi – ion-pair inSN1 mechanisms – neighbouring group participation, non-classical carbocations – substitutions at allylic and vinylic carbons. Reactivity – effect of structure, nucleophile, leaving group and stereochemical factors – correlation of structure with reactivity – solvent effects – rearrangements involving carbocations – Wagner-Meerwein and dienone-phenol rearrangements.

Aromatic nucleophilic substitutions – SN1, SNAr, Benzyne mechanism – reactivity orientation – Ullmann, Sandmeyer and Chichibabin reaction – rearrangements involving nucleophilic substitution – Stevens – Sommelet- Hauser and von-Richter rearrangements.

UNIT III - ELECTROPHILIC SUBSTITUTION REACTIONS **15**

Aromatic electrophilic substitution reaction – orientation, reactivity and mechanisms based on transition state theory with suitable reactions – substitutions in thiophene and pyridine – N-oxide quantitative treatment of the structural effects on reactivity. Substituent effects – origins of Hammett equation – principles of Hammett correlation – effect of structure on reaction mechanisms Hammett parameters – σ and ρ, modified forms of Hammett equation, Taft Equation.

Aliphatic electrophilic substitution – SE2, SEi and SE1 mechanisms – diazonium coupling reactions – metals as electrophile in substitution reactions and decomposition of diazonium salts.

	UNIT IV - ADDITION AND ELIMINATION REACTIONS	**15**
	Addition to carbon-carbon multiple bonds – electrophilic, nucleophilic and free radical additions – orientation of the addition – stereochemical factors influencing the addition of bromine and hydrogen bromide, hydroxylation, 1,2- dihydroxylation – hydroboration leading to formation of alcohols – oxidation and ozonolysis. Addition to carbonyl and conjugated carbonyl systems – mechanism – Grignard reagents – 1,2- and 1,4-additions (lithium dimethylcuprate) – addition tocarbon-oxygen double bond – Benzoin, Knoevenagel, Stobbe, Darzens glycidic ester condensation and Reformatsky reactions. Elimination reactions – mechanisms; E1, E2, E1cB – stereochemistry of elimination, Hofmann‟s and Zaitsev‟s rules – competition between elimination and substitution – pyrolytic cis-elimination, Chugaev reaction – examples such as Hofmann degradation, Cope elimination – Bredt‟s rule with examples	
	UNIT – V STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS	**15**
	Stereoisomerism – symmetry – enantiomers and diastereomers – R and S nomenclature – optical activity and chirality – types of molecules exhibiting optical activity – absolute configuration – chirality in molecules with non- carbon stereocenters (N, S and P) – molecules with more than one chiral centre – atropisomerism. Molecular chirality – allenes, spiranes, biphenyls – methods of determining configuration – E and Z nomenclature – determination of configuration of geometrical isomers – stereochemistry of addition and elimination reactions – stereospecific and stereoselective synthesis [elementary examples]. Basic concepts of conformational analysis – conformations of cyclopentane, cyclohexane, cyclohexene and bridged (norbornane type) ring systems –anomeric effect in cyclic compounds.	

LECTURE	**TUTORIAL**		**TOTAL**
60	**15**		**75**

TEXT BOOKS

1. J. March and M. B. Smith, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure; 7th Ed., Wiley, New York, 2013.
2. I.L. Finar, Organic Chemistry; Vol.II, 7th Ed., Pearson education Ltd, New Delhi, 2009.
3. R. T. Morrison and R. N. Boyd, Organic Chemistry, 7th Ed., Pearson, New Delhi, 2011.
4. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry; Parts A and B, 5th Ed., Springer, Germany, 2007.
5. T. H. E. Lowry and K. S. Richardson, Mechanism and Theory in Organic Chemistry; Addison-Wesley, USA, 1998.
6. P. S. Kalsi, Stereochemistry; Wiley eastern limited; New Delhi, 1993.
7. D. Nasipuri, Stereochemistry of Organic Compounds - Principles and Applications; 2nd Ed., New Age International, New Delhi, 1994.
8. E. L. Eliel, and S. H. Wilen, Stereochemistry of Organic Compounds; John Wiley, New York, 1994.

REFERENCE BOOKS

1. R. K. Bansal, Organic Reaction Mechanisms; 11th Ed., Tata McGraw Hill, Noida, 2006.
2. J. Clayden, N. Greeves, S. Warren, and P. Wothers, Organic Chemistry; 1st Ed., Oxford University Press, UK, 2000.
3. R. O. C. Norman and J. M. Coxon, Principles of Organic Synthesis, Chapman & Hall, 3rd Ed, 1993.
4. 7. Stuart Warren, Organic Synthesis: Disconnection Approach, Wiley India (P) Ltd, 2007.
5. M. B. Smith, Organic Synthesis, Academic Press, 3rd Ed, 2011.

E RESOURCES

1. http://nptel.ac.in/courses/104103071/21
2. https://www.youtube.com/watch?v=Ih7tQ7rY2Wc
3. http://nptel.ac.in/courses/104101005/

4. https://www.youtube.com/watch?v=12hmgzeiGo4
5. https://www.youtube.com/watch?v=WEeFhsjn-lo

COURSE CODE	COURSE NAME	L	T	P	C
YCY102	INORGANIC CHEMISTRY- I	4	1	0	5
C:P:A	4.5: 0 : 0.5				
		L	T	P	H
		4	1	0	5

Learning Objectives:

1. To learn the chemistry of boron, silicon, P-N compounds, S-N compounds and other main group elements.
2. To learn and understand the bonding theories which describe the bonding in coordination complexes.
3. To understand the theoretical aspects of electronic spectra and its application for the structural elucidation of coordination compounds
4. To understand the reaction kinetics mechanisms involved in coordination complexes.
5. To learn and understand the concepts of photochemistry and features of Photoelectron Spectroscopy

COURSE OUTCOMES- On the successful completion of the course, students will be able to		DOMAIN	LEVEL
CO1	***Recall*** the basics of main group elements and ***explain*** the structure-property relations of main group compounds	Cognitive	Remember Understand
CO2	***Discuss*** the theories and bonding nature of Coordination compounds.	Cognitive	Understand
CO3	***Describe*** the theory and ***interpret*** electronic spectra of Coordination compounds	Cognitive	Understand Apply
CO4	***Identify*** and ***understand*** the type and nature of electron transfer reactions in four and six coordination compounds.	Cognitive Affective	Understand Receive
CO5	***Rewrite*** the basics of photochemistry and ***explore*** its applications towards coordinated compounds.	Cognitive	Understand

UNIT – I Inorganic Chain and Cluster Compounds — 15

Chemistry of boron – boranes, higher boranes, borazines , boron nitrides, hydroborate ions – Preparation, properties and structure. Carboranes- Types such as nido-closo, arachno-preparation, properties and Structure. Metal clusters: Chemistry of low molecularity metal clusters only, Structure of Re_2Cl_8; multiple metal-metal bonds.

Types of inorganic polymers, comparison with organic polymers, silanes, higher silanes, multiple bonded systems, silicon nitrides, siloxanes. P-N compounds, cyclophosphazenes and cyclophosphazanes. S-N compounds – S_4N_4, (SN)x. Isopoly and heteropoly acids – Structure and bonding of 6- and 12 – isopoly and heteropoly anions. Structure of silicates - applications of Paulings rule of electrovalence - isomorphous replacements in silicates – ortho, meta and pyro silicates – one dimensional, two dimensional and three dimensional silicates.

UNIT – II Stability of Complexes and Theories of Metal-Ligand Bonding — 15

Stability of Complexes: Studies of coordination compounds in solution – detection of complex formation in solution – stability constants – stepwise and overall formation constants. Simple methods (Potentiometric, pH metric and photometric methods) of determining the formation

constants. Factors affecting stability – statistical and chelate effects – forced configurations. Metal-Ligand Bonding: Crystal field theory – splitting of d-orbitals under various geometries – factors affecting splitting – CFSE and evidences for CFSE (structural and thermodynamic effects). Spectrochemical series – Jahn-Teller distortion – spectral and magnetic properties of complexes – site preferences.Limitations of CFT – ligand field theory – MO theory – sigma and pi-bonding in complexes – Nephelauxetic effect – the angular overlap model.

UNIT – III Electronic Spectra of Coordination Complexes	**15**

Spectroscopic term symbols for d^n ions – derivation of term symbols and ground state term symbol, Hund‟s rule, Selection rules – breakdown of selection rules, spin orbit coupling, band intensities, weak and strong field limits – correlation diagram, Energy level diagrams. Orgel diagram for weak field Oh and Td complexes – Splitting of energy level due to Jahn-Teller distortion. Modified orgel diagram – Limitiations of orgel diagram Tanabe–Sugano(T-S) diagrams – Evaluation of Dq and B values for d^2 –d^8 complexes charge transfer spectra. Complications in band classification between Lf(d-d) and CT bands. Comparison between d-d bands and CT bands – Numerical problems, Lanthanides and Actinides- Spectral properties.

UNIT –IV Reaction Mechanism in Coordination Complexes	**15**

Kinetics and mechanism of reactions in solution – labile and inert complexes – ligand displacement reactions in octahedral and square planar complexes – acid hydrolysis, base hydrolysis and anation reactions. Trans effect – theory and applications – electron transfer reactions – electron exchange reactions – complementary and non-complementary types – inner sphere and outer sphere processes – application of electron transfer reactions in inorganic complexes – isomerisation and racemisation reactions of complexes. Molecular rearrangements of four- and six-coordinate template effect and its applications for the synthesis of macrocyclic ligands.

