SEMESTER: I
COURSE CODE: 23PCH1C01
TITLE OF THE COURSE: CORE 1: ORGANIC CHEMISTRY – I
(ORGANIC REACTION MECHANISM)
(Skill Development)

COURSE OBJECTIVES:

- To understand the mechanism, the path and the feasibility of a chemical reaction.
- To understand the techniques involved in the substitution, electrophilic, nucleophilic, addition and elimination reactions.

COURSE OUTCOMES:

At the end of the course, the student will have the ability to

CO1	Explain aromaticity, kinetic - non-kinetic methods of reaction mechanism.	**K2**
CO2	Describe the electrophilic substitution on monosubstituted and disubstituted benzenes.	**K1**
CO3	Analyze the factors affecting nucleophilic substitution reaction – nature of the substrate, solvent, nucleophile and leaving group.	**K4**
CO4	Discuss the stereochemistry of elimination reactions and their mechanisms.	**K2**
CO5	Categorize the electrophilic, nucleophilic and free radical addition.	**K4**

Syllabus

Credits: 5 **Instructional Hours: 90**

UNIT I: AROMATICITY (K2) **(18 Hours)**

Huckel's Rule. benzenoid - non benzenoid aromatics - concept of aromaticity, non- aromatic - antiaromatic systems, Craig's rule, alternant - non-alternant hydrocarbons – chemistry of fullerenes, sydnones – tropolones – fulvenes, ferrocene, azulene, annulenes, and heteroannulenes. kinetic and non-kinetic methods of study of reaction mechanisms - primary and secondary kinetic isotopic effects, study of reaction mechanism, study of intermediates, isotopic labelling, stereo chemical studies and cross over experiments. Hammond's Postulate. Linear free energy relationship - Hammett Equation and Taft Equation.
(Self-Study: NMR Spectrum of 18 – Annulene, Difference between intermediate and transition state, Kinetically & Thermodynamically controlled reactions)

UNIT II: ALIPHATIC AND AROMATIC ELECTROPHILIC SUBSTITUTION REACTIONS(K1) **(18 Hours)**

Introduction - mechanism of electrophilic substitution reactions - halogenation, nitration, sulphonation, Friedel – Crafts alkylation and acylation reactions. Orientation and reactivity. Electrophilic substitution on monosubstituted and disubstituted benzenes. Typical reactions - Gattermann - Koch, Bischler Napieralski. Kolbe-Schmitt, Hofmann-Martius and Jacobson's reactions. Aliphatic electrophilic Substitution Reactions -$SE1$, $SE2$ and Se_i mechanisms, structure reactivity relationship. Friedel Crafts acylation at olefinic carbon – Stork – Enamine Reaction. Typical substitution reactions - Von Braun reaction, Claisen condensation and hydrolysis of esters.
(Beyond the Curriculum: Orientation and reactivity of trisubstituted benzene)

UNIT III: ALIPHATIC AND AROMATIC NUCLEOPHILIC SUBSTITUTION REACTIONS (K4) **(18 Hours)**

Mechanism of aliphatic nucleophilic substitution - $SN1$, $SN2$, $SN1CB$ and SNI.Factors affecting nucleophilic substitution reaction – nature of the substrate, solvent, nucleophile and leaving group. Neighboring group participation (NGP). Ambient nucleophiles, ambient substrates. Stereochemistry of nucleophilic substitution reactions. Substitution at vinyl carbon allylic carbon, bridge head carbon compounds. Aromatic nucleophilic substitution reactions -

benzyne mechanism - intermediate complex mechanism and S_NAR mechanism - structure reactivity relationship - Ziegler alkylation and Chichibabin reaction.

UNIT IV: ELIMINATION REACTIONS (K2) (18 Hours)

Elimination reactions: E_1, E_2, E_i, E_1CB mechanisms, stereochemistry of elimination reactions, effect of substrate structure, effect of attacking base, effect of leaving group, effect of medium and eliminations versus substitution. Typical elimination reactions - Chugaev reaction, Hoffmann degradation, Cope elimination and dehydration of alcohols. carbenes and nitrenes - structure, generation and reactions.

UNIT V: ADDITION REACTIONS (K4) (18 Hours)

Electrophilic, nucleophilic and free radical addition reaction to double and triple bonds - hydration, hydroboration, Michael Addition, epoxidation and hydroxylation. Addition reactions to carbonyl compounds – Mannich, Claisen Schmidt, Dieckmann, Stobbe, Knoevenagel, Darzen, Wittig, Perkin, Thorpe and benzoin reactions. Stereo selectivity in carbonyl addition reactions – Cram's Rule.
(Self-Study: Compare the electrophilic and nucleophilic addition of olefins.)

TEXT BOOKS

1. March J and Smith.M.B.2007. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure.6th Edition. Wiley. New Jersey.
2. Finar, I.L. 2012. Organic Chemistry- Volume 1. 6th Edition. Pearson Education Ltd. London

REFERENCE BOOKS

1. Morrison, RT. Boyd R.S. 2012. Organic Chemistry. 7th Edition. Prentice Hall of India Pvt. Ltd. New Delhi.
2. Mukherji S.M. and Singh. S.P. 1990. Organic Reaction Mechanism. MacMillan India Ltd. Chennai.
3. Ahluwalia V.K. and Parashar R.K. 2009. Organic Chemistry. Viva Books (P) Ltd. Delhi
4. Agarwal. O.P. 2008. Organic Chemistry Reactions & Reagents. Krishna and Prakashan Media. Meerut
5. Jagadamba Singh and Yadav L.D.S. 2011. Advanced Organic Chemistry. Publisher- Pragati Prakashan. Delhi
6. Kalsi P.S.2011. Organic Reactions and Mechanisms. New Age International. Private limited. New Delhi.
7. N. Tewari. 2011. Advanced Organic Reaction Mechanisms. 3rd Edition. Books and Allied Private Ltd. Kolkata

BLENDED LEARNING

UNIT IV: ELIMINATION REACTIONS (K2)

Topic	Links
Elimination Reactions: E_1 Reaction	https://www.khanacademy.org/science/organic-chemistry/substitution-elimination-reactions/elimination-reactions-tutorial/v/e1-reactionshttps://www.youtube.com/watch?v=EZvJ0OPtNrA
E_2 Reaction	https://www.khanacademy.org/science/organic-chemistry/substitution-elimination-reactions/elimination-reactions-tutorial/v/e2-reactions
E_1CB	https://www.youtube.com/watch?v=B494VE1IVfo
E_1 Vs. E_2	https://www.youtube.com/watch?v=jdajgFJHYsU
Stereochemistry of Elimination Reactions	https://www.youtube.com/watch?v=zrpSJ7C8CLE
Stereochemistry of E_2 Reaction	https://www.youtube.com/watch?v=Pb47EQ3r0hA

Effect of Substrate Structure in Elimination Reaction	https://www.khanacademy.org/science/organic-chemistry/substitution-elimination-reactions/e1-e2-tutorial/v/e1-elimination-mechanism
Effect of Leaving Group	https://www.youtube.com/watch?v=8ipH5NYF93I https://www.youtube.com/watch?v=gTTS0pja4Xw https://www.youtube.com/watch?v=gTTS0pja4Xw
Effect of Medium	https://www.khanacademy.org/science/organic-chemistry/substitution-elimination-reactions/sn1-sn2-e1-e2-jay/v/elimination-vs-substitution-reagent
Effect of Solvent in E_2 Reaction	https://www.youtube.com/watch?v=9ghdh-eciBM
Effect of Solvent in E_1 Reaction	. https://www.youtube.com/watch?v=CT-PuIvKkgU
Eliminations Versus Substitution	https://www.youtube.com/watch?v=gIVddEzZmdM
Chugaev reaction	https://www.youtube.com/watch?v=PvOSs28xjxw
Hoffmann Degradation/Rearrangement	https://www.youtube.com/watch?v=PLB2h22-tr4
Cope Elimination	https://www.youtube.com/watch?v=RpH_7mMQNk0
Dehydration of Alcohols	https://www.youtube.com/watch?v=hEIEOHYkcwI
Carbenes Structure, Generation and reactions	https://www.youtube.com/watch?v=YJrzXHJ9I1M
Nitrenes Structure, Generation and Reactions	https://www.youtube.com/watch?v=t0ezotERf6c

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	2	3	2	2	2		2		2		3	2
CO2	3	1	1			2		1					3	2
CO3	3	1	1					1					3	2
CO4	3	2	2		2	2	2	1	2	1		2	3	2
CO5	3	2	1					1			2		3	2

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Twice in a Semester
6.	Unit – III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Quiz	Once in a Semester

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: I
COURSE CODE: 23PCH1C02
TITLE OF THE COURSE: CORE 2: INORGANIC CHEMISTRY - I
(RING COMPOUNDS, SOLID STATE AND NUCLEAR CHEMISTRY)
(Skill Development)

COURSE OBJECTIVES:

- To make the student to understand about the crystal structures of various compounds, defects in crystal structure, properties of solids.
- To describe the nuclear chemistry in depth.

COURSE OUTCOMES:

At the end of the course the students will have the ability to

CO1	Explain the coordination number, radius ratio, structure of ionic crystals and defects in crystal structure.	**K2**
CO2	Describe the preparation and properties of inorganic polymers.	**K1**
CO3	Analyze the electrical, magnetic and optical properties of solids	**K4**
CO4	Explain n / p ratio, binding energy and radioactive decay.	**K2**
CO5	Write Q - value of nuclear reactions and application of radio isotopes	**K1**

Syllabus

Credits: 4 **Instructional Hours: 75**

UNIT I: SOLID STATE CHEMISTRY (K2) **(15 hours)**

Ionic crystals - coordination number, radius ratio rule. Structure of ionic crystals CsCl, ZnS (zinc blende and wurtzite), rutile, spinels & inverse spinels. Metallic state free electron theory. Electronic structure of solids - band structure of metals, insulators & semi-conductors. Band theory of semiconductor. Non stoichiometry, point defects in solids – Schottky & Frenkel defects.
(Self-Study: Primitive and non-primitive unit cell, Bravais Lattices and Packing in crystals)

UNIT II: INORGANIC RINGS AND CHAINS (K1) **(15 Hours)**

Preparation, properties & structure of borazines, phosponitrilic compounds (trimer &tetramer). Nitrides of sulphur – S_4N_4, $(NSF)_3$, $(NSF)_4$. Isopoly and hetero poly acids of molybdenum and tungsten. Organo halosilanes, silanols and siloxanes.

Borane and its derivatives – correlation between structure and number of electrons involved in bonding in the frame work - Wade's rules – closo, nido, arachno and hypho structures.