Unit-V: Inorganic Photochemistry and Photoelectron Spectroscopy	**15**

Photophysical and photochemical processes of coordination compounds. Unimolecular charge-transfer photochemistry of cobalt(III) complexes , photoreduction – ligand-field photochemistry of chromium(III) complexes – Adamson‟s rules, photoactive excited states, Photochemistry of organometallic compounds – metal carbonyl compounds – compounds with metal-metal bonding – Reinecke‟s salt, chemical actinometer. Photoelectron Spectroscopy (PES) - Theory, Types, origin of fine structures - shapes of vibrational fine structures – adiabatic and vertical transitions, PES of homonuclear diatomic molecules (N_2, O_2) and heteronuclear diatomic molecules (CO, HCl) and polyatomic molecules (H_2O, CO_2, CH_4, NH_3) – evaluation of vibrational constants of the above molecules, Koopman‟s theorem- applications and limitations.

LECTURE	**TUTORIAL**	**TOTAL**
60	**15**	**75**

TEXT BOOKS

1. Day,J.SelbinandH.H.Sisler,Theoretical Inorganic Chemistry; Literary Licensing(LLC), Montana, 2012.
2. N. H. Ray, Inorganic Polymers, Academic Press, 1978.
3. F.A.Cotton and G.Wilkinson, C.A.Murillo and M.Bochmann, Advanced Inorganic Chemistry; 6thEd., A Wiley - Interscience Publications, John Wiley and Sons,USA, 1999.
4. J.E.Huheey,Inorganic Chemistry;4th Ed.,Harper and Row publisher, Singapore,2006.
5. W.Adamson, Concept of Inorganic Photochemistry; John Wiley and Sons, NewYork,1975.
6. S.F.A.Kettle,Physical Inorganic Chemistry –A Coordination ChemistryApproach ,Spectrum; Academic Publishers, Oxford University Press, New York, 1996.
7. R. S. Drago, Physical methods in chemistry; Saunders college publications, Philadelphia, 1992

REFERENCE BOOKS

1. A. W. Adamson and P. D. Fleischauer, Concepts of Inorganic Photochemistry; R. E. Krieger Pubs, Florida, 1984.
2 J. Ferraudi, Elements of Inorganic Photochemistry; Wiley, New York, 1988.

3 F. Basolo and R. G. Pearson, Mechanism of Inorganic Reactions; 2nd Ed., John Wiley, New York, 1967.
4 R. K. Sharma, Inorganic Reactions Mechanism; Discovery Publishing House, New Delhi, 2007.

E RESOURCES

1. https://www.youtube.com/watch?v=YChUH_XSZJ0
2. https://www.youtube.com/watch?v=7gNByyjaYrY
3. https://www.youtube.com/watch?v=Ox3pnVN47gw
4. https://www.youtube.com/watch?v=wq4XHcNBBgg

COURSE CODE	COURSE NAME	L	T	P	C
YCY103	PHYSICAL CHEMISTRY- I	4	1	0	5
C:P:A	4.5: 0 : 0.5				
		L	T	P	H
		4	1	0	5

Learning Objectives:

1. To understand the kinetics of chemical reaction and mechanisms involved in catalysis.
2. To gain on understanding of the Ionic activity, ionic interactions, Debye-Hückel-Bjerrum model, Debye-Hückel limiting law and Debye-Hückel theory of strong electrolytes.
3. To learn and understand the Electro kinetic phenomena, voltammetry and
4. design, applications of the batteries and Fuel Cells, Corrosion and its Protection
5. To understand the concept of different laws of thermodynamics and describe the theories of classical thermodynamics.
6. To understand about the various applications of Quantum Statistics

COURSE OUTCOMES- On the successful completion of the course, students will be able to		**DOMAIN**	**LEVEL**
CO1	***Recognize*** and ***explain*** the features of various kinetic theories involved in chemical reactions and Catalysis.	Cognitive	Remember Understand
CO2	***Illustrate*** the ionic activity, ionic interactions, Debye-Hückel-Bjerrum model, Debye-Hückel limiting law and Debye-Hückeleory of strong electrolytes.	Cognitive	Understand
CO3	***Apply*** **the Electro kinetic phenomena for the development of Batteries and Fuel Cells and for the application of Corrosion Protection**	Cognitive	Understand Apply
CO4	***Explain*** the concept of different laws of thermodynamics and ***describe*** the theories of classical thermodynamics.	Cognitive Affective	Understand
CO5	***Summarize the*** various applications of Quantum Statistics.	Cognitive	Understand

	UNIT - I CHEMICAL KINETICS AND CATALYSIS	**15**
	Absolute reaction rate theory -Thermodynamic terms-Significance of entropy and volume of activation. Reactions in solution: factors determining reaction rates in solutions, effect of dielectric constant and ionic strength, - Bronsted –Bjerrum equation-Primary and Secondary salt effect, influence of solvent on reaction rates. Acid base catalysis-Bronsted relations, catalytic coefficients and their determination. Enzyme catalysis and its mechanism, Michaelis-Menten equation, effect of pH and temperature on enzyme catalysis, Mechanism of enzyme	

	inhibition kinetics of surface reactions- unimolecular reactions-Bimolecular reactions- Langmuir Hinshelwood and Elay-Rideal mechanism. Chemical dynamics: Study of fast reactions by stopped flow techniques- relexation method, flash photolysis and the nuclear magnetic resonance method. Linear free energy relationship- Hammett equation, Taft equation-Separation of polar, resonance and steric effects.	
	UNIT – II ELECTROCHEMISTRY - I	**15**
	Deviation from ideal behaviour.ion-solvent and ion-ion interactions. Debye-Hückel-Bjerrum model, Ion association and triple ion formations.Expression for the mean activity coefficient.Debye-Hückel limiting law and its applications -Diverse ion effect.Van‟t Hoff factor and its relation to colligative properties.Debye-Hückel theory of strong electrolytes.Debye-Hückel length and potential around a central ion, its interpretation. Transport of ions in Solution: Electrolytic conduction- Debye - Hückel-Onsager treatment of strong electrolytes- ionic atmosphere- Anomalous conductance of non aqueous electrolytes	
	UNIT – III ELECTROCHEMISTRY- II	**15**
	Electrical double layer - Electrocapillary phenomena - Surfactants - Lipmann‟s equation, Electrokinetic phenomena. Zeta potential and its applications.Structure of electrical double layer – Helmholtz-Perrin, Guoy-Chapmann and Stern models. Butler-Volmer equation for one electron transfer reaction - equilibrium and exchange current densities- and symmetry factor - transfer coefficient. Cyclic voltammetry and Stripping voltammetry - principle – instrumentation- Corrosion and passivation of metals - Pourbaix diagram - Evans diagram –Batteries and Fuel cells-Ion selective electrodes	
	UNIT- IV CLASSICAL THERMODYNAMICS	**15**
	Third law, thermodynamics, need for it, Nernst heat theorem and other forms of stating the third law. Thermodynamic quantities at absolute zero, apparent exceptions to the third law - thermodynamics of systems of variable composition, partial molar properties, chemical potential, relationship between partial molar quantities, Gibbs Duhem equation and its applications (the experimental determination of partial molar properties not included) - thermodynamic properties of real gases, fugacity concept, calculation of fugacity of real gas, activity and activity coefficient, concept, definition, standard states and experimental determinations of activity and activity coefficient of electrolytes.	
	UNIT –V STATISTICAL THERMODYNAMICS	**15**
	Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law- Classical statistics-Maxwell-Boltzmann (MB) statistics-Quantum statistics-Bose-Einstein (BE) and Fermi-Dirac (FD) statistics-Derivation of distribution function-MB, BE and FD statistics-comparison-Partition functions-Translational, rotational, vibrational and electronic partition function –Calculation of thermodynamic parameters and equilibrium constants in terms of partition function; Debye and Einstein heat capacity of solids.	

	LECTURE	**TUTORIAL**		**TOTAL**
	60	**15**		**75**

TEXT BOOKS

1. K. J. Laidler, Chemical Kinetics; 3rd Ed., Tata McGraw Hill, Noida, 1987.
2. J. W. Moore and R. G. Pearson, Kinetics and Mechanism; 3rd Ed., John Wiley and Sons, New York, 1981.
3. M. Mortimer and P. G. Taylor, Chemical Kinetics and Mechanism; 1st Ed., Royal Society of Chemistry, UK, 2002.
4. J. N. Gurtu and A. Gurtu, Advanced Physical Chemistry; 5th Ed., Pragathi Prakashan, Meerut, 2006.
5. J. I. Steinfeld, J. S. Francisco and W. L. Hase, Chemical Kinetics and Dynamics; 2nd Ed., Prentice Hall, New Jersey, 1999.
6. P. W. Atkins, Physical Chemistry; 7th Ed., Oxford University Press, Oxford, 2001.
7. J. Rajaram and J. C. Kuriacose, Thermodynamics for Students of Chemistry - Classical, Statistical and Irreversible; Pearson Education, New Delhi, 2013.
8. Horia Metiu, Physical Chemistry, Thermodynamics; Taylor and Francis, Singapore, 2006.

REFERENCE BOOKS

1. M. C. Gupta, Statistical Thermodynamics, Wiley Eastern, New Delhi, 1990.
2. Yi-Chen Cheng, Macroscopic and Statistical Thermodynamics, World Scientific, 2006.
3. D. A. McQuarrie, Text Book of Physical Chemistry, University Science Books, Mill Valley, California, 1983.
4. R. A. Alberty and R. J. Silbey, Physical Chemistry, John Wiley and Sons, New York, 1992.

E RESOURCE

1. https://www.youtube.com/watch?v=pGerRhxNQJE
2. https://www.youtube.com/watch?v=R-x9KdNjQmo
3. https://www.youtube.com/watch?v=F_NmS-Wy2lE
4. https://www.youtube.com/watch?v=6QXtnmB1vqk
5. https://www.youtube.com/watch?v=1zZ6rvh1cgw

COURSE CODE	COURSE NAME	L	T	C
YCYE02	INDUSTRIAL CHEMISTRY	4	1	5
		L	T	H
C:P:A	3.75:0.75:0.5	4	1	5

COURSE OUTCOMES: On the successful completion ofthe course, students will be able to		DOMAIN	LEVEL
CO1	***Illustrate*** the basic ideas of an industry and industrial wastes.	Cognitive Psychomotor	Remember Understand Set
CO2	***Rephrase*** and ***Report*** the preparation and properties of petroleum and petrochemicals.	Cognitive Affective	Understand Respond
CO3	***Identify*** the role and functions of portland cement.	Cognitive Affective	Understand Apply Respond
CO4	***List*** the various process involved in the paper industry	Cognitive Psychomotor	Analyze Perception
CO5	***Outline*** the preparation and mode of action of soaps, detergents and perfumes.	Cognitive Psychomotor	Analyze Perception

SYLLABUS:

UNIT I	BASIC IDEAS AND INDUSTRIAL WASTES	

Basics idea about unit operation – flow chart – chemical conversion – batch versus continuous processing – chemical process selection – design – chemical process control. Types of industrial wastes – treatment of wastes or effluent with organic impurities – treatment of wastes or effluent with inorganic impurities – treatment of some important chemical wastes.		**15**
UNIT II	**PETROLEUM AND PETROCHEMICALS**	
Introduction – saturated hydrocarbons from natural gas – uses of saturated hydrocarbons – unsaturated hydrocarbons – acetylene, ethylene, propylene, butylene – aromatic hydrocarbons – toluene and xylene. Preparation of rectified spirit from beat – methylated spirit – preparation of absolute alcohol from rectified spirit – petrochemicals in India.		**15**
UNIT III	**MANUFACTURE OF CEMENT**	
Introduction – types of cement – high alumina cement, water proof cement, slag cement, acid resisting cement, white cement, coloured cement, Pozzolana cement. Setting of cement – properties of cement – testing of cement – uses of cement –concrete – cement industries in India.		**15**
UNIT IV	**PULP AND PAPER AND MANUFACTURE OF PAPER**	
Introduction – manufacture of pulp – types of pulp – sulphate or craft pulp, soda pulp, Rag pulp – beating, refining, filling, sizing and colouring. Calendaring – uses – paper industries in India.		**15**
UNIT V	**SOAPS, DETERGENTS AND PERFUMES**	
Introduction – types of soaps – hard and soft soaps – manufacture of soap (hot and continuous process only) – cleansing action of soap – detergents – surface active agents – biodegradability of surfactants, amphoteric detergents. Introduction – production of natural perfumes – flower perfumes – jasmine, rose and lily – production of synthetic perfumes – muscone and nitro-musks.		**15**

REFERENCE BOOKS:

1. B. K. Sharma, Industrial Chemistry; 8th Ed., Goel Publishing House, New Delhi, 1997.
2. R. N. Shreve, and J. A. Brink Jr. Chemical Process Industries; 4th Ed., McGraw Hill, Toronto, 1977.
3. A. C. S. Brain, Production and Properties of Industrial Chemicals; Reinhold, New York, 1989.

	LECTURE	TUTORIAL	SELF-STUDY	TOTAL HOURS
Hours	**60**	**15**	**-**	**75**

COURSE CODE	YCY105	L	T	P	C
CORSE NAME	PHYSICAL CHEMISTRY LAB	0	0	6	3
PREREQUISITE	NIL	L	T	P	H
C:P:A	0.6: 2.2:0.2	0	0	6	3

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Describe*** the definition and significance of physical parameters like rate constant, activation energy, order and various laws and also ***relate*** the results.	Cognitive and Psychomotor	Remember Perception
CO2	***Estimate*** the physical parameters of the reactions and ***explain*** the relation between these parameters.	Cognitive and Psychomotor	Understand Set
CO3	***Interpret*** the results and ***recognize*** the relation of physical parameters and its significance in the reaction.	Cognitive and Affective Phsycomotor	Apply Receive Mechanism

Experiments to be exercised **2**

1. Kinetics-acid hydrolysis of ester–comparison of strengths of acids.
2. Kinetics-acid hydrolysis of ester–determination of energy of activation (Ea).
3. Kinetics-saponification of ester–determination of ethyl acetate by conductometry.
4. Kinetics-persulfate-iodine reaction – determination of order, effective of ionic strength on rate constant.
5. Determination of molecular weight of substance by transition temperature method.
6. Determination of molecular weight of substances by Rast method.
7. Determination of Critical Solution Temperature (CST) of phenol-water system and effect of impurity on CST.
8. Study of phase diagram of two components forming a simple eutectic.
9. Study of phase diagram of two compounds forming a compound.
10. Study of phase diagram of three components system.
11. Determination of molecular weight of substances by cryoscopy.
12. Determination of integral and differential heat of solutions by colorimetry.
13. Polymerization-rate of polymerization of acrylamide.
14. Distribution law – study of Iodine-Iodine equilibrium.
15. Distribution law – study of association of benzoic acid in benzene.
16. Adsorption – oxalic acid/acetic acid on charcoal using Freundlich isotherm.

TEXT BOOKS

1. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd Ed., National Pubs, London, 1988.
2. G. Svehla, Text Book of Macro and Semimicro Qualitative Inorganic Analysis; 5th Ed., Longman group Ltd, London, 1987.
3.A. I. Vogel, Text Book of Quantitative Inorganic Analysis; 6th Ed., Longman, New Delhi, 2000

	LECTURE	PRACTICAL	TOTAL
	0	90	90

	SEMESTER II				
COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
YCY201	**INORGANIC CHEMISTRY-II**	**4**	**1**	**0**	**5**
C:P:A	**4.0:0.5:0.5**	**L**	**T**	**P**	**H**
		4	**1**	**0**	**5**

Learning Objectives:

1. To learn the concepts, structure and bonding of organometallic compounds.
2. To understand the reaction mechanisms and catalytic role of organometallic compounds.
3. To understand the concepts of bioinorganic chemistry and its applications.
4. To understand the structure and packing in solids
5. To learn and understand the concepts of nuclear chemistry and applications of radioisotopes.

COURSE OUTCOMES: On the successful completion of the course, students will be able to		**DOMAIN**	**LEVEL**
CO1	***Recall*** and ***discuss*** the basic concepts of structure and bonding of organometallic compounds; ***Demonstrate*** the possible synthetic methods of organometallic complexes which are very useful in the modern era.	Cognitive Psychomotor	Remember Understand Set
CO2	***Summarize*** and ***Report*** the reaction mechanisms and catalytic role organometallic compounds.	Cognitive Affective	Understand Respond
CO3	***Describe*** the basic of bioinorganic chemistry and applications of various concepts. ***Identify*** the various metalloenzymes/ metalloporphyrins and their structure-function relations.	Cognitive Affective	Understand Apply Respond
CO4	***Analyze*** and ***Explain*** the various types of solid state packing and the types of chemical forces	Cognitive Psychomotor	Understand Analyze Perception
CO5	***Recite*** the principles of nuclear chemistry and ***illustrate*** the applications of radioisotopes	Cognitive Affective	Remember Understand Apply

SYLLABUS:

UNIT I – ORGANOMETALLICS-I: STRUCTURE AND BONDING	
Types of organometallic compounds on the basis of the nature of M-C bond. EAN rule: 18e- and 16e- rules – determinator of oxidation state, configuration, coordination number of the metal centre – Types and application 18e- / 16e- rules. Carbonyls – isolated concept.- Structure of carbonlys (simple and polynuclear) Nitrosyls – bridging and terminal nitrosyls, bent and linear nitorsyls. Dinitrogen compounds donors – Alkyl and Aryl – preparation and properties; chain carbon donors – olefins, acetylene and allyl complexes – synthesis, structure and bonding; cyclic carbon donors – (metallocene) – synthesis, structure and bonding.	**15**
UNIT II -ORGANOMETALLICS-II: REACTIONS , CATALYSIS AND CARBENES	