UNIT III: PROPERTIES OF SOLIDS (K4) (15 Hours)

Electrical properties – superconductivity - superconducting elements – critical temperature – persistent currents – thermoelectric effects - Thomson effect, Peltier effect &Seeback effect – magnetic properties (perfect diamagnetism) – Meissner Effect. Optical properties of solids - lasers, luminescence.

UNIT IV: NUCLEAR CHEMISTRY (K2) (15 Hours)

Nucleus - subatomic particles - properties – binding energy - n-p ratio in stable and metastable nuclei - different types - nuclear forces - liquid drop model - shell model - mode of radioactive decay - A, B, Γ Decay - electron Capture - nuclear isomerism - internal conversion- Experimental methods: Cloud chamber, nuclear emulsion, nubble chamber, proportional counter, GM counter- scintillation and Cherenkov counters, nuclear reactor, Particle accelerators: Linear accelerators- cyclotron, synchrotron, betatron and bevatron.
(Beyond the Curriculum: Nuclear power plants in India)

UNIT V: NUCLEAR REACTIONS (K1) (15 Hours)

Q-Value, columbic barrier, cross section, different types of nuclear reactions- projectiles capture – particle emission, spallation, fission fusion-theories of fission, use of fission products, fissile and fertile isotopes – U^{233}, U^{235}, Pu^{239}, Th^{232} - atomic power projects in India, stellar energy, synthetic elements – application of radio isotopes - hot atom chemistry.
(Self-Study: Radio carbon dating and rate equation for average half-life of radioactive isotopes.)

TEXT BOOKS

1. Gurdeep Raj. (2014). Advanced Inorganic Chemistry. 12th Edition. Geol Publishing House. Delhi
2. Madan. R.D. (2011). Advanced Inorganic Chemistry. 3rd Edition. S. Chand & Company, New Delhi.
3. Arnikar, H.J. (2000). Essentials of Nuclear Chemistry. 4th Edition. New Age International. Delhi

REFERENCE BOOKS

1. Huheey, J.E. (1993) Inorganic Chemistry - Principles, Structure and Reactivity. Harper Collins, IV Edition. New York
2. Cotton F.A. and Wilkinson, G. (1988) Advanced Inorganic Chemistry –A Comprehensive Text, John Wiley and Sons, V Edition. New Jersey.
3. West. A R (2013). Solid State Chemistry and its applications, Wiley &Sons. New Jersey.
4. Sarkar, R.P. (2012). General and Inorganic chemistry, (Parts I), 3rd Edition, New Central Book Agency (P)Ltd, India.
5. Atkins, P.W. Overton, T. J. Rourke, M. Weller and F. Armstrong; Shriver & Atkins: (2006) Inorganic Chemistry, 4th Ed. Oxford University Press. Oxford.
6. Pilli, S.O. (2010) Solid State Physics, Revised VI Edition, Publishers - New Age International, Ltd, New Delhi.
7. Lee, J.D. (1988) Modern Concepts in Inorganic Chemistry, V Edition, Wiley, New Jersey.
8. Friedlander, G. Kennedy, J. W. and J. M. Miller, (2000). Nuclear and Radiochemistry, John Wiley and Sons Inc., Second Edition. Japan.
9. Banerjee, S.P. (2013) Advanced Inorganic Chemistry – Vol. I Books and Allied (P)Ltd. India.

BLENDED LEARNING

UNIT V: NUCLEAR REACTIONS (K1)

Topic	Links

Nuclear reactions -Q-value	https://youtu.be/hGl-ny8mJXw
Coulombic barrier, cross section	https://youtu.be/iM2h9GuBh_E
Different types of nuclear reactions-projectiles capture – particle emission, spallation, fission fusion	https://youtu.be/RCho1BlILI0
Theories of fission, use of fission products	https://youtu.be/0kLXGTob9s8, https://youtu.be/SX-VGGTp6W8
fissile and fertile isotopes – U^{233}, U^{235}, Pu^{239}, Th^{232}-	https://youtu.be/GKkoiCevFyY
atomic power projects in India	https://youtu.be/67SuH-KsR_U
stellar energy	https://youtu.be/FaRK0SPmprM, https://youtu.be/v3y8AIEX_dU
synthetic elements	https://youtu.be/mH2Ts1hxg9U, https://youtu.be/4MU22xvaLqY
application of radio isotopes	https://youtu.be/4xxqDE4DsEY

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2		2								1	1	
CO2	3	1		1	3					2			2	
CO3	3		1	1	2				1	2	3	3	2	2
CO4	3	2	3	1		3	2		2	2	2	3	2	2
CO5	2	2	3	3		3	2	1		2	2	3	1	2

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
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3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Quiz	Once in a Semester

Course Designed by: **.J.Antonette Luciana Sherryn**	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

POST GRADUATE PROGRAMME – M.Sc. CHEMISTRY

LEARNING OUTCOME BASED CURRICULUM FRAMEWORK under CBCS PATTERN

SYLLABUS & SCHEME OF EXAMINATION

(For the candidates admitted from the academic year 2023 – 2024 onwards)

SEMESTER	COURSE CODE	TITLE OF COURSE	NATURE	INSTRUCTIONAL HOURS	CREDIT POINTS	EXAM MARKS		
						CIA	ESE	TOTAL
I	23PCH1C01	Core 1 Organic Chemistry – I (Organic Reaction Mechanism**)** ***(Skill development)***	CC	5	5	25	75	100
	23PCH1C02	Core 2 Inorganic Chemistry - I (Ring Compounds, Solid State & Nuclear Chemistry) ***(Skill development)***	CC	5	5	25	75	100
	23PCH1C03	Core 3 Physical Chemistry - I (Group Theory, Kinetics & Photochemistry) ***(Skill development)***	CC	5	4	25	75	100
	23PCH1E01 23PCH1E02	Elective I Nanomaterials and their Applications (Or) Green Chemistry ***(Employability)***	DSE	3	4	25	75	100
	23PCH1CP1	Practical I Organic Chemistry – I	CC	4	-	-	-	-
	23PCH1CP2	Practical II Inorganic Chemistry – I	CC	4	-	-	-	-
	23PCH1CP3	Practical III Physical Chemistry – I	CC	4	-	-	-	-
II	23PCH2C04	Core 4 Organic Chemistry - II **(**Stereochemistry and Concerted Reactions) ***(Skill development)***	CC	5	4	25	75	100

	23PCH2C05	Core 5 Inorganic Chemistry - II (Coordination Chemistry) ***(Skill development)***	CC	5	4	25	75	100
	23PCH2C06	Core 6 Physical Chemistry – II (Quantum Mechanics & Electrochemistry) ***(Skill development)***	CC	5	5	25	75	100
	23PCH2E01 23PCH2E02	Elective II Analytical Chemistry (Or) Research Methodology ***(Employability)***	DSE	3	4	25	75	100
	23PCH1CP1	Practical I Organic Chemistry – I	CC	4	4	40	60	100
	23PCH1CP2	Practical II Inorganic Chemistry – I	CC	4	4	40	60	100
	23PCH1CP3	Practical III Physical Chemistry – I	CC	4	4	40	60	100
III	23PCH3C07	Core 7 Organic Chemistry – III (Chemistry of Natural Products) ***(Skill development)***	CC	5	4	25	75	100
	23PCH3C08	Core 8 Physical Chemistry - III (Thermodynamics) ***(Skill development)***	CC	5	4	25	75	100
	23PCH3C09	Core 9 Organic Spectroscopy ***(Skill development)***	CC	5	4	25	75	100
	23PCH3E01 23PCH3E02	Elective III Corrosion & Battery Technology (Or) Environmental Chemistry ***(Employability)***	DSE	3	4	25	75	100
	23PCH3CP4	Practical IV Organic Chemistry – II	CC	4	-	-	-	-
	23PCH3CP5	Practical V Inorganic Chemistry – II	CC	4	-	-	-	-
	23PCH3CP6	Practical VI Physical Chemistry – II	CC	4	-	-	-	-
IV	23PCH4C10	Core 10	CC	5	5	25	75	100

		Organic Chemistry – IV (Disconnection Approach and Organic Synthesis) ***(Skill development)***						
	23PCH4C11	Core 11 Inorganic Chemistry - III (Organometallics & Bio Inorganic Chemistry) ***(Skill development)***	CC	5	4	25	75	100
	23PCH4E01 23PCH4E02	Elective IV Medicinal Chemistry (Or) Phytochemistry ***(Employability)***	DSE	3	4	25	75	100
	23PCH3CP4	Practical IV Organic Chemistry – II	CC	4	4	40	60	100
	23PCH3CP5	Practical V Inorganic Chemistry – II	CC	4	4	40	60	100
	23PCH3CP6	Practical VI Physical Chemistry – II	CC	4	4	40	60	100
	23PCH4PVV	Project		5	4	50	50	100
		Digital Security		-	2			50
		MOOC/SWAYAM/NPTEL			2			
		Internship			2			
		TOTAL		**120**	**90** **+2** **+2** **+ 2**			**2200 + 50**

(CC- Core Courses, DSE- Discipline Specific Elective)

SEMESTER: I
COURSE CODE: 23PCH1C03
TITLE OF THE COURSE: CORE 3: PHYSICAL CHEMISTRY – I
(GROUP THEORY, KINETICS AND PHOTOCHEMISTRY)
(Skill Development)

COURSE OBJECTIVES:

- To learn about the general aspects of group theory that help to classify the molecules into different point groups
- To understand the principle reaction rate theories for gas phase reactions
- To learn about the basic concepts of Photochemical reactions.

COURSE OUTCOMES:

At the end of the course the students will have the ability to

CO1	Identify the point groups of molecules using symmetry selection rules	**K1**
CO2	Examine the group theory aspects with IR and Raman Spectra	**K4**
CO3	Explain the thermodynamic formulation and theories of reaction rates	**K2**
CO4	Study the influence of various factors on the rate of the reactions and different methods of fast reactions	**K1**
CO5	Study the theory and the experimental techniques of Photochemistry	**K2**

Syllabus

Credits: 4 **Instructional Hours: 75**

UNIT I: SYMMETRY ELEMENTS AND SYMMETRY OPERATIONS (K1) (15 Hours)

Rotation - axis of symmetry - symmetry planes - inversion center - improper rotations- effect of performing successive operations (commutative and non - commutative) - inverse operations. groups and their basic properties: definition of group - basic properties of a group - definition of abelian group - isomorphic group - similarity transformation and classes - group multiplication tables - symmetry classification of molecules into point groups (Schoenflies symbol only).