Ligand substitution-oxidative addition and reductive elimination-1,1 and 1,2-insertion-addition and elimination reactions-alkene isomerization - hydroboration hydrocyanation – hydrogenation of olefins -Wilkinson‟s catalyst - hydroformylation of olefins- Wacker-Schmidt synthesis- Monsanto acetic acid process- Eastman Halcon process- Fischer-Tropsch process- hydrosilylation. Fischer and Schrock carbenes - bonding and reactivity- Grubbs catalyst- carbenes structure, synthesis and reactions-alkene metathesis – mechanism- C-H and C-C activation- agnostic bonds -Ziegler-Natta polymerization of olefins- Ene reaction.	**15**
UNIT III- BIOINORGANIC CHEMISTRY:	
Function and transport of alkali and alkaline earth metal ions: characterization of K^+, Na^+, Ca^{2+} and Mg^{2+} – complexes of alkali and alkaline earth metal ions with macrocycles – ion channels – ion pumps, catalysis. Metalloporphyrins/Metalloenzymes: Dioxygen transport and storage-hemoglobin and myoglobin: electronic and spatial structures-hemeythrin and hemocyanine- synthetic oxygen carriers, model systems-blue copper proteins (Cu)-iron-sulfur proteins (Fe)-cytochromeselectron transport chain- carbon monoxide poisoning- iron enzymes-peroxidase, catalase and cytochrome P-450, copper enzymes- superoxide dismutase, vitamin B_{12} and B_{12} coenzymes, photosynthesis- photosystem-I &II, nitrogen fixation, cisplatin	**15**
UNIT IV- CHEMISTRY OF SOLID STATE: STRUCTURE	
Weak Chemical forces: van der Waals forces, Hydrogen bonding, Close packing of atoms and ions HCP and BCC types of packing voids, radius ratio – derivation – its influence on structures. Lattice energy – Born-Lande equation - Kapustinski equation, Madelung constant. Representative structures of AB and AB_2 types of compounds - rock salt, cesium chloride, wurtzite, zinc blende, rutile, fluorite, antifluorite, cadmium iodide and nickel arsenide. Structure of graphite and diamond. Spinels -normal and inverse types and perovskite structures. Band theory of solids- non-stoichiometry- point defects – linear defects- effects due to dislocations-electrical properties of solids-conductor, insulator, semiconductor-intrinsic-impurity semiconductors-optical properties-lasers and phosphors-elementary study of liquid crystals.	**15**
UNIT V - NUCLEAR AND RADIATION CHEMISTRY	
Properties of nucleus – different types of nuclear forces , Nuclear structure and nuclear stability, Nuclear models- – liquid drop model, shell model of nucleus, Radioactivity and nuclear reactions, nuclear reactions induced by charged particles – Q value – nuclear reaction cross section, significance and determination – theory of nuclear fission, nuclear fusion, stellar energy. Hot atom chemistry, Nuclear fission and fusion reactors. The interaction of nuclear radiations with matter. Radiation hazards and therapeutics. Detectors and their principles. Tracer Application of radioisotopes in agriculture, industry and medicine. Isotope dilution and radio-activation methods of analysis.	**15**

	LECTURE	**TUTORIAL**	**PRACTICAL**		**TOTAL HOURS**
Hours	**60**	**15**	**-**		**75**

REFERENCES BOOKS

1. J. E. Huheey, Inorganic Chemistry; 4th Ed., Harper and Row Publishers, Singapore, 2006.
2. K. F. Purcell and J. C. Kotz, Inorganic Chemistry; Thomson Learning, Boston, 1980.
3. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry; Panima Publishing Company, New Delhi, 1997.
4. W. Kaim and B. Schewederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life; 2nd Ed., John Wiley and Sons, New York, USA, 2013.
5. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry; 6th Ed., John Wiley and Sons,
6. A. R. West, Basic Solid State Chemistry, John Wiley, **1991**
7. H. J. Arniker, Essentials of Nuclear Chemistry, 2nd Ed, Wiley Eastern Co, **1987**.
8. G. Friedlander, J. W. Kennedy and J. M. Miller, Nuclear and Radiochemistry, Wiley, **1964**

New York, 1999.
9. R. C. Mehrotra and A. Singh, Organometallic Chemistry; 2nd Ed., New Age International Ltd. New Delhi, 2014.
10. R. H. Crabtree, The Organometallic Chemistry of the Transition Metals; 3rd Ed., John Wiley and Sons, New York, 2001

TEXT BOOKS

1. A. W. Parkins and R. C. Poller, An Introduction to Organometallic Chemistry; 1987, Oxford University Press, Chennai.
2. I. Haiduc and J. J. Zuckerman, Basic Organometallic Chemistry; Walter De Gruyter Inc, USA, 1985.
3. P. Powell, Principles of Organometallic Chemistry; 2nd Ed., Chapman and Hall, London, 1988.
4. B. Douglas, D. H. McDaniel and J. J. Alexander, Concepts and Models of Inorganic Chemistry; 3rd Ed., John Wiley and sons, New York, 1994.
5. M. Bochmann, Organometallics 1: Complexes with transition metal-carbon bonds; Oxford Chemistry Primers Series, No. 12, and M. Bochmann, Organometallics 2: Complexes with transition metal-carbon bonds; No. 13, 1994.
6. David L. Nelson and Michael M. Cox, Leninger Principles of Biochemistry, WH Freeman, 2017.

E-Resources

1. https://nptel.ac.in/courses/104103069/33
2. https://nptel.ac.in/courses/104105038/21
3. https://onlinecourses.nptel.ac.in/noc18_cy09/preview

COURSE CODE	COURSE NAME	L	T	P	C
YCY202	PHYSICAL CHEMISTRY-II	4	1	0	5
C:P:A	4.5:0:0.5	L	T	P	H
		4	1	0	6

Learning Objectives:

1. To learn the concepts and applications of symmetry elements and symmetry operations.
2. To learn and under the concepts of quantum mechanics to apply for the energy calculations in simple and multielectron systems.
3. To understand the concepts of molecular spectroscopy and interaction of electromagneticradiation with monoatomic and diatomic molecules.
4. To understand the photo physical properties of various type of chemical reactions.
5. To learn the various concepts of adsorption and free energy reaction at interphase.

COURSE OUTCOMES: On the successful completion of thecourse, students will be able to		DOMAIN	LEVEL
CO1	***Explain*** rules and concepts of group theory for the determining of type of vibrations and hybridizations.	Cognitive	Understanding
CO2	***Describe*** the principles and postulates of quantum mechanics and ***illustrate*** the wave mechanical treatment for simple, multielectron systems and predict the energy level in the molecular systems.	Cognitive	Understand Apply
CO3	***Describe*** the physical aspects of molecular spectroscopy and interaction of electromagnetic radiation with diatomic and polyatomic molecules	Cognitive	Remember
CO4	***Generalize*** the photo physical properties of chemical reactions.	Cognitive	Understand
CO5	***Apply*** and ***identify*** the various concepts of adsorption and free energy reaction at interphase.	Cognitive	Apply Remember

SYLLABUS:

UNIT- I GROUP THEORY AND ITS APPLICATIONS	15

Symmetry elements and operations – point groups – assignment of point groups to molecules – group postulates and types of groups – group multiplication tables, sub groups, similarity transformations – conjugate elements and classes. Matrix representation of symmetry operations and point groups – reducible and irreducible representations – properties of irreducible representation. The great orthogonality theorem – construction of character table – direct product – projection operators – symmetry of hybrid orbitals. Applications of group theory- Determination of representations of vibrational modes in non-linear molecules such as water, ammonia, BF_3, CH_4 and XeF_4.Determination of Hybrid orbitals in non-linear molecules – Examples: H_2O, NH_3, BF_3, CH_4 and XeF_4.

UNIT- II QUANTUM CHEMISTRY	15

Black body radiation-Planck‟s quantum theory-Wave particle duality-Uncertainty Principle. Operators-linear, commutation, Hermitian and Hamiltonian operators. Eigen functions and Eigen values-Postulates of quantum mechanics. Derivation of Schrodinger‟s time-independent wave equation and its application to particle in a one dimensional box, particle in a three dimensional box, quantum tunneling, harmonic oscillator, rigid rotor and hydrogen atom. Born-Oppenheimer approximation-Hydrogen molecule ion. LCAO-MO and VB treatments of the hydrogen molecule. Antisymmetry and Pauli‟s exclusion principle. Slater detrimental wave function, term symbols and spectroscopic states-Russell Saunders coupling. The variation theorem and Perturbation theory.Applications of variation method and perturbation theory to the helium atom.

UNIT –III M O L E C U L A R S P E C T R O S C O P Y	15

Micro wave spectroscopy- Theory- selection rules, –Instrumentation, Principle of micro wave oven; Energy levels in atoms and molecules- Fourier transformation Rotational spectra of diatomic and polyatomic molecules–P,Q,R branches- effect of isotopic substitution. Non-rigid rotator- Linear molecules. Theory of Rotational Raman spectra. Electronic spectra -electronic spectra of molecules -Born Oppenheimer approximation -vibrational coarse structure -Franck-condon principle -dissociation energy -fortrat

diagram -Pre-dissociation -various types of transitions -solvent effect on spectra. Vibrational spectra of diatomic molecules – selection rules –overtones, combination and hot bands - Fermi resonance Energy of diatomic molecule, simple harmonic and unharmonic oscillator, rotational character of vibration spectra, Theory of Vibrational Raman spectroscopy-Coherant Antistokes Raman Spectroscopy (CARS).

UNIT IV- PHOTOCHEMISTRY AND RADIATION CHEMISTRY	15

Photophysical processes of electronically excited molecules – Jablonski diagram, Primary and Secondary Processes, quantum yield and its determination-chemical actinometer. Excimers and exciplexes-Kinetics of collisional quenching-Stern Volmer equations. Photosensitization, Chemiluminescence. Photosynthesis, solar energy conversions. Semiconductor photo catalysis, lasers. Radiation Chemistry-linear energy transfer, G-value, dosimeters, radiolysis of water, solvated electrons.

UNIT-V SURFACE PHENOMENA	15

Adsorption and free energy reaction at interphase -potential energy diagram - Lennard-Jones plot -surface area determination -heats of adsorption -determination -adsorption from solution -Gibbs adsorption theorem -solid-liquid interface –Wetting and contact angle -solid-gas interfaces -soluble and insoluble films. Surface tension: methods of measuring surface tension -electrical phenomena at interface including electro kinetic phenomenon -Micelles and reverse micelles -solubilisation -micro emulsion or micellar emulsions

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL HOURS**
Hours	**60**	**15**	**-**	**75**

REFERENCE BOOKS

1. F.A. Cotton, Chemical Application of Group Theory, John Wiley and Sons Inc. New York, 1971.
2. K.V. Raman, Group theory and its applications to Chemistry, Tata McGraw-Hill Publishing Company, 1990
3. A.K. Chandra, Introductory Quantum Chemistry, 4th ed., Tata McGraw Hill, 1994.

3 R. K. Prasad, Quantum Chemistry, 2nd ed., New Age International Publishes (2000),
4 I. N. Levine, Quantum Chemistry, 4th ed., Prentice Hall of India Pvt Ltd., (1994),
5 S. Glasstone, Introduction to Theoretical Chemistry, Affiliated East-West Press
6 G. N. Barrow, Introduction to Molecular Spectroscopy, International Mc.Graw Hill Edition(1993),
7 G. Friedlander, J. W. Kennedy and J. M. Miller, Nuclear and Radiochemistry, Wiley, 1964.
8 K. K. Rohatgi-Mukherjee, Fundamentals of Photochemistry; 3rd Ed., New Age International Pvt. Ltd., New Delhi, 2014.

TEXT BOOKS

1. G. N. Barrow, Introduction to Molecular Spectroscopy, International McGraw Hill Student Edition (1984),
2. B. P. Straughan and S. Walker, Spectroscopy, Vol.I to III, Chapman Hall, London (1976),
3. D. A. McQuarrie, Quantum Chemistry, University Science Books (1998),
4. R. L. Flurry, Jr, Symmetry Groups: Theory and Chemical Applications; Prentice Hall, New Jersy, 1980.
5. 2. S. F. A. Kettle, Symmetry and Structure; 2nd Ed., John Wiley and Sons, Chichester, 1995.

E-Resources

https://www.youtube.com/watch?v=R-x9KdNjQmo
https://onlinecourses.nptel.ac.in/noc18_cy15/preview
https://www.youtube.com/watch?v=6QXtnmB1vqk

COURSE CODE	COURSE NAME	L	T	P	C
YCY203	PHYSICAL METHODS IN CHEMISTRY-I	4	1	0	5
PREREQUISITE	NIL	L	T	P	H
C:P:A	4.5:0:0.5	4	1	0	5

COURSE OUTCOMES: On the successful completion of the course, students will be able to		DOMAIN	LEVEL
CO1	***Explain*** the basic principles of molecular spectroscopy.	Cognitive	Understand
CO2	***Relate*** the fundamentals of NMR spectroscopy and interpret the NMR spectra of organic compounds.	Cognitive	Remember Understand
CO3	***Explain*** the principles of UV, and IR spectroscopy ***&*** ***Identify*** the IR and UV active organic compounds	Cognitive	Understand Apply
CO4	***Apply*** the techniques of ESR, ORD and Mass spectroscopy of organic compounds.	Cognitive Affective	Apply Respond
CO5	***Examine*** the X-ray, electron, neutron diffractions of simple compounds.	Cognitive Affective	Analyze Receive

UNIT I	PRINCIPLES OF MOLECULAR SPECTROSCOPY	15

Interaction of electromagnetic radiation with molecular systems, Microwave spectroscopy – rotational spectra of diatomic molecules, rigid and non-rigid rotors – intensity of spectral lines – effects of isotopic substitution – microwave spectra of polyatomic molecules – linear and symmetric top molecules – infrared spectra – diatomic molecules, simple harmonic and anharmonic oscillators – diatomic vibrating rotator rotation – vibration spectrum of carbon monoxide – interaction of rotation and vibration (breakdown of Born-Oppenheimer approximation) – influence of the rotation on the spectrum of polyatomic molecules, linear and symmetric top molecules, parallel and perpendicular vibrations – influence of nuclear spin. Raman spectra – rotational Raman spectra of linear and symmetric top molecules – vibrational Raman spectra – rotational fine structure – electronic spectra of diatomic molecules – vibrational coarse structure – intensity of vibrational lines in electronic spectra – rotational fine structure – fortrat diagram.

UNIT II	NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY	15

^{1}H NMR Spectroscopy – multiplicity – coupling constant – spin-spin splitting – vicinal and geminal coupling constants – Karplus equation – long range coupling constants, influence of stereochemical factors on chemical shift of protons. Simplification of complex spectra – double resonance techniques, shifts reagents – chemical spin decoupling of rapidly exchangeable protons (OH, SH,COOH, NH, NH_2) – an elementary treatment of NOE phenomenon. ^{13}C NMR Spectroscopy − broad band decoupling – off resonance decoupling – chemical shifts of common functional groups – FT NMR and its importance-DEPT spectra – identification of small compounds based on NMR data – 2D techniques: 1H–1H COSY, ^{1}H–^{13}C HETCOSY – NOESY.

UNIT III	UV-VISIBLE AND IR SPECTROSCOPY	15

UV-Visible spectroscopy – introduction – instrumentation, sampling techniques – Woodward-Fieser and Scott‟s rules for conjugated dienes and polymers, ketones, aldehydes, α,β-unsaturated acids, esters, nitriles, and amides – differentiation of geometrical isomers and positional isomers – disubsitituted benzene derivatives – study of steric effect in aromaticity.
Infrared spectroscopy – Introduction – instrumentation, sampling techniques – factors influencing group frequencies – quantitative studies – hydrogen bonding (intermolecular and intramolecular).

UNIT IV	ESR, ORD AND MASS TECHNIQUES	15

ESR – basic principles – comparison between ESR and NMR spectra – hyperfine splitting – applications to organic free radicals.
Optical rotatory dispersion and circular dichroism – introduction to theory and terminology – cotton effect – ORD curves – axial halo-ketone rule and its applications – the octant rule – its applications – applications of ORD to determine absolute configuration of monocyclic ketones – comparison between ORD and CD – their interrelationships.
Mass Spectrometry – instrumentation – resolution – ESI, EI, CI and FAB methods – base peak, isotopic peaks, metastable peaks – importance of metastable peaks, parent peak, recognition of molecular ion peak – fragmentation – general rules – pattern of fragmentation for various classes of compounds, McLafferty rearrangement – nitrogen rule.

UNIT V	X-RAY DIFFRACTION	15

X-Ray diffraction by single crystal method – space groups – systematic absences in X-ray data and identification of lattice types, glide planes and screw axes – X-ray intensities – structure factor and its relation to intensity and electron density – phase problem – structure solution by heavy atom method and direct method – determination of absolute configuration of molecules – a brief account of Cambridge Structural Database (CSD) and Protein Data Bank (PDB). Electron diffraction by gases – scattering intensity vs. scattering angle, Wierl equation – measurement techniques. Neutron diffraction by crystals – magnetic scattering – measurement techniques – elucidation of structure of magnetically ordered unit cell.

LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL
60	15	-	-	75

TEXT BOOKS

1. C. N. Banwell, Fundamentals of Molecular Spectroscopy; 4th Ed., McGraw Hill Education, Noida, 1994.
2. B. P. Straughan and S. Walker, Spectroscopy; Vol.3, Halstead Press, Sydney, 1978.
3. G. M. Barrow, Introduction to Molecular Spectroscopy; McGraw Hill, New York,1964.
4. P. K. Ghosh, Introduction to Photoelectron Spectroscopy; John Wiley, New York, 1989.
5. P. M. Silverstein and amd F. X. Western, Spectroscopic Identification of Organic Compounds; 8th Ed., John Wiley, New York, 2014.

REFERENCES

1. W. Kemp, Organic Spectroscopy; 3rd Ed., Palgrave, New York, 1991.
2. J. R. Dyer, Applications of Absorption Spectroscopy of Organic Compounds, PHI Learning, New Delhi, 2009.
3. Y. R. Sharma, Elementary Organic Spectroscopy – Principles and Chemical applications; S. Chand, New Delhi, 1992.
4 . P. S. Kalsi, Spectroscopy of Organic Compounds; 6th Ed., New Age International Publishers, New Delhi, 2004

5. W. Clegg, Crystal Structure Determination; Oxford University press, UK, 1998.
6. G. H Stout and L. H. Jensen, X-ray Structure Determination: A Practical Guide; John Wileyand Sons, New York, 1992.
7. J. P. Glusker and K. N. Trueblood, Crystal Structure Analysis: A Primer; 3rd Ed., OxfordUniversity Press, UK, 2010.
8. D. N. Sathyanarayana, Electronic Absorption Spectroscopy and Related Techniques; University Press, Hyderabad, 2001.

E REFERENCES

1. Web Pages: Cambridge Structural Database (CSD)- http://www.ccdc.cam.ac.uk/products/csd/Protein Data Bank (PDB)
2. http://www.rcsb.org/pdb/home/home.do

COURSE CODE	COURSE NAME	L	T	P	C
YCY204	INORGANIC CHEMISTRY PRACTICAL-II	0	0	6	3
C:P:A	0.6: 2.2:0.2	L	T	P	H
		0	0	6	6

Learning Objectives:

1. To learn and understand the volumetric and gravimetric analysis of metal ions present in solution.
5. To learn the synthetic procedure of various inorganic compounds.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify*** the various Metals ions in the solution using volumetric method	Cognitive Psychomotor	Remember Perception
CO2	***Estimate*** the amount of Metal ions present in solution using gravimetric method.	Cognitive Psychomotor	Understand Set
CO3	***Synthesis*** of various inorganic compounds.	Cognitive Psychomotor Affective	Apply Set Receiving

1.	**Titrimetry (V) and Gravimetry (G)** A mixture of solution(s) should be given for estimation 1. Cu (V) and Ni (G); 2. Cu (V) and Zn (G); 3. Fe (V) and Zn (G); 4. Fe (V) and Ni (G); 5. Zn (V) and Cu (G).
2.	**Preparation of the following compounds:** 1. Tetramminecopper (II) sulphate. 2. Potassium trioxalatochromate (III). 3. Potassium trioxalatoaluminate (III). 4. Trithioureacopper (I) chloride. 5. Trithioureacopper (I) sulphate.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	-	-	90	90

REFERENCE BOOK

1. A. I. Vogel, "Quantitative Inorganic Analysis", ELBS, 3rd Edition, 1971.
2. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd Ed., National Pubs, London, 1988.
3. G. Svehla, Text Book of Macro and Semimicro Qualitative Inorganic Analysis; 5th Ed., Longman group Ltd, London, 1987.