(Beyond the Curriculum: Application of symmetry operator measures)

UNIT II: REDUCIBLE REPRESENTATIONS AND VIBRATIONAL SPECTROSCOPY (K4) (15 Hours)

Definition of reducible and irreducible representations - irreducible representations as orthogonal vectors - direct product rule - great orthogonality theorem and its consequences (statement only proof not needed) - determinations of characters for irreducible - Representation Of C_2V and C_3V point groups using the orthogonality theorem - calculation of character values of reducible representations per unshifted atom for each type of symmetry operation-determination of total cartesian representation - determination of direct sum from total cartesian representation. Group theory and vibrational spectroscopy - vibrational modes as basis for group representation - Symmetry selection rules for IR and Raman spectra (mutual exclusion principle) - classification of vibrational modes.

UNIT III: CHEMICAL KINETICS (K2) (15 Hours)

Rates of chemical reaction – kinetics of first, second and third order reactions – complex methods of determining rate laws, order and molecularity concepts – theories of reaction rates – Arrhenius theory, hard-sphere collision theory of gas phase reactions – potential energy surfaces – activated complex theory for ideal gas reactions (formation in terms of partition functions) – relation between activated complex theory and hard sphere collision theory – thermodynamic formulation - activated complex theory (enthalpies and entropies of activation) – kinetic isotopic effect.

UNIT IV: KINETICS OF REACTION IN SOLUTION(K1) (15 Hours)

Comparison between gas phase and solution reactions – cage effect. Influence of solvent on reactions between ions and reaction between ions and neutral molecules – influence of ionic strength on rates of reactions in solution – significance of volume and entropy of activation – secondary salt effect - kinetic treatment of complex ion. parallel reactions of the same order (first or second order) – reversible reaction of same order (first or second order) – first order forward and second order backward – consecutive first order reactions, steady state and rate determining step (or equilibrium) approximation of complex reactions – chain reactions and explosions.
(Self-Study: Kinetics of Free radical reactions mechanism).

UNIT V: PHOTOCHEMISTRY (K2) (15 Hours)

Absorption and emission of radiation – theories – spontaneous and induced emission– laser – Franck Condon Principle - Type 1 & 2 – physical properties of electronic excited state – Jablonski diagrams – emission – resonance emission – selection rule – e-type and p-type – excimer and exciplex complex formation – Stern-Volmer equation – photosensitization and chemiluminescence – experimental techniques – actinometry – chemical actinometry – bio chemiluminescence – photochromism – photo stabilization – photosynthesis – PS I and PS II – photochemical energy- storage reactions.
(Self-Study: fluorescence – phosphorescence – delayed fluorescence)

TEXT BOOKS

1. Sathyanarayana D.N. 2004.Vibrational Spectroscopy: Theory and Applications. 1st Edition. New Age International Pvt Ltd. New Delhi.
2. Peter Atkins and Julio de Paula. 2009. Elements of Physical Chemistry. 5th Edition. Oxford University Press. Oxford.

REFERENCE BOOKS

1. Drago R.S. 2012. Physical Methods in Inorganic Chemistry. 1st Edition. Affiliated East-West Press Pvt. Ltd. New Delhi.
2. Cotton F.A. 1990. Chemical Applications of Group Theory. 3rd Edition. John Wiley &Sons Ltd. New York.
3. Robert M. Silverstein, Francis X. Webster, David J. Kiemle and David L. Bryce.2014. Spectrometric Identification of Organic Compounds. 8th Edition. John Wiley & Sons Ltd. New York.
4. Gopinathan M.S. and Ramakrishnan V. 2013. Group Theory in Chemistry. 2nd (Reprint) Edition. Vishal Publishing Co. India
5. Venkata Raman K. 1990. Group Theory and its applications to Chemistry. Tata McGraw-Hill. New Delhi.
6. Peter Atkins, Julio de Paula and James Keeler. 2018. Atkin's Physical Chemistry. 11th Edition. Oxford University Press. Oxford.
7. Gurdeep Raj. 2007. Advanced Physical Chemistry. Goel Publishing House. New Delhi.
8. Keith J. Laidler. 1987. Chemical Kinetics. 3rd Edition. Harper & Row. New York.
9. John W. Moore and Ralph. G. Pearson. 1981. Kinetics and Mechanism. 3rd Edition. John Wiley & Sons Ltd. New York.
10. Keith J. Laidler. 2003. Chemical Kinetics. 3rd Edition. Pearson Education India. New Delhi.

BLENDED LEARNING

UNIT V: PHOTOCHEMISTRY (K2)

Topic	Links
Absorption and emission of radiation theories	https://youtu.be/hoqEX7dC0yA https://youtu.be/vQBqwBpvy84 https://youtu.be/EOURuV9cNOM

	https://youtu.be/y_biQpljz7A
Spontaneous and induced emission– laser	https://youtu.be/WZ_GjUHctkE https://youtu.be/YHmGNDMV1cY
Franck Condon Principle - Type 1 & 2	https://youtu.be/-I0iAFX7GXI https://youtu.be/mf_zFHxiY28
Physical properties of electronic excited state	https://youtu.be/SZ4IDPDzqJ8
Jablonski diagrams	https://youtu.be/JWfOLz5QiC0 https://youtu.be/_IEWeanbfnQ https://youtu.be/sFVigyHyr_M https://youtu.be/HEQMgRFtv3c
Emission – Resonance emission – Selection rule	https://youtu.be/hWo2b-i6UiE
e-type and p-type	https://youtu.be/x96gw0Ns4vg
Excimer and exciplex complex formation	https://youtu.be/rBhzxChiy7w
Stern-Volmer equation	https://youtu.be/1suMOB0_w9A
Photosensitization and Chemiluminescence	https://youtu.be/dCr3uaBp4LA
Actinometry- Chemical actinometry	https://youtu.be/mN6x_6wB0W8 https://youtu.be/34nLM_a7RLs https://youtu.be/CfoR7no_vmk https://youtu.be/iTkWj7EVEq8
Bio chemiluminescence	https://youtu.be/RMMZ3rnzUHM https://youtu.be/dOgyQV1dLU8
Photochromism	https://youtu.be/KK3o5o847-c
Photo stabilization	https://youtu.be/1f0K-S301cE
Photosynthesis – PS I and PS II	https://youtu.be/_hUxKPSNTl0 https://youtu.be/dg9ZUT2cIL0
Photochemical energy- storage reactions	https://youtu.be/y8n9K6YAa2c

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3		2				2				L		1	
CO2		3		3		2			3			3		3
CO3	2			3		2	1			1		2	1	
CO4	3		2	1		1							2	
CO5	2	2		2				2		1			2	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Twice in a Semester
6.	Unit – III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Report Writing	Once in a Semester

Course Designed by: Mrs.S.Valli	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: I
COURSE CODE: 23PCH1E01
TITLE OF THE COURSE: ELECTIVE I – NANOMATERIALS AND THEIR APPLICATIONS
(Employability)

COURSE OBJECTIVES:

- To introduce the fundamental principles and techniques
- To understand the various synthesis and characterization of Nanoparticles
- To explore the application of nanostructure materials in various disciplines

COURSE OUTCOMES:

At the end of the course the students will have the ability to

CO1	Explain the basic aspects of nano science and technology	**K2**
CO2	Relate the properties of nanoparticles	**K2**
CO3	Apply methods in synthesizing the nano materials	**K3**
CO4	Interpret the characterization techniques in nanomaterials	**K2**
CO5	Categorize the applications in various fields	**K4**

Syllabus

Credits: 4 **Instructional Hours:60**

UNIT I: NANOTECHNOLOGY (K2) **(12 Hours)**

Definitions - history of nanotechnology - concept of nanotechnology - definition of nano dimensional materials – unique properties due to nano size, quantum dots, classification of nanomaterials, and synthesis of nanomaterials. Physical and chemical methods microemulsions, sol gel method, combustion method, wet chemical method. Biogenic methods of synthesis of nanoparticles by bacteria, fungi, plants and algae, inorganic nanomaterials, organic nanomaterials - typical examples.

UNIT II: NANOPARTICLES (K2) **(12 Hours)**

Size control of metal nanoparticles and their characterization of their properties – optical, electronic, magnetic and applications, stabilization in sol, glass and other media, alloy nanoparticles, change of band gap, blue shift, colour change in sol, glass and composites and surface resonance.

UNIT III: CARBON CLUSTERS AND NANOSTRUCTURES(K3) **(12 Hours)**

Nature of carbon bond - new carbon structures – carbon clusters – discovery of C60
- alkali doped C60 - superconductivity in C60 - larger and smaller fullerenes, carbon nanotubes -structure and characterization – mechanism of formation chemically modified carbon nanotubes - doping functionalizing nanotubes - application of carbon nanotubes carbon dots, nanowires.
(Self-Study: Application of C60)

UNIT IV: CHARACTERIZATION OF NANO SCALE MATERIALS (K2) **(12 Hours)**

Nanomaterials characterization, X-Ray diffraction, UV-VIS spectroscopy, photoluminescence spectroscopy, principles of atomic force microscopy (AFM) - transmission electron microscopy (TEM) resolution and scanning transmission electron microscopy (STEM) - scanning electron microscopy (SEM) **(IND 4.0)**
(Self-Study: Sample preparation techniques).

UNIT V: APPLICATION OF NANOPARTICLES (K4) **(12 Hours)**

Application of metal nanoparticles in fields of health, environment, optical and textiles, biological application of nanoparticles, biosensors – membrane-based water purification – application of nano carbon and its sustainability - nano medicine as drug delivery - nano biometrics – nano diamond – Buckminster fullerene.

TEXT BOOKS

1. Jeremy Ramsden. (2009). Essentials of Nanotechnology. Jeremy Ramsden and Ventus Publishing Aps. Denmark. United Kingdom.
2. Pradeep. (2010). Nano the essentials. Tata Mc-Graw Hill Publishing Company Ltd. New Delhi. India.