COURSE CODE	COURSE NAME	L	T	P	C
YCY205	ORGANIC CHEMISTRY PRACTICAL –I	0	0	6	3
PREREQUISITE	**Nil**	**L**	**T**	**P**	**H**
C:P:A	1.8: 0.8:0.4	0	0	6	6

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Interpret*** the individual organic components present in the given organic mixture.	Cognitive Psychomotor	Understand Perception
CO2	***Estimate*** the melting point/boiling point of the synthesized compounds /individual component present in the mixture.	Cognitive Psychomotor	Understand Set
CO3	***Predict*** the nature of functional group present in the given mixture.	Cognitive Psychomotor Affective	Apply Set Receive

ORGANIC CHEMISTRY PRACTICAL –I

1. Qualitative analysis of an organic mixture containing two components

Mixtures containing two components are to be separated (pilot separation) and purified (bulk separation) – The physical constants are to be reported (analysis).

2. Preparation of organic compounds (single stage)

1. Methyl-*m*-nitrobenzoate from methylbenzoate (nitration)
2. Glucose pentaacetate from glucose (acetylation)
3. Resacetophenone from resorcinol (acetylation)
4. Benzophenone oxime from benzophenone (addition)
5. *o*-Chlorobenzoic acid from anthranilic acid (Sandmayer reaction)
6. *p*-Benzoquinone from hydroquinone (oxidation)
7. Phenylazo-2-naphthol from aniline (diazotization)

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	0	0	90	90

TEXT BOOKS

1. J. Mohan, Organic Analytical Chemistry: Theory and Practice; Narosa, (2003).
2. V. K. Ahluwalia, P. Bhagat, and R. Agarwal, Laboratory Techniques in Organic Chemistry; I. K. International, (2005).
3. N. S. Gnanaprakasam and G. Ramamurthy, Organic Chemistry Lab Manual; S.V.Printers, (1987).
4. A. I. Vogel, A. R. Tatchell, B. S. Furniss, A. J. Hannaford and P. W. G. Smith, Vogel‟s Textbook of Practical Organic Chemistry; 5th Ed., Prentice Hall, (1989).

COURSE CODE	COURSE NAME	L	T	P	C
YCYE03	PHARMACEUTICAL CHEMISTRY	4	1	0	5
PREREQUISITES	**Nil**	**L**	**T**	**P**	**H**
C:P:A	**4:0:1**	**4**	**1**	**0**	**5**

COURSE OUTCOMES: On the successful completion of thecourse, students will be able to		DOMAIN	LEVEL
CO1	***Recall*** the various terminology of pharmaceutical chemistry.	Cognitive	Remember Understand
CO2	***Outline*** the structural aspects of antibiotics and ***relate*** their functions..	Cognitive	Understand
CO3	***Illustrate*** the biological activities of analgesic and antipyretics.	Cognitive Affective	Remember Understand Receive
CO4	***Summarize*** the activities of anaesthetics and local anaesthetics.	Cognitive Affective	Understand Respond
CO5	***Inference*** the various concepts of clinical chemistry.	Cognitive Affective	Analyze Respond

UNIT I	BASICS OF PHARMACEUTICALCHEMISTRY	15

Definitions – the terms – drugs, pharmacology, pharmacy, chemotherapy, therapeutics – pharmacologically active principles in plants – first aid – important rules of first aids, cuts, fractures, bleeding for blood, maintaining breathing burns and first aid box – tuberculosis (t.b.), jaundice, piles, typhoid, malaria, cholera – causes – symptoms, diagnosis – prevention and treatment – medicinally important compounds of iron – ferrous gluconate, ferrous sulphate and ferric ammonium citrate.

UNIT II	ANTIBIOTICS	15

Definition – introduction – classification and biological actions – penicillin, chloramphenicol, streptomycin and tetracycline – structure, properties and therapeutic uses – chemical structure and pharmacological activity – effect of unsaturation, chain length, isomerism, halogens, amino groups, hydroxyl groups and acid groups.

UNIT III	ANALGESIC AND ANTIPYRETICS	15

Narcotic analgesic – analgesic action of morphine – derivatives of morphine – heroin and apomorphine – synthetic analgesics – pethidine, methadone – nonnarcotic analgesic – aspirin, paracetamol and phenacetin – analgin – preparation, properties and uses – ibuprofen and ketoprofen – structure and uses.

UNIT IV	ANAESTHETICS AND LOCAL ANAESTHETICS	15

Characteristics of anaesthetics – classification of anaesthetics – general anaesthetics – volatile anaesthetics – ether, chloroform and halothane – advantages and disadvantages – non-volatile anaesthetics (intravenous anaesthetics) – methohexitone and propanidid – structure and uses – cocaine and amethocaine – structure and uses – benzocaine and procaine – structure,
synthesis and uses.

UNIT V	CLINICAL CHEMISTRY	15

Determination of sugar (glucose) in serum – *o*-toluidine method – diagnostic test for sugar in urine – Benedict‟s test – detection of diabetes – detection of cholesterol in urine – detection of anaemia – estimation of haemoglobin (Hb concentration) – red cell count.

LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL
60	15	-	-	75

TEXT BOOKS

1. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry; 5th Ed., S.Chand and Company Ltd., New Delhi, (2014).

REFERENCES

1. S. Lakshmi; Pharmaceutical Chemistry; 1st Ed., S. Chand and Company Ltd., NewDelhi, (1995).
2. Bhagavathi Sundari; Applied Chemistry; 1st Ed., MJP Publishers.

COURSE CODE	YCY301	L	T	P	C
COURSE NAME	ORGANIC CHEMISTRY II	4	1	0	5
		L	T	P	H
C: P: A	4.5:0:0.5	4	1	0	5

COURSE OUTCOMES:		Domain	Level
CO1	***Recall*** and ***summarize*** the nucleophilic substitution reactions of aliphatic and aromatic compounds.	Cognitive	Remember Understand
CO2	***Outline*** the reaction mechanism ofelectrophilic substitution reactions and explain the structure and orientation of the substituted products.	Cognitive	Remember Understand
CO3	***Identify***the reagents of various rearrangement reaction and***illustrate***the mechanism of the addition and elimination reactions	Cognitive	Apply Understand
CO4	***Recognize*** and ***Interpret*** the preparation and properties ***of*** various heterocyclic compounds	Cognitive Affective	Understand Receive
CO5	***Understand*** and ***Examine*** the structural components of various of natural products.	Cognitive Affective	Analyze Receive

UNIT I - NUCLEOPHILIC SUBSTITUTION REACTIONS **15**

Aliphatic nucleophilic substitution – mechanisms – SN1, SN2, SNi – ion-pair inSN1 mechanisms – neighbouring group participation, non-classicalcarbocations – substitutions at allylic and vinylic carbons. Reactivity – effect of structure, nucleophile, leaving group and stereochemical factors – correlation of structure with reactivity – solvent effects – rearrangements involving carbocations – Wagner-Meerwein and dienone-phenol rearrangements.

Aromatic nucleophilic substitutions – SN1, SNAr, Benzyne mechanism – reactivity orientation – Ullmann, Sandmeyer and Chichibabin reaction – rearrangements involving nucleophilic substitution – Stevens – Sommelet- Hauser and von-Richter rearrangements.

UNIT II - ELECTROPHILIC SUBSTITUTION REACTIONS **15**

Aromatic electrophilic substitution reaction – orientation, reactivity and mechanisms based on transition state theory with suitable reactions – substitutions in thiophene and pyridine – N-oxide quantitative treatment of the structural effects on reactivity. Substituent effects – origins of Hammett equation – principles of Hammett correlation – effect of structure on reaction mechanisms Hammett parameters – σ and ρ, modified forms of Hammett equation, Taft Equation.

Aliphatic electrophilic substitution – SE2, SEi and SE1 mechanisms – diazonium coupling reactions – metals as electrophile in substitution reactions and decomposition of diazonium salts.

UNIT III - ADDITION AND ELIMINATION REACTIONS **15**

Addition to carbon-carbon multiple bonds – electrophilic, nucleophilic and free radical additions – orientation of the addition – stereochemical factors influencing the addition of bromine and hydrogen bromide, hydroxylation, 1,2- dihydroxylation – hydroboration leading to formation of alcohols – oxidation and ozonolysis. Addition to carbonyl and conjugated carbonyl systems – mechanism – Grignard reagents – 1,2- and 1,4-additions (lithium dimethylcuprate) – addition to
carbon-oxygen double bond – Benzoin, Knoevenagel, Stobbe, Darzens glycidic ester condensation and Reformatsky reactions.
Elimination reactions – mechanisms; E1, E2, E1cB – stereochemistry of elimination, Hofmann‟s and Zaitsev‟s rules – competition between elimination and substitution – pyrolytic *cis*-elimination, Chugaev reaction – examples such as Hofmann degradation, Cope elimination – Bredt‟s rule with examples.

UNIT IV - HETEROCYCLES	**15**

Nomenclature: Trivial, systematic and replacement nomenclature – nonaromatic heterocycles – synthesis of tetrahydrofurans – pyrrolidines – tetrahydropyrans – piperidines. Synthesis and reactivity of heterocycles: aziridines – oxiranes – thiiranes – azetidines – oxetanes – oxazoles – imidazoles – thiazoles – isooxazoles. Synthesis and reactivity of aromatic heterocycles: pyrazoles – isothiazoles – triazoles – pyrimidines – purines – triazines – pyridazines – pyrazines.

UNIT V - NATURAL PRODUCTS	**15**

Terpenoids: introduction – biosynthesis of menthol, camphor – total synthesis: Takasago synthesis of menthol, Corey's synthesis of longifolene, Curran's synthesisof hirsutene. Steroids: introduction – partial synthesis of androsterone and testosterone (from Cholesterol) – total synthesis: Johnson's synthesis of progesterone and Vollhardt's synthesis of estrone. Alkaloids: introduction – biosynthesis of nicotine, camptothecin – total synthesis: Corey's synthesis of epibatidine, Comin's asymmetric synthesis of Camptothecin and Woodward's synthesis of reserpine.

LECTURE	TUTORIALS	SELF STUDY	PRACTICAL	TOTAL
60	15	-	-	75

TEXT BOOKS

1. S. H. Pine and J. B. Hendrickson, D. J. Cram and G. S. Hammond, Organic Chemistry; 5th Ed., McGraw Hill, Noida, (1987).
2. T. H. E. Lowry and K. S. Richardson, Mechanism and Theory in Organic Chemistry; 3rd Ed., Benjamin-Cummings Publishing, USA, (1997).
3. J. March and M. B. Smith, Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 6th Ed., Wiley, New York, (2007).
4. J. Clayden, N. Greeves, S. Warren, and P. Wothers, Organic Chemistry, 2nd Ed., Oxford University Press, UK, (2012).
5. I. L. Finar, Organic Chemistry; Vol.II, 7th Ed., Pearson Education Ltd., New Jersey, (2009).

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1. R. K. Bansal, Reaction Mechanism in Organic Chemistry; Tata McGraw Hill, Noida, (1990)
2. F. A. Carey, and R. J. Sundberg, Advanced Organic Chemistry, Parts A and B, 5th Ed., Springer, Germany, (2007).

3. E. J. Corey, and X-M. Cheng, The Logic of Chemical Synthesis; 1st Ed., Wiley-Interscience,
New York, (1995).
4. T. L. Gilchrist, Heterocyclic Chemistry; 3rd Ed., Prentice Hall, New Jersey, 1997.
5. R. K. Bansal, Heterocyclic Chemistry; 3rd Ed., Wiley Eastern Ltd, New Delhi, 1999.
6. K. C. Nicolaou and E. J. Sorensen, Classics in Total Synthesis, Targets, Strategies,Methods; Wiley VCH, Germany, 1996.
7. Longifolene: F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry; Vol.2.5th Ed., Springer, Berlin, 2008.
8. Androsterone and Testosterone: J. Chem. Soc. Perkin Trans. I; 1986, 117.
9. Epibatidine: J. Org. Chem; 1993, 58, 5600.
10. Estrone, Estradiol and 2-Methoxyestradiol: J. Org. Chem; 2009, 74, 6362.

COURSE CODE	COURSE NAME	L	T	P	C
YCY305	ANALYTICAL CHEMISTRY	4	1	0	5
PREREQUISITES	NIL	L	T	P	H
C:P:A	4.4:0:0.6	4	1	0	5

COURSE OUTCOMES		Domain	Level
CO1	***Describe*** the basic principle of instrumental methods	Cognitive	Remember, Understand
CO2	***Classify*** the various types of analytical error and show their significance.	Cognitive	Remember, Understand
CO3	***Inspect*** the application ofvarious techniques in chromatography.	Cognitive Affective	Analyze Receive
CO4	***Illustrate*** the principles and instrumentation of thermoanalytical and fluorescence techniques.	Cognitive	Understand, Analyze
CO5	***Examine*** the concept of electroanalytical techniques.	Cognitive Affective	Analyze, Respond

UNIT I: INSTRUMENTAL METHODS OF ANALYSIS **15**

Principles and applications of extended X-ray absorption fine structure (EXAFS) – surface extended X-ray absorption (SEXAFS) – atomic absorption spectroscopy (AAS) – flame emission spectroscopy (FES) – turbidimetry – theory and applications.

UNIT II: DATA AND ERROR ANALYSIS **15**

Various types of error – accuracy, precision, significant figures – frequency distributions, the binomial distribution, the Poisson distribution and normal distribution – describing data, population and sample, mean, variance, standard deviation, way of quoting uncertainty, robust estimators, repeatability and reproducibility of measurements.

Hypothesis testing, levels of confidence and significance, test for an outlier, testing variances, means t-Test, paired t-Test – analysis of variance (ANOVA) – correlation and regression.

Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals – general polynomial equation fitting, linearizing transformations, exponential function fit – r and its abuse – multiple linear regression analysis, elementary aspects.

UNIT III: CHROMATOGRAPHY **15**

Solvent extraction – principles of ion exchange, paper, thin-layer and column chromatography techniques – columns, adsorbents, methods, Rf values, McReynold's constants and their uses – HPTLC, HPLC techniques – adsorbents, columns, detection methods, estimations, preparative column – GC-MS techniques – methods, principles and uses.

UNIT IV: THERMOANALYTICAL METHODS AND FLUORESCENCE SPECTROSCOPY	**15**

Principles – instrumentations and applications of thermogravimetry analysis (TGA), Differential Thermal Analysis (DTA) and Differential Scanning - Calorimetry (DSC) –thermometric titrations – types – advantages.

Basic aspects of synchronous fluorescence spectroscopy – spectral hole burning – flow cytometry – fluorometers (quantization) – instrumentation – applications.

UNIT V: ELECTROANALYTICAL TECHNIQUES	**15**

Electrochemical sensors, ion-sensitive electrodes, glass – membrane electrodes, solid-liquid membrane electrodes – ion-selective field effect transistors (ISFETs) – sensors for the analysis of gases in solution.

Po larography – principles and instrumentation – dropping mercury electrode – advantages – Ilkovic equation – applications of polarography – polarographic maxima – oscillographic polarography, AC polarography – cyclic voltammetry – advantages over polarographic techniques – chronopotentiometry – advantages – controlled potential coulometry – amperometric titrations: principles – techniques – applications – estimation of lead.

LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL
60	15	-	-	75

TEXT BOOKS

1. D. B. Hibbert and J. J. Gooding, Data Analysis for Chemistry; Oxford UniversityPress, UK, 2006.
2. J. Topping, Errors of Observation and Their Treatment; 4th Ed., Chapman Hall, London, (1984).
3. A. Braithwaite and J. F. Smith, Chromatographic Methods; 5th Ed., Springer, Germany; (1995).
4. V. K. Srivastava and K. K. Srivastava, Introduction to Chromatography; 2nd Ed.,Holden Day, New York, (1985).
5. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis; 6th Ed., CBS Publishers and Distributors, Chennai, (1986).
6. D. A. Skoog, D. M. West and D. J. Holler, Fundamentals of Analytical Chemistry, 7th Ed., Harcourt College Publishers, Singapore, (2004).
7. A. Sharma, S. G. Schulman, Introduction to Fluorescence Spectroscopy; Wiley- Interscience, New York, (1999).

REFERENCES

1. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy; 4th Ed., Tata McGraw-Hill, New Delhi, (1994).
2. A. I. Vogel, Text Book of Quantitative Inorganic Analysis; 6th Ed., Longman, New Delhi, (2000).
3. D. C. Harris, Quantitative Chemical Analysis; 4th Ed., W. H. Freeman Publications, New York, (1995).
4. S. C. Gupta, Fundamentals of Statistics; 6th Ed., Himalaya Publications, Delhi, (2006).

COURSE CODE	COURSE NAME	L	T	P	C
YEC304A	PHARMACEUTICAL CHEMISTRY	4	1	0	5
PREREQUISITES	Nil	L	T	P	H
C:P:A	4:0:1	4	1	0	5

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Recall*** the various terminology of pharmaceutical chemistry.	Cognitive	Remember Understand
CO2	***Outline*** the structural aspects of antibiotics and ***relate*** their functions..	Cognitive	Understand
CO3	***Illustrate*** the biological activities of analgesic andantipyretics.	Cognitive Affective	Remember Understand Receive
CO4	***Summarize*** the activities of an aesthetics and localanaesthetics.	Cognitive Affective	Understand Respond
CO5	***Inference*** the various concepts of clinical chemistry.	Cognitive Affective	Analyze Respond

UNIT I	BASICS OF PHARMACEUTICALCHEMISTRY	15

Definitions – the terms – drugs, pharmacology, pharmacy, chemotherapy, therapeutics – pharmacologically active principles in plants – first aid – important rules of first aids, cuts, fractures, bleeding for blood, maintaining breathing burns and first aid box – tuberculosis (t.b.), jaundice, piles, typhoid, malaria, cholera – causes – symptoms, diagnosis – prevention and treatment – medicinally important compounds of iron – ferrous gluconate, ferrous sulphate and ferric ammonium citrate.