REFERENCE BOOKS

1. Rao. C.N.R. Muller. A. Cheetham.K. (2004). Chemistry of Nanomaterials. (Vol.1 and 2). Wiley VCH. Weinheim.
2. Poole. Jr. C.P. Owens. F.J. (2003). Introduction of Nanotechnology. Wiley Interscience. New Jersey,
3. Klabunde.K.J. (Ed). (2009). Nano scale Materials in Chemistry. Second Ed Wiley Interscience. New York.
4. Mohan Kumar.G.(2016). Nanotechnology nano materials and nano devices. Narosa Publishing House. New Delhi.
5. Chattopadhyay.K.K & Banerjee. A.N (2012) Introduction to Nanoscience and Nanotechnology. PHI Learning Private Limited, New Delhi- 1100001

BLENDED LEARNING

UNIT V: APPLICATION OF NANOPARTICLES (K4)

Topic	**Links**
Application of Metal Nanoparticles. Fields of Health, Environment, Optical and Textiles-	https://youtu.be/wJg7s3fKoME
Biological Application of Nanoparticles	https://youtu.be/D61QrzhaDDc
Biosensors – Membrane Based Water Purification	https://youtu.be/yxxWN_pM2FE
Application of Nano Carbon Sustainability	https://youtu.be/gJd0MeECLHA
Application of Nano Carbon Sustainability	https://youtu.be/l9i8t4lg4xM

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	2			3		2	1			1		2	3	
CO2	3	2	2	3	3	2	2		2	2	2	2	2	3
CO3	3	1	2	2	2		2		3	2	2	3	3	2
CO4	2		2	3		3						2	2	
CO5	3		3	2								2	2	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Twice in a Semester
6.	Unit – III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Quiz	Once in a Semester

Course Designed by: Mrs.J.Johncy Caroline	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: I
COURSE CODE: 23PCH1E02
TITLE OF THE COURSE: ELECTIVE I – GREEN CHEMISTRY
(Employability)

COURSE OBJECTIVES:

- To enable a comprehensive knowledge about the fundamentals of green chemistry
- To understand the importance of assisted synthesis and industrial applications using green chemistry techniques

COURSE OUTCOMES:

At the end of the course the students will have the ability to

CO1	Know the fundamental aspects of green chemistry	**K2**
CO2	Learn the properties and characteristics of green solvent	**K2**
CO3	Study the synthesis of organic molecules using green catalyst	**K3**
CO4	Analyze synthesis of compounds using basic principles of green chemistry	**K2**
CO5	Find the industrial applications of green chemistry	**K4**

Syllabus

Credits: 4 **Instructional Hours: 60**

UNITI: GREEN CHEMISTRY (K2) (12 Hours)

Introduction- definition and history of green chemistry, Terminologies related to green chemistry-Principles of green chemistry. Alternative energy sources used in chemical reactions-Introduction and generation of microwave (MW)-theory of microwave iniated organic reactions-Thermal and non-thermal effect of MW-Introduction and generation of ultrasound (Sonochemistry)-theory of sonochemistry-cavitation theory-sonoluminescence-History and theory of mechano chemistry-hot spot theory, magma-plasma model and reaction-based theory.
(Self-Study: Advantages of Green Chemistry)

UNIT II: ORGANIC SYNTHESIS IN BENIGN GREEN SOLVENTS (K2) (12 Hours)

Organic synthesis in water- properties of water -types and theory of reactions in aqueous medium- hydrophobic effect, hydrogen bonding, polarity effect, Marcus-trans phase H bonding-difference between Breslow hydrophobic effect and Marcus trans phase H bonding-examples of organic reactions in aqueous medium-Ugireaction, Sonogashira reaction and Baylis-Hillman reaction. Organic synthesis in supercritical carbon dioxide($scCO_2$)-introduction, properties, utility and drawback of $scCO_2$- examples of organic reactions in $scCO_2$.

UNITIII: ORGANIC SYNTHESIS USING GREEN CATALYSTS (K3) (12 Hours)

Phase transfer catalyst (PTC)-introduction –mechanism of PTC reaction-Types and advantages of PTC-applications of PTC in organic synthesis-nitriles, thiocyanates, para toluene sulphonates and azides from alkyl halide, benzoyl cyanides from benzoyl chloride. Organic synthesis using polymer supported catalysts-introduction-polymer bound anhydrous aluminium chloride, polymeric super acid catalyst, polystyrene metallo porphyrin and polymer supported photosensitizers.
(Self-Study: Importance of Green catalysts)

UNIT IV: GREEN SYNTHESIS INVOLVING BASIC PRINCIPLES OF GREEN CHEMISTRY (K2) (12 Hours)

Introduction-synthesis of adipic acid, catechol, disodium iminodiacetate (DSIDA), ibuprofen, adiponitrile, sebasic acid, polyaspartate, quinoxalines. photo induced organic synthesis-

introduction-photochemical conversion of alpha pinene into trans pinocarveol using singlet oxygen, photoirradiation of dibenzoyl diazomethane in presence of amino acid.

UNIT V: GREENER APPROACHES IN INDUSTRIAL APPLICATION (K4) (12 Hours)

Green oxidant-tetra amido macrocyclic ligand (TAML)-marine antifoulant- right fit pigments-poly lactic acid (PLA) a biodegradable polymer- utility and disadvantages of PLA-healthier fats and oils by green chemistry, chemical inter esterification (CIE) and enzyme inter esterification (EIE), merits of EIE over CIE-development of fully recyclable carpet (cradle to cradle carpeting)-biofuels-bioethanol and biodiesel.

TEXT BOOKS

1. Ahluwalia. V.K. (2016). Green Chemistry Environmentally benign reactions. Ane Books Pvt. Ltd. New Delhi. India.
2. Chandrakanta Bandyopadhyay. (2019). An insight into Green Chemistry. Books and Allied (P) Ltd. Kolkata. India.

REFERENCE BOOKS

1. Samuel Delvin. (2008). Green Chemistry. IVY Publishing House. (I Edition 2006) Sarup & Sons. New Delhi. India.
2. Lancaster.M. (2002). Green Chemistry: An Introductory Text. Royal Society of Chemistry. Cambridge.
3. Sanghli. R S. Srivastava. M.M. (2008). Green Chemistry: Environmentally friendly alternatives Narosa Publishing House. New Delhi. India.
4. Lancaster.M.(2016). Green Chemistry: An Introductory Text. (3rdEdition) Royal Society of Chemistry. Cambridge.

BLENDED LEARNING

UNIT IV: GREEN SYNTHESIS INVOLVING BASIC PRINCIPLES OF GREEN CHEMISTRY (K2)

Topic	**Links**
Introduction-synthesis of adipic acid, catechol	https://youtu.be/oBFbnZ4_LBY
Disodium iminodiacetate (DSIDA)	https://youtu.be/gW6uNKxVdCE
ibuprofen	https://youtu.be/NXYVYwXuvvA
Adiponitrile	https://youtu.be/vTlopiu_RLw
Sebasic acid	https://youtu.be/VD2fJ7Gtm5Q
Diphenyl quinoxaline	https://youtu.be/P79Uq02cCl4
Photo induced organic synthesis-introduction	https://youtu.be/iqflFx9BnyU
Photochemical conversion of alpha pinene	https://youtu.be/kv6ueXkiUnE
Photoirradiation of dibenzoyl diazomethane in presence of amino acid	https://youtu.be/wmhmAESv72E

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	3			3		2	2				3	2	3	
CO2	2	2	2	3	3	3	3		2	3	2	3	2	
CO3	2	3	3	2	2	2	2			2	3			
CO4	3		3	3		2			3	2	3	3	3	3
CO5	3		2	2						3	2	2	2	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Twice in a Semester
6.	Unit – III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Term Paper	Once in a Semester

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: II
COURSE CODE: 23PCH2CO4
TITLE OF THE COURSE: CORE 4: ORGANIC CHEMISTRY – II
(STEREOCHEMISTRY AND CONCERTED REACTIONS)
(Skill Development)

COURSE OBJECTIVES:

- To familiarize the stereochemistry of organic reactions and to know the nature of addition in pericyclic reactions.
- To understand the chemical and photochemical organic reactions.

COURSE OUTCOMES:

At the end of the course, the student will have the ability to

CO1	Discuss the cyclic and acyclic molecules.	**K2**
CO2	Explain the type of pericyclic reaction.	**K2**
CO3	Describe the type of photophysical and photochemical processes.	**K1**
CO4	Apply the various oxidation and reduction reactions in daily life.	**K3**
CO5	Investigate the connectivity of organic reactions by using the rearrangement of organic molecules.	**K4**

Syllabus

Credits: 4 **Instructional Hours: 75**

UNIT I: STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS (K2) (15 Hours)

Introduction and classification. Molecular representation (Fischer projection, Newman projection formula). Basic requirements of optical isomerism – optical isomerism exhibited by allenes, spiranes and biphenyls, nitrogen and sulphur compounds–the role of nitrogen inversion. configurational nomenclature - D & L, R & S and E &Z nomenclatures. conformations of cyclic molecules: conformations of cyclohexane, mono and disubstituted cyclohexanes - configurations and conformations of fused polycyclic systems, decalin, perhydro phenanthrene, perhydro anthracene. Stereochemistry of fused and bridged ring systems.

(Beyond the Curriculum: Molecular Representation, Configurations and Conformations, Conformations of Acyclic molecules, Enantiotopic and diastereotopic ligands & groups)

UNIT II: CONCERTED REACTIONS (K2) (15 Hours)

Introduction, utility and characteristics of concerted reactions- Woodward - Hofmann rules - orbital correlation diagrams ,theory of pericyclic reactions(perturbation theory, Frontier molecular orbital theory(FMO),Huckel - Mobius Approach, Dewar - Zimmermann Approach). , classification (electro cyclic reactions, cycloaddition reaction, cheletropic reactions, ene reactions, group transfer reactions and sigmatropic rearrangements), dis rotatory and con rotatory ways of movement in pericyclic reactions. Diel's Alder reaction, [1, 3], [1, 5] and [3, 3] Sigmatropic rearrangements. Aza and oxy Cope rearrangement.

UNIT III: ORGANIC PHOTOCHEMISTRY (K1) (15 Hours)

Organic Photochemistry Photolytic reactions of carbonyl compounds: Norrish Type I, II - McLafferty rearrangement reactions – Paterno – Buchi reaction - Cis and Trans isomerization, photodimerization - photochemistry of alkenes, dienes and aromatic compounds – photo rearrangement of enones and dienones - Photo-Fries rearrangement – Di-π-methane rearrangement – photo reduction and photo oxidation – photo-substitution reactions; de Mayo, Hofmann-Loffler-Freytag reactions. Photoaddition reaction.

(Self-Study: Photochemical reactions, Photo polymerization, UV induced dental filling, Light induced reactions)

UNIT IV: OXIDATIONS AND REDUCTIONS(K3) (15 Hours)

Oxidation: Fenton's Reagent, MnO_2, Meta-chloroperoxy benzoic acid (M-CPBA), Lead tetra acetate, dehydrogenation by quinones, per benzoic acid, SeO_2, chromium trioxide - pyridine PCC (Pyridinium Chloro Chromate), PDC (Pyridinium Dichromate), Lemieux reagent ($NaISO_4$ with $KMnO_4$and OsO_4), Dess - Martin periodinane oxidation DMSO - oxalyl chloride (Swern reaction), Etard reaction, ozonolysis of olefins, Corey - Kim oxidation, Prevost reaction.

Reduction: TBH (Tri n-Butyl Tin Hydride), $LiAlH_4$, $NaBH_4$, B_2H_6, aluminium iso propoxide, and Baker's Yeast, DIBAL (Diisobutyl Aluminum Hydride). Typical reactions such as Birch Reduction, MPV, McFadyen-Steven's reduction, Bouveault-Blanc, McCurry's coupling and Rosenmund reduction. Reduction of nitro compounds - acyloin condensation – catenanes. Metal catalyzed carbon – carbon bond forming reaction – Suzuki and Hech Coupling.

UNIT V: MOLECULAR REARRANGEMENTS (K4) (15 Hours)

Heterolytic, hemolytic and aromatic rearrangements. Nucleophilic rearrangements - migration to electron deficient carbon rearrangement (Wagner-Meerwein, Wolff, allylic and Sommelet-Hauser rearrangements)- migration to electron deficient nitrogen rearrangement (Schmidt reaction) - migration to electron deficient oxygen rearrangements (Favorski, Neber, Dakin & Baeyer-Villiger rearrangement). Aromatic rearrangements (Orton, Baker- Venkataraman, Bamberger and Von- Ritcher rearrangements). Electrophilic rearrangements (Stevens and Smiles rearrangements).

(Self-study: Radical Rearrangement, Isoquinoline synthesis)

TEXT BOOKS

1. March J and Smith.M.B.2007. March's Advanced Organic Chemistry: Reactions. Mechanisms and Structure. 6th Edition. Wiley. New Jersey.
2. Finar, I.L. 2012. Organic Chemistry Volume -I. 6th Edition. Pearson Education Ltd. London.

REFERENCE BOOKS

1. Morrison, RT. Boyd R.S. 2012. Organic Chemistry. 7th Edition. Prentice Hall of India Pvt. Ltd., New Delhi.
2. Mukherji S.M. and Singh. S.P. 1990 Organic Reaction Mechanism. MacMillan India Ltd., Chennai.
3. Ahluwalia V.K. and Parashar R.K. 2009.Organic Chemistry. Viva Books (P)Ltd. Delhi
4. Agarwal. O.P. 2008. Organic Chemistry Reactions & Reagents. Krishna and Prakashan Media. Meerut
5. Jagadamba Singh and L.D.S. Yadav .2011. Advanced Organic Chemistry. Publisher – Pragati Prakashan. Delhi
6. Kalsi P.S. 2011.Organic Reactions and Mechanisms. New Age International Private Limited. New Delhi.
7. Tewari. N. 2011. Advanced Organic Reaction Mechanisms. 3rd Edition. Books and Allied (P) Ltd. Delhi
8. Nasipuri.2005. Stereochemistry of Organic Compounds. 2nd Edition. New Age Publishers. Delhi
9. Ashok Kumar Mitra, 2016.Reactions, Reagents and Synthesis in Organic Chemistry, Books & Allied Pvt Ltd. Delhi
10. Magatama Singh and Yadav L.D.S.2006. Organic Synthesis. Publisher. Pragati Prakashan.Delhi.
11. Ernest E. Eliel and Samuel H. Wilen. 2008. Stereochemistry of organic compounds. John & Wiley's Sons Pvt Ltd. North Carolina.

BLENDED LEARNINGS

UNIT V: MOLECULAR REARRANGEMENTS (K4)

Topics	Blended Learning Links
Wagner-Meerwein rearrangement	https://www.youtube.com/watch?v=YPoo91opvqM
Wolff rearrangement	- https://www.youtube.com/watch?v=6NIm0POakR8

Allylic rearrangement	https://www.youtube.com/watch?v=HU0Gpt7vh9c
Sommelet- Hauser rearrangement	https://www.youtube.com/watch?v=eq7kXDLGXbQ
Schmidt reaction	https://www.youtube.com/watch?v=VPBND2fvvJQ
Favorski rearrangement	https://www.youtube.com/watch?v=4Ju28x8fzNI
Neber rearrangement	https://www.youtube.com/watch?v=0jDy8ginTns
Dakin rearrangement	https://www.youtube.com/watch?v=sjeU2HLsjB8
Baeyer-Villiger rearrangement	https://www.youtube.com/watch?v=PUNnjXtVzMc
Orton rearrangement	https://www.youtube.com/watch?v=bz-u5qUMwMA
Von- Ritcher rearrangement	https://www.youtube.com/watch?v=G2NQTzTnuSc
Baker- Venkataraman rearrangement	https://www.youtube.com/watch?v=Gz-1gbMMbUc
Bamberger rearrangement	https://www.youtube.com/watch?v=xeRWknYTaKQ
Smiles rearrangement	https://www.youtube.com/watch?v=6Pij6xcB6TA
Stevens rearrangement	https://www.youtube.com/watch?v=PQ4dQPg-pAY

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	2	2	2	2	1				2	3	3	2
CO2	3	2	2		2		3		2			2	3	2
CO3	3	2	2	2	3	3	2	1		2	2	2	3	2
CO4	3			2		2	2			2		2	3	2
CO5	3	2	2				3		2	1		2	3	2

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Twice in a Semester
6.	Unit - III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Quiz	Once in a Semester

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: II
COURSE CODE: 23PCH2C05
TITLE OF THE COURSE: CORE 5: INORGANIC CHEMISTRY - II (COORDINATION CHEMISTRY)
(Skill Development)

COURSE OBJECTIVES:

- To gain knowledge about structure, properties theories and term states of complex compounds.
- To know the metal carbonyl compounds and their substitution reactions and biological importance of coordination compounds.

COURSE OUTCOMES:

At the end of the course the students will have the ability to

CO1	Gain the application of different theories for transition metal ligand complex	**K4**
CO2	Study the electronic spectra of complex compounds and their magnetic properties	**K2**
CO3	Find the stability and bonding nature metal carbonyl compounds	**K1**
CO4	Know about homogeneous catalysis by coordination compounds	**K1**
CO5	Learn functions and applications of bio coordination complexes	**K4**

Syllabus

Credits: 4 **Instructional Hours:75**

UNITI: TRANSITION METAL CHEMISTRY(K4) (15 Hours)

Structure, bonding and properties of transition metal ligand complexes, CFT, splitting of d-orbitals in octahedral, tetragonal, square planar and tetrahedral complexes, factors influencing magnitude of $\Delta 0$, applications of CFT- colour, Jahn-Teller distortions, spectrochemical series and molecular orbital theory (MOT) of octahedral and tetrahedral complexes. isomerism of coordination complexes.
(Self-study: nomenclature and preparation of complex compounds)

UNITI I: TERM SYMBOLS (K2) (15 Hours)

Term states of D^n ions - electronic spectra of coordination compounds - selection rules - band intensities and band widths - energy level diagrams of Orgel and Tanabe - Sugano of Ti^{3+}, V^{3+}, Ni^{2+}, Cr^{3+}, Co^{2+}, Cr^{2+} and Fe^{2+} - calculation of 10Dq and B For V^{3+}(Oct) and Ni^{2+} (Oct) complexes. Magnetic properties of coordination compounds - change in magnetic properties of complexes in terms of spin orbit coupling - temperature independent paramagnetism - spin cross over phenomena. Nephelauxetic effect - charge transfer spectra.

UNIT III: METAL CARBONYLS (K1) (15 Hours)

Metal carbonyls – EAN rule - 18 electron rule-nature of bonding in metal carbonyls - preparation, properties and structure of metal carbonyls, carbonyl halides, carbonyl hydrides and nitrosyl complexes. Vaska's compound, Zeise salt. Metal clusters - di, tri and tetra nuclear clusters.
(Beyond the Curriculum: Application of Metal Carbonyls)

UNIT IV: SUBSTITUTION REACTIONS AND CATALYSIS (K1) (15 Hours)

Substitution reactions in square planar and octahedral complexes – trans effect –theories of trans effect – redox reactions. homogeneous catalysis by coordination compounds –Alkene hydrogenation (Wilkinson Catalyst), Hydroformylation, Wacker process, Ziegler Natta Catalyst.
(Self-Study: Mechanism of homogeneous catalysis by complex compounds)

UNIT V: BIO INORGANIC CHEMISTRY(K4) (15 Hours)

Biological coordination compounds: role of metal ions in living system (Ca, Mg, P, Cr, Fe, Co, Ni, Cu, And Zn) - porphyrin ring compounds, structure and functions of hemoglobin, myoglobin, ferredoxins, rubredoxins. Applications of metal complexes in medicinal chemistry - platinum based drugs and chelation therapy, Pb and Hg poisoning only.

TEXT BOOKS

1. Gopalan R and V. Ramalingam. 2013. Concise Coordination Chemistry. Vikas Publishing House Pvt Ltd. Mumbai
2. James E. Huheey, 1993. Inorganic Chemistry. 4thEdn. Wesley Pub. Co., New York.
3. Cotton F. A. and G. Wilkinson. Advanced Inorganic Chemistry.5thEdn. John-Wiley & Sons, New York.

REFERENCE BOOKS

1. Sarkar R .2009. General and Inorganic Chemistry (Part II). New Central Book Agency(P) Ltd. Delhi
2. Shriver, D.F. Atkins. P and Langford C.H.1990. Inorganic Chemistry, OUP, Delhi.
3. Beckmann, 1996. Organometallics 1. Complexes with Transition Metal - Carbon - Bonds, Oxford Science Publications. London
4. Huheey, J. E. Keiter, E. A. 1983. Inorganic Chemistry. 4th Ed. Harper and Row. New York.
5. Malhotra R. C and A. Singh .2006. Organometallic Chemistry. A Unified Approach. New Age International. Delhi

BLENDED LEARNING LINKS

UNIT IV: SUBSTITUTION REACTIONS AND CATALYSIS (K1)

Topics	Blended Learning Links
Substitution reactions in square planar and octahedral complexes	https://youtu.be/4pJqBEOy_OM, https://youtu.be/Du6Jh1ZyP0U
Trans Effect-Theories of Trans effect-redox reactions	https://youtu.be/9nDUfojnjNk
alkene hydrogenation (Wilkinson catalyst)	https://youtu.be/HRUd_XwmDgA
Hydroformylation	https://youtu.be/am2BJYhwEh8, https://youtu.be/I-xpPpcvq3E
The Wacker process	https://youtu.be/sNzxS5Tq_NU, https://youtu.be/nIOhrPUv1Lo
Ziegler Natta catalyst-	https://youtu.be/Cng_yY5EDHs

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3			3		2	1			2		2	2	
CO2	3	2	2	3	3	2			2	2	1	2	2	3
CO3	2	3	2	1	2	2			2	2	2	3	2	2
CO4	3		2	2		1						2	2	
CO5	3		2	2								2	2	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Twice in a Semester
6.	Unit – III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Quiz	Once in a Semester

Course Designed by: **Ms.J.Antonette Luciana Sherryn**	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: II
COURSE CODE: 23PCH2C06
TITLE OF THE COURSE: CORE 6: PHYSICAL CHEMISTRY - II
(QUANTUM MECHANICS AND ELECTROCHEMISTRY)
(Skill Development)

COURSE OBJECTIVES:

- To introduce the principle of Quantum mechanical wave functions, basic concepts of black body radiation and solving Schrodinger equation for various systems
- To understand the various instrumental methods used in chemical and structural analysis

COURSE OUTCOMES:

At the end of the course the students will have the ability to

CO1	Explain the basic concepts of black body radiation and algebra of operators	**K2**
CO2	Solve Schrodinger wave equation for particle in various systems	**K3**
CO3	Describe the need for approximation methods	**K1**
CO4	Gain knowledge about the inter ionic theories and the thermodynamics of electrochemical reactions	**K3**
CO5	Study the electro kinetic phenomenon and the formation of double layer.	**K2**

Syllabus

Credits: 5 **Instructional Hours: 90**

UNIT I: BASIC CONCEPTS OF BLACK BODY RADIATION AND OPERATORS (K2)
(18 Hours)

Basic concepts - black body radiation. Time-dependent and time-independent Schrodinger equations Born's interpretation of the wave function. Requirements of the acceptable wave function. Algebra of operators. Sums and products of operators. Commutator. Linear operators. eigen functions and eigen values. Correspondence between physical quantities in classical mechanics and operators in quantum mechanics. Hamiltonian operator. angular momentum operator. quantization of angular momentum and its spatial orientation. Average (expectation) values. postulates of quantum mechanics.
(Self-Study: Stationary states and uncertainty relations in operators)

UNIT II: SOLVING SCHRODINGER EQUATION (K3) **(18 Hours)**

Particle in a one - dimensional box. Quantization of energy. Normalization of wave function. Orthogonality of the particle in one - dimensional box wave functions. Illustration of the uncertainty principle and correspondence principle with reference to the particle in a one-dimensional box. Particle in a three - dimensional box. Separation of variables.
Solving of Schrodinger equation for the one - dimensional harmonic oscillator. harmonic oscillator model of a diatomic molecule. Illustration of the uncertainty principle and correspondence principle with reference to harmonic oscillator. Solving of Schrodinger equation for a rigid rotor. Rigid rotor model of a diatomic molecule.

UNIT III: APPROXIMATION METHODS (K1) **(18 Hours)**

Schrodinger equation for the H-atom (Or H-like species) separation of variables (solving of radial equation is not needed but nature of solution is given), energy levels. Radial factors of the H-atom wave functions. Orbitals and orbital shapes. Probability density and radial distribution functions. The most probable distance of the H-Atom (Or H- Like Species) 1S electron.
Need for approximation methods. The perturbation theory (first order only).application of the perturbation method to He-Atom. The variation method. Application of variation method to He-atom.

UNIT IV: ELECTROCHEMISTRY I (K3) **(18 Hours)**

Ions in solutions: conductivity of solutions and their measurement - the Arrhenius ionization theory - transport numbers and mobilities of ions - measurement of transport numbers - Hittorf method and moving boundary method - ionic activities and activity coefficients and their determination by various methods – Debye – Huckel - Onsager theory - ionic atmosphere – Debye - Huckel limiting law. Wien effect and Debye – Falkenhagen effect
– Thermodynamics of electrochemical reactions – free energy and EMF – standard and formal electrode potentials – problems based on electrode potentials and their measurements – ion selective electrodes. Electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
(Self-Study: Properties of electric current and conductance measurements).

UNIT V: ELECTROCHEMISTRY II (K2) **(18 Hours)**

Metal / electrolyte interface**:** Outer Helmholtz plane (OHP) and Inner Helmholtz plane (IHP) - potential profile across double layer region - potential difference across electrified interface - structure of the double layer **-** electrocapillary thermodynamics – Lippmann equation – measurements of double layer capacitances – potential of zero charge – Stern model – specific adsorption of cations, anions and neutral molecules – a brief outline of electro kinetic phenomenon and membrane potentials. Butler Volmer equation- one step one electron transfer kinetics - exchange current density. Helmholtz-Perrin, Gouy-Chapman models – Electrode Kinetics. Hydrogen over potential – theories of hydrogen overvoltage - mechanism of hydrogen evolution reactions
(Beyond the Curriculum: Bipolar Electrochemistry)

TEXT BOOKS

1. McQuarrie D.A. (1983) Quantum Chemistry, University Science Books, Mil Valley, California.
2. Samuel Glasstone, 2007. An Introduction to Electrochemistry, Maurice Press. UK.

REFERENCE BOOKS

1. Atkins, P.W. 1990. Advanced Physical Chemistry, Oxford Press. England.
2. Robert A. Albert,1987. Physical Chemistry, (Sixth edition), Wiley Eastern Limited Reprint, New Jersey.
3. Prasad, R. K. 1996. Quantum Chemistry, New Age International Publishers, New Delhi
4. Hanna, M.W.1965. Quantum Mechanics in Chemistry, W.A. Benjamin Inc. London,
   Arul Doss, G. 2002. Molecular Structure and Spectroscopy, Prentice Hall. US
4. Anantharaman, R. 2001, Fundamentals of Quantum Chemistry, Macmillan India Limited., India
5. Sathyanarayana, D. N2004. Vibrational Spectroscopy, New Age International Publishers, Delhi.
6. Gordon M. Barrow – 2007.Physical Chemistry, 5th Edition, Mc Graw Hill Publishing Company Ltd, New York.
7. Manoj Agarwal, Electrochemistry, 2017, Arjun Publishing House, Delhi.

BLENDED LEARNING LINKS

UNIT V: ELECTROCHEMISTRY II (K2)

Topics	Blended Learning Links
Outer Helmholtz plane (OHP) and Inner Helmholtz plane (IHP) - potential profile across double layer region **Helmholtz double layer-**	https://youtu.be/Ejz8YFqDMy8https://youtu.be/HDQ8ct4md-8https://youtu.be/ibG2TrqbQ0ghttps://youtu.be/pGI6az7AiJU

Electrocapillary thermodynamics	https://youtu.be/lc7dhS1pbhttps://youtu.be/0EzO-1eGHk0 https://youtu.be/GlCvY-nLVa0https://youtu.be/WN8cr6b2Gbo
Lippmann Equation	https://youtu.be/V-nM8dYJ_dQhttps://youtu.be/BT7fFlO9CwE
Measurements of double layer capacitance Potential of zero charge	https://youtu.be/Ymsxvw-Zw9o
Stern Model- Specific adsorption of cations, anions and neutral molecules	https://youtu.be/B2562asJkMg https://youtu.be/JYMQizDO8PYhttps://youtu.be/pGI6az7AiJU
Butler Volmer Equation- One Step One Electron Transfer Kinetics - Exchange Current Density	https://youtu.be/N6XNQ30h0mAhttps://youtu.be/dNkDAgg9MUY
Electro kinetic phenomenon and membrane potentials	https://youtu.be/Y4f7BKU62jo https://youtu.be/uIgXT3eo2Xk
Helmholtz-Perrin, Gouy-Chapman, And Stern Models – Electrode Kinetics	https://youtu.be/Cep_HFC3mA4 https://youtu.be/xR6jOVNKl2E https://youtu.be/PPKBrNzOkPw
Hydrogen Over potential – Theories of Hydrogen Overvoltage - Mechanism of Hydrogen Evolution Reactions	https://youtu.be/l7HXaUZbvtohttps://youtu.be/2ubmVx0lVwk https://youtu.be/Owj98eiUQpw

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3		2				1				2		1	
CO2		3		3		1			3	2		3		3
CO3		2		2	3			1		1			2	
CO4	3		2	1		1							2	
CO5	3		2										1	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Twice in a Semester
6.	Unit - III & IV Seminar	Twice in a Semester
7.	Unit – V Other component: Quiz	Once in a Semester

Course Designed by: Mrs.S.Valli	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: II
COURSE CODE: 23PCH2E01
TITLE OF THE COURSE: ELECTIVE II- ANALYTICAL CHEMISTRY
(Employability)

COURSE OBJECTIVES:

- To learn about the quantitative measurements and treatment of data
- To understand the various instrumental methods used in chemical and structural analysis

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Explain the significance of treatment of analytical data	**K2**
CO2	Learn about the general concepts and basics of Conductometric titrations	**K1**
CO3	Study the principles and different methods of potentiometric titrations	**K1**
CO4	Gain knowledge about the theory behind colorimetry and flame emission and absorption spectroscopy	**K2**
CO5	Understand the concepts of electrochemical methods and Electrogravimetry	**K2**

Syllabus

Credits: 4 **Instructional Hours:60**

UNITI: TREATMENT OF ANALYTICAL DATA (K2) (12Hours)

Nature of quantitative measurements and treatment of data. Basic statistical concept - frequency distribution, average and measure of dispersion, significance of Gaussian distribution curves, null hypothesis, confidential interval of mean, rejection data, student's T, Q and F tests, regression and correlation, quality control and control chart. Objectives, sampling - size of sample handling, transfer and storage samples.

UNIT II: CONDUCTOMETRIC TITRATION (K1) (12 Hours)

Conductometric titrations – general concept and basis of conductometric titrations, apparatus and measurement of conductivity, applications of direct conductometric measurements. high frequency methods – theory, apparatus, merits of low and high frequency analysis (oscillometry), determination of non-ionic species in process control and zone detector.
(Self-Study: Advantages and disadvantages of conductometric titrations)

UNIT III: POTENTIOMETRIC TITRATION(K1) (12 Hours)

Standard and formal potentials, types of electrodes. Glass membrane, precipitate and solid-state electrodes, liquid membrane electrodes, mechanism of electrode, response and evaluation

of selectivity coefficient, application of ion-selective electrodes. Methods – manual titrimeters and automated titrators, direct potentiometry and potentiometric titrations including differential methods, acid – base titrations, precipitation titration in non-aqueous systems.

UNIT IV: TECHNIQUES IN INORGANIC CHEMISTRY (K2) (12 Hours)

Colorimetry: theoretical and practical aspects of colorimetric analysis. flame emission and atomic absorption spectroscopy – types of atomic spectroscopy – emission methods – absorption methods – fluorescence methods – source and atomizers for atomic spectroscopy– flame atomizers – electrothermal atomizers – principle and applications of atomic absorption spectroscopy. Advantages of atomic absorption spectrometry over flame photometry.

UNIT V: ELECTROCHEMICAL METHODS (K2) (12 Hours)

Analysis of cyclic voltammetry, coulometry and amperometry - principle and applications, Nyquist and Tafel Plots. Electrogravimetry – theory of electrogravimetry, order of deposition, over potential, polarization curves, constant potential and consecutive deposition, selective deposition, constant current deposition, assembly of electrode and deposition of complex ions. ***(Self-Study: Study of movement of electrons in oxidation-reduction reactions)***

TEXT BOOKS

1. Willard, Merit Dean and Settle. 1986. Instrumental Methods of Analysis, IV Edn, CBS Publishers and Distributors. Delhi.
2. Skoog D.A. 1985. Principles of Instrumental Analysis, III Edn. Saunders College Pub. Co, Pennsylvania.

REFERENCE BOOKS

1. Vogel A.I., 1986.Text Book of Quantitative Inorganic Analysis, III and IV Edn, ELBS. Delhi.
2. Bockris J.O.M., and Reddy AKN. 1970.Modern Electrochemistry. Plenum. NY.
3. Skoog D.A. and. West D.M. 1982.Fundamentals of Analytical Chemistry, IV Edn, Holt Rinehart and Winston Publications.US
4. Kaur H. 2006. Instrumental Methods of Chemical analysis, Pragati Publishers. Delhi.

BLENDED LEARNING

UNIT V: ELECTROCHEMICAL METHODS (K2)

Topics	Blended Learning Links
Analysis of Cyclic Voltammetry	https://youtu.be/K9jnznGIF1Q https://youtu.be/56wpAio4v-M
Amperometry principle and applications -	https://youtu.be/lrdeauk2QUIhttps://youtu.be/1EWiEENa4Gs
Electrogravimetry theory of electrogravimetry, order of deposition, over potential, polarization curves-	https://youtu.be/o1jytXWBiUchttps://youtu.be/KsxiPjUvvV8 https://youtu.be/LbvvRyo3VzY
Coulometry principle and applications	- https://youtu.be/q3-iIB_Ydtohttps://youtu.be/Rr0gA6wlGeshttps://youtu.be/hKVXo4rgLIc
Nyquist and Tafel Plots -	https://youtu.be/Ek8Ac3tFcSIhttps://youtu.be/dXRQSm2vb7M https://youtu.be/po_RLxDarMU

Constant current deposition, assembly of electrode and deposition of complex ions.	https://youtu.be/9tVNcW75Sg0https://youtu.be/kJrgglcV4Oghttps://youtu.be/lfT9L3ADkZw

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3		2		1		2		1				1	
CO2		3		2		1		2		2	3	1		2
CO3	3		2		2		1		1	2	2	2	2	1
CO4	2		2	2		2	2	2	3		3	3	2	
CO5	2		1	2	3		2			2			2	3

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit – I & II Assignment	Once in a Semester
6.	Unit – III & IV Seminar	Once in a Semester
7.	Unit – V Other component: Participation in Conference	Once in a Semester

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: II
COURSE CODE: 23PCH2E02
TITLE OF THE COURSE: ELECTIVE II– RESEARCH METHODOLOGY
(Employability)

COURSE OBJECTIVES:

- To learn and practice the literature survey aspects of the project and prepare the scope and goals of the proposed project
- To analyze the recent developments in research methodology to create scientific knowledge.
- To practice and improve the research presentation skills and with latest tools

COURSE OUTCOMES:

CO1	Interpret Literature Survey and Submission of Manuscripts for Publication.	**K2**
CO2	Summarize Error Analysis	**K2**
CO3	Implement Spectroscopic Analysis for The Research Work	**K3**
CO4	Learn Paper Publication Relevant to Project Work	**K1**
CO5	Associate The Knowledge of Research Methodology with Experimental Work	**K2**

Syllabus

Credits: 4 **Instructional Hours: 60**

UNIT I: LITERATURE SURVEY AND PRESENTATION OF REPORT (K2) (12 Hours)

Literature survey introduction to research, selection of a research topic, reviewing the literature, preparing the proposal and design of study. Experimentation and interpretation of results. Formation, testing and rejection of hypothesis. Application of microcal origin and chemdraw. Preparation and presentation of report; dissertation and thesis writing. Primary and secondary literature: journals, patents, reviews, chemical abstracts, treatises and monographs. printed materials and online literature search; websites, search engine for locating information and chemical data bases. E-mail operation and online submission of manuscripts for publication.

UNIT II: ERROR ANALYSIS (K2) (12 Hours)

Error analysis. Limitations of analytical methods, accuracy, precision and minimization of errors. Systematic and random errors and reliability of results. Replicate determination and t-test. Correlation, linear regression and analysis of variance.

UNIT III: ANALYTICAL TECHNIQUES (K3) (12 Hours)

Spectroscopy studies. Principles, sampling techniques and application of UV VIS spectrophotometry, Far, Near and FTIR spectrophotometry and ICP spectrometry. Thermo analytical techniques: TGA, DTA, DSC and thermometric titrations. Magnetic susceptibility and EPR spectroscopy measurements and characterization of samples.

UNIT IV: PAPER PUBLICATION (K1) (12 Hours)

Plagiarism in academic journals. Self-plagiarism, plagiarism detection software. syllabus for these two units (published papers in journals) shall be provided to the students by the concerned teacher/guide to whom the students are allotted in the III semester itself for their project work in the IV semester.
(Self-Study: Project Relevant Published Papers and Comparative Studies)

UNIT V: RESEARCH METHODOLOGY (K2) (12 Hours)

Literature survey and research methodology (seminar paper related to project work in IV semester). This paper in III semester forms the foundation for project work in iv semester. Hence the students are allotted in the beginning of III semester itself to the teacher/guide for their project work in IV semester.
(Self-Study: Research Methodology Related to Project Work)

TEXT BOOKS

1. Jerry March, 1992, Advanced Organic Chemistry, 4th Edn. John Wiley &Sons, US.
2. Vogel's Textbook of Quantitative Chemical Analysis, 1978,5th Edn. ELBS. Delhi

REFERENCE BOOKS

1. Rajammal P. Devadas, 1976.A Handbook of Methodology of Research, S.R.K. Vidyalaya Press, Chennai.
2. Anderson J. Durstanand B.H, Poole M. 1977. Thesis and Assignment Writing, 28, Wiley Eastern, New Delhi,
3. Willard H.H., Merritt L.L., Dean J. A and F.A. Settle. 1986. Instrumental Methods of Chemical Analysis, 6th Edn. CBS Publishers, New Delhi.
4. Bard A.J., and Faulkner L.R. 2004. Electrochemical Methods: Fundamentals and Applications, 2nd Edn. John Wiley and Sons, New York.

BLENDED LEARNING

UNIT IV: PAPER PUBLICATION (K1)

Topics	Blended Learning Links
Plagiarism in academic journals-	https://youtu.be/rvCY6ANSOXQ, https://youtu.be/Wwicykd4cmA
Self-plagiarism	https://youtu.be/Qc7ghAWTLws
Plagiarism detection software	https://youtu.be/Y_wAe81cBUQ, https://youtu.be/9TU6JIh_wIY

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	2	3	1	3	3	2	2	2	3	2	3	
CO2	2	3	3	3		3	2	3			3	3	2	
CO3	3	2		3		3		3	3	3	3	2		2
CO4	3	3	2	2		2	3	2			3	3	2	
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit - III & IV Seminar	Twice in a Semester
7.	Unit – V Other component:	Once in a Semester

	Quiz	

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

PRACTICAL SYLLABUS
SEMESTER I & II
COURSE CODE: 23PCH1CP1
PRACTICAL I - ORGANIC CHEMISTRY I

COURSE OBJECTIVES:

- To motivate the students to understand the principles of basic organic chemistry
- To impart knowledge on different reaction mechanism.

COURSE OUTCOMES:

At the end of the course, the student will have the ability to

CO1	Separation and analysis of organic compounds	**K4**
CO2	Single stage preparation of organic compounds	**K3**
CO3	Record Transfer the results of experimental work through record presentation	**K4**
CO4	Viva –Voice Examination To check the student's knowledge on the respective practical	**K2**

Syllabus

Credits: 4 **Instructional hours: 120**

I. Analysis of Two Component Mixtures

Separation and characterization of organic compounds.

Inorganic Preparation

About ten preparations involving one or two or three stages comprising of the following processes: Nitration, acylation, halogenation, diazotization, rearrangement, hydrolysis, reduction, alkylation and oxidation and preparations illustrating the following: Benzoin condensation, Cannizzaro reaction, Perkin reaction, Reimer-Tiemann reaction, Sandmeyer reaction, Fries rearrangement, Skraup synthesis. (Recrystallisation of product, melting point determination and calculation of percentage yield).

Note: A minimum of six organic mixtures should be analyzed by each student. A minimum of five preparations should be done by each student.

TEXT BOOKS

1.V.K. Ahluwalia, P. Bhagat, R. Aggarwal, Laboratory Techniques in Organic Chemistry, I.K. International, 2005.

2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel‟s Textbook of Practical Organic Chemistry, 5th Ed., Prentice Hall, 1996

REFERENCES

1) NS Gnanapragasam and G Ramamurthy, Organic Chemistry Lab Manual, S Viswanathan (Printers and Publishers Pvt Ltd) 2010.
2) Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, 2003, Pearson Education Pvt. Ltd., New Delhi.

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			3		2	1			1		2	1	
CO2	3	2	3	2	3	2	2	2	3	2	2	2	2	3
CO3	2	2	2	2	2	3	2		2	1	2	3	3	2
CO4	3		2	1		1						2	2	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	**Assessment Methods**	**Frequency of Assessment**
1.	Observation	Once in a year
2.	Record	Once in a year
3.	Model Practical Examination I	Once in a year
4.	Model Practical Examination II	Once in a year
5.	End Semester Examination	Once in a year

Course Designed by: Mrs.J.Johncy Caroline	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER I &II
SUBJECT CODE: 23PCH1CP2
PRACTICAL – II – INORGANIC CHEMISTRY I

COURSE OBJECTIVES:

- To focus on detecting the ions present in aqueous solutions in the micro-range.
- To educate the significance of the micro-scale and reduce the wastage of chemical substances.
- To impart knowledge about the syntheses and characterization of the inorganic complexes.

COURSE OUTCOMES:

At the end of the course, the student will have the ability to

CO1	Qualitative Analysis	**K2**
CO2	Inorganic Complex preparations	**K3**
CO3	Colorimetric Estimations of Ions	**K4**
CO4	Record Transfer the results of experimental work through record presentation	**K3**
CO5	Viva Voce To check the student's knowledge on the respective practical	**K4**

Syllabus

Credits: 4 **Instructional hours: 120**

Qualitative Analysis

a. Analysis of the common cations like – Cu, Pb, Hg, Ag,
b. Analysis of the less common ions – Tl, W, Se, Te, Mo, Ce, Th, Ti, Zr, V, Be, U & Li

Inorganic Complex Preparations

a. Lead Tetra Acetate
b. Dipyridinium Hexachloroplumbate
c. Hydroxylamine Hydrochloride
d. Ortho- And Para- Hydroxy Phenyl Mercuric Chloride
e. Potassium Cupric Chloride
f. Chrome Alum
g. Copper (I) Chloride
h. Trithio Urea Copper (I)
i. Potassium Trioxalato-Aluminato (III)
j. Potassium Trioxalato Chromate (III)
k. Potassium Trioxalato Ferrate (III)
l. Hexamine Cobalt (III) Chloride
m. Chloro Pentammine Chromium (III)
n. ChloroAquoPentammine Chromium (III) Nitrate
o. Tetrammine Copper (II) Sulphate
p. Ammonium Hexachloro Stagnate (IV)

Colorimetric Estimations

(Using Colorimeters) of copper, iron, nickel, manganese, chromium and zirconium.
Note: A minimum of six inorganic mixtures, each of two common and two rare elements should be analyzed by a student. A minimum of six preparations should be done by a student.

TEXT BOOKS

1. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd Ed., The National Publishing Company, Chennai,2010.
2. Palmer, W. G. Experimental Inorganic Chemistry; Cambridge University Press,1954.

REFERENCES

1.G.Svehla, Vogel's Text book of Inorganic Qualitative Analysis, 7th Ed, Pearson,1996.
2. Woollins, J. D. Ed., Inorganic Experiments; VCH: Weinheim,1994.
3. H.A. O Hill and P. Day, Practical methods in Advanced Inorganic Chemistry, John Wiley, 1968.

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			2		2	1			1		2	1	
CO2	3	2	3	3	3	2	2	2	2	2	2	2	2	3
CO3	2	1	2	2	2	3	2		2	3	2	3	2	2
CO4	3		2	1		1						2	2	
CO5	2		2	2								1	1	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	Observation	Once in a year
2.	Record	Once in a year
3.	Model Practical Examination I	Once in a year
4.	Model Practical Examination II	Once in a year
5.	End Semester Examination	Once in a year

Course Designed by: **Ms.J.Antonette Luciana Sherryn**	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER I & II
COURSE CODE: 23PCH1CP3
TITLE OF THE COURSE: PRACTICAL –III – PHYSICAL CHEMISTRY – I

COURSE OBJECTIVES:

- To learn about the significance of non-electrical experiments.
- To find out the concentration of unknown solutions through various electrical experiments with the aid of potentiometry.

COURSE OUTCOMES:

At the completion of the course, the student will have the ability to

CO1	Electrical Experiments	**K3**
CO2	Non electrical experiments	**K2**
CO3	Record Transfer the results of experimental work through record presentation	**K2**
CO4	Viva Voce Examination To check the student's knowledge on the respective practical	**K2**

Syllabus

Credits: 4 **Instructional Hours: 120**

Non-Electrical Experiments

1. Heat of solution from solubility.
2. Heat of solution by calorimetry.
3. Molecular weight determination by Rast method using digital Beckmann thermometer.
4. Determination of activity and activity co-efficient by freezing point method.
5. Distribution coefficient and determination of equilibrium constant.
6. Thermal analysis of simple binary systems.
7. Determination of equilibrium constant.
8. Study of phase diagram of two components forming simple eutectic.

Electrical Experiments

1. Determination of pH and pka values using quinhydrone and glass electrodes; potentiometric titrations. (Acid – base, redox and precipitation).
2. Determination of solubility of sparingly soluble salt by emf method.
3. Determination of activity coefficients from emf data.
4. Potentiometry – Determination of pH.
5. Potentiometry – Determination of dissociation constant of week acids.

TEXT BOOKS

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels et al.
3. Selected Experiments in Physical Chemistry – Latham.
4. Experiments in Physical Chemistry – James and Prichard.

REFERENCE BOOKS

1. Mukhopadhyay R and Chatterjee.P.2004.Advanced practical chemistry. Books and Allied Pvt Ltd. Kolkata.
2. Yadav.J.B.2013.Advanced Practical Physical Chemistry. Goel Publishing House. Meerut. India
3. Kheterpal.S.C. Kapil.P.N. and Dhawan.S.N..2004. Advanced College Practical Chemistry-Volume II. Pradeep Publications. India

MAPPING OF CO'S WITH PO'S / PEO'S

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1			2		2	3			1		2	3	
CO2	2	2	3	3	3	2	2	3	2	2	3	2	2	3
CO3	3	1	2	2	2	3	2		3	3	2	3	3	2
CO4	3		3	1		2						2	3	

Correlation: 3 – High, 2 – Medium, 1 - Low

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	Observation	Once in a year
2.	Record	Once in a year
3.	Model Practical Examination I	Once in a year
4.	Model Practical Examination II	Once in a year
5.	End Semester Examination	Once in a year

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: III
COURSE CODE: 23PCH3C07
TITLE OF THE COURSE: CORE 7: ORGANIC CHEMISTRY - III
(CHEMISTRY OF NATURAL PRODUCTS)
(Skill Development)

COURSE OBJECTIVES:

- To explain the isolation, classification and structural elucidation of natural plant products like terpenoids, steroids and alkaloids and their significance
- To know the importance of natural pigments and value the use of reactions and reagents in natural product synthesis.

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Learn the isolation and structural elucidation of terpenoids	**K4**
CO2	Study the structural elucidation and synthesis of steroids	**K2**
CO3	Gain knowledge about the constitution and synthesis of alkaloids	**K4**
CO4	Distinguish the biologically important pigments and copigments	**K2**
CO5	Know the applications of reactions and reagents in natural product synthesis.	**K1**

Credits: 4 **Instructional Hours: 75**

UNIT I: TERPENOIDS (K4) **(15 Hours)**

Introduction, isolation, classification and structural elucidation of terpenoids – synthesis of Zingiberene, Eudesmol, Juvenile Hormone, Abietic Acid and Caryophyllene.

UNITII: STEROIDS (K2) **(15 Hours)**

Introduction, structural elucidation and synthesis of Cholesterol (Synthesis Not Required) Ergosterol, Equilenin, Estrone, Testosterone and Progesterone.

(Beyond the Curriculum: Biological applications of steroids)

UNIT III: ALKALOIDS (K4) **(15 Hours)**

Introduction, isolation of alkaloids, structural elucidation and synthesis of Morphine, Reserpine, Quinine, Atropine and Nicotine.

(Self-Study: Medicinal values of alkaloids).

UNITIV: PROTEINS AND NUCLEIC ACIDS (K2) **(15 Hours)**

Classification and structure of proteins -synthesis of polypeptides and oxytocin, solid state peptide synthesis. Enzymes and coenzymes. Structure of RNA and DNA and their biological importance.

Natural Pigments and Copigments

Structure, synthesis and reactions of anthocyanins (cyanin and pelargonin). flavones, isoflavones. Purines (adenine and guanine).

(Self-Study: Structure of essential and non essential amino acids)

UNITV: REACTIONS AND REAGENTS IN NATURAL PRODUCT SYNTHESIS (K1) **(15 Hours)**

Reactions: Oppanauer oxidation, Barbier – Wieland degradation, Barton reaction, Jones oxidation, Vilsmier - Hack reaction. Arndt Eistert synthesis, Gabriel synthesis and Leucart reaction.

Reagents: Preparations and synthetic applications of DDQ (2, 3-Dichloro-5, 6- Dicyano-1, 4-Benzoquinone), DBU (1, 5-Diazabicyclo [5.4.0] Undecene-5), DCC (Dicyclohexyl Carbodiimide) and Crown Ethers ([12] Crown-4 & [18] Crown-6). Girard reagent, diazoacteic ester, trifluroacetic acid.

TEXT BOOKS

1. Finar I.L . *Organic Chemistry Volume – II. Stereochemistry and the Chemistry of Natural Products*. 5th Edition. Pearson Education Ltd., London, (2011).
2. Gautam Bramachari. *Organic Name Reactions*. Revised Edition - Narosa Publishing House. New Delhi, (2012).

REFERENCE BOOKS

1. Agarwal, O.P. *Organic Chemistry Natural Products* – Volume- I. Geol Publishing House. Delhi, (2008)

2. Agarwal, O.P. *Organic Chemistry Natural Products* – Volume- II. Geol Publishing House. Delhi, (2009)
3. Krishnaswamy, N.R. *Chemistry of Natural Products*. 2nd Edition. Universities Press Pvt Ltd. India, (2010).
4. Ahluwalia V.K. *Chemistry of Natural Products*. Vishal Publishing Company. India, (2008)
5. Gurdeep R. Chatwal. *Organic Chemistry of Natural Products* – Volume- I. 5th Edition. Himalaya Publishing House. India (2013)

BLENDED LEARNING
UNITIV: PROTEINS AND NUCLEIC ACIDS

Topics	Links
Classification of Proteins	https://www.youtube.com/watch?v=cXBubSuR-2w
Structure of RNA And DNA And Their Biological Importance.	https://www.youtube.com/watch?v=0lZRAShqft0
Structure of Proteins	https://www.youtube.com/watch?v=Bsk9hvXDJp8
Solid State Peptide Synthesis	https://www.youtube.com/watch?v=GI7xY4o7vak
Structure and Synthesis of Oxytocin	https://www.youtube.com/watch?v=dX1QsJ7e7LI
Enzymes and Co Enzymes	https://www.khanacademy.org/test-prep/mcat/biomolecules/enzyme-structure-and-function/v/cofactors-coenzymes-and-vitamins
Structure and functions of DNA	https://www.youtube.com/watch?v=RA9n0Enu5Gw
Structure and functions of RNA	https://www.youtube.com/watch?v=tK4hZYTt6y4https://www.youtube.com/watch?v=hMZ_OkNCAYI
Flavonoids	https://www.youtube.com/watch?v=ufG3UUUHr0M
Flavonoids, Isoflavones, Structure Elucidation & Synthesis	https://www.youtube.com/watch?v=TPG8bGH0JMk
Purine synthesis	https://www.youtube.com/watch?v=VXWyWzbigrg
Anthocyanins	https://www.youtube.com/watch?v=hMZ_OkNCAYI

MAPPING OF CO'S WITH PO'S / PEO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2			3		2	2			2		2	2	
CO2	3	2		3	3	2	2		2	1	2	2	2	3
CO3	3	2		2	3	2	2		2	2	2	3	2	2
CO4	3		2	2		1						2	2	
CO5	2			2								2	1	

(Correlation: 3 – High; 2 – Medium; 1 – Low)

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Dr.K.Anbarasi	**Verified by HOD:** Dr. N.Gunavathy
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: III
COURSE CODE: 23PCH3C08
TITLE OF THE COURSE: CORE