UNIT II	ANTIBIOTICS	15

Definition – introduction – classification and biological actions – penicillin, chloramphenicol, streptomycin and tetracycline – structure, properties and therapeutic uses – chemical structure and pharmacological activity – effect of unsaturation, chain length, isomerism, halogens, amino groups, hydroxyl groups and acid groups.

UNIT III	ANALGESIC AND ANTIPYRETICS	15

Narcotic analgesic – analgesic action of morphine – derivatives of morphine – heroin and apomorphine – synthetic analgesics – pethidine, methadone – nonnarcotic analgesic – aspirin, paracetamol and phenacetin – analgin – preparation, properties and uses – ibuprofen and ketoprofen – structure and uses.

UNIT IV	ANAESTHETICS AND LOCAL ANAESTHETICS	15

Characteristics of anaesthetics – classification of anaesthetics – general anaesthetics – volatile anaesthetics – ether, chloroform and halothane – advantages and disadvantages – non-volatile anaesthetics (intravenous anaesthetics) – methohexitone and propanidid – structure and uses – cocaine and amethocaine – structure and uses – benzocaine and procaine – structure, synthesis and uses.

UNIT V	CLINICAL CHEMISTRY	15

Determination of sugar (glucose) in serum – *o*-toluidine method – diagnostic test for sugar in urine – Benedict's test – detection of diabetes – detection of cholesterol in urine – detection of anaemia – estimation of haemoglobin (Hb concentration) – red cell count.

LECTURE	TUTORIAL	SELF STUDY	PRACTICAL	TOTAL
60	15	-	-	75

TEXT BOOKS

1. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry; 5th Ed., S.Chand and Company Ltd., New Delhi, (2014).

REFERENCES

1. S. Lakshmi; Pharmaceutical Chemistry; 1st Ed., S. Chand and Company Ltd., New Delhi,

(1995).
2. Bhagavathi Sundari; Applied Chemistry; 1st Ed., MJP Publishers, Chennai,

COURSE CODE	COURSE NAME	L	T	C
YEC403B	INDUSTRIAL CHEMISTRY	4	1	5
		L	T	H
C:P:A	3.75:0.75:0.5	4	1	5

COURSE OUTCOMES: *On the successful completion of the course, students will be able to*		DOMAIN	LEVEL
CO1	***Illustrate*** the basic ideas of an industry and industrial wastes.	Cognitive Psychomotor	Remember Understand Set
CO2	***Rephrase*** and ***Report***the preparation and properties of petroleum and petrochemicals.	Cognitive Affective	Understand Respond
CO3	***Identify*** the role and functions of portland cement.	Cognitive Affective	Understand Apply Respond
CO4	***List*** the various process involved in the paper industry	Cognitive Psychomotor	Analyze Perception
CO5	***Outline*** the preparation and mode of action of soaps, detergents and perfumes.	Cognitive Psychomotor	Analyze Perception

SYLLABUS:

UNIT I	**Basic Ideas and Industrial Wastes**	
Basics idea about unit operation – flow chart – chemical conversion – batch versus continuous processing – chemical process selection – design – chemical process control. Types of industrial wastes – treatment of wastes or effluent with organic impurities – treatment of wastes or effluent with inorganic impurities – treatment of some important chemical wastes.		**15**
UNIT II	**Petroleum and Petrochemicals**	
Introduction – saturated hydrocarbons from natural gas – uses of saturated hydrocarbons – unsaturated hydrocarbons – acetylene, ethylene, propylene, butylene – aromatic hydrocarbons – toluene and xylene. Preparation of rectified spirit from beat – methylated spirit – preparation of absolute alcohol from rectified spirit – petrochemicals in India.		**15**
UNIT III	**Manufacture of Cement**	
Introduction – types of cement – high alumina cement, water proof cement, slag cement, acid resisting cement, white cement, coloured cement, Pozzolana cement. Setting of cement – properties of cement – testing of cement – uses of cement –concrete – cement industries in India.		**15**
UNIT IV	**Pulp and Paper and Manufacture of Paper**	
Introduction – manufacture of pulp – types of pulp – sulphate or craft pulp, soda pulp, Rag pulp – beating, refining, filling, sizing and colouring. Calendaring – uses – paper industries in India.		**15**
UNIT V	**Soaps, Detergents and Perfumes**	

Introduction – types of soaps – hard and soft soaps – manufacture of soap (hot and continuous process only) – cleansing action of soap – detergents – surface active agents – biodegradability of surfactants, amphoteric detergents. Introduction – production of natural perfumes – flower perfumes – jasmine, rose and lily – production of synthetic perfumes – muscone and nitro-musks.	**15**

REFERENCE BOOKS:

1. B. K. Sharma, Industrial Chemistry; 8th Ed., Goel Publishing House, New Delhi, 1997.
2. R. N. Shreve, and J. A. Brink Jr. Chemical Process Industries; 4th Ed., McGraw Hill, Toronto, 1977.
3. A. C. S. Brain, Production and Properties of Industrial Chemicals; Reinhold, New York, 1989.

	LECTURE	TUTORIAL	SELF-STUDY	TOTAL HOURS
Hours	**60**	**15**	**-**	**75**

COURSE CODE	**COURSE NAME**	**L**	**T**	**C**
YEC404B	**CHEMISTRY OF NANOSCIENCE AND NANOTECHNOLOGY**	**4**	**1**	**5**
		L	**T**	**H**
C:P:A	**4.4:0:0.6**	**4**	**1**	**5**

COURSE OUTCOMES: ***On the successful completion of the course, students will be able to***		**DOMAIN**	**LEVEL**
CO1	***Outline*** the synthetic methods of nano materials.	Cognitive Psychomotor	Remember Understand Set
CO2	***Compare*** the properties and characterization of nano materials.	Cognitive Affective	Understand Respond
CO3	***Predict*** the reactions of nano particles	Cognitive Affective	Understand Apply Respond
CO4	***Classify*** the applications ofcarbon clusters andnanostructures.	Cognitive Psychomotor	Analyze Perception
CO5	***List*** the role and significance of nano particlesin nano device.	Cognitive Psychomotor	Analyze Perception

SYLLABUS:

UNIT I	**Synthetic Methods**	
Definition of nanodimensional materials – historical milestones – unique properties due to nanosize, quantum dots, classification of nanomaterials.General methods of synthesis of nanomaterials – hydrothermal synthesis, solvothermal synthesis – microwave irradiation– sol-gel and precipitation technologies – combustion flame – chemical vapour condensation process – gas-phase condensation synthesis – reverse micelle synthesis – polymer-mediated synthesis–protein microtubule-mediated synthesis – synthesis of nanomaterials using microorganisms and other biological agents – sonochemical synthesis –hydrodynamic cavitation. Inorganic nanomaterials – typical examples – nano TiO_2/ZnO/CdO/CdS, organic nanomaterials – examples – rotaxanes and catenanes		**15**
UNIT II	**Characterisation of Nanoscale Materials**	

Principles of Atomic Force Microscopy (AFM) – Transmission Electron Microscopy(TEM) Resolution and Scanning Transmission Electron Microscopy (STEM) – Scanning Tunneling Microscopy (STM) – Scanning Nearfield Optical Microscopy (SNOM).Scanning ion conductance microscope, scanning thermal microscope, scanning probe microscopes and surface plasmon spectroscopy.	**15**
UNIT III **Reactions in Nanoparticles**	
Reactions in nanospace – nanoconfinement – nanocapsulesCavitands, cucurbiturils, zeolites, M.O.Fs, porous silicon, nanocatalysis.	**15**
UNIT IV **Carbon Clusters and Nanostructures**	
Nature of carbon bond − new carbon structures − carbon clusters – discovery of C60−alkali doped C60−superconductivity in C60−larger and smaller fullerenes. Carbon nanotubes – synthesis − single walled carbon nanotubes − structure and characterization − mechanism of formation − chemically modified carbon nanotubes −doping − functionalizing nanotubes − applications of carbon nanotubes. Nanowires −synthetic strategies − gas phase and solution phase growth – growth control − properties.	**15**
UNIT V **Nanotechnology and Nanodevices**	
DNA as a nanomaterial – DNA – knots and junctions, DNA – nanomechanical device designed by Seeman. Force measurements in simple protein molecules and polymerase – DNA complexes–molecular recognition and DNA based sensor. Protein nanoarray, nanopipettes, molecular diodes, self-assembled nanotransistors, nanoparticle mediated transfection.	**15**

REFERENCE BOOKS:

1. C. N. R. Rao, A. Muller and A. K. Cheetham (Eds), The Chemistry of Nanomaterials: Vol. 1 and 2; Wiley-VCH;Germany, Weinheim, 2004.
2. C. P. Poole, Jr: and F. J. Owens, Introduction to Nanotechnology; Wiley Interscience, New Jersey, 2003.
3. K. J. Klabunde (Ed), Nanoscale Materials in Chemistry; 2nd Ed., Wiley-Interscience, New York, 2009.
4. T. Pradeep, Nano: The Essentials in Understanding Nanoscience and Nanotechnology; 1st Ed., Tata McGraw Hill, New York, 2007.
5. H. Fujita (Ed.), Micromachines as Tools in Nanotechnology; Springer-Verlag, Berlin, 2003.
6. Bengt Nolting, Methods in Modern Biophysics; 3rd Ed., Springer-Verlarg, Berlin, 2009.
7. H. Gleiter, Nanostructured Materials: Basic Concepts, Microstructure and Properties, Elsevier, Chennai, 2000.
8. W. Kain and B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life; 2nd Ed., John-Wiley R Sons, New York, 2013.

Hours	LECTURE	TUTORIAL	SELF-STUDY	TOTAL HOURS
	60	15	-	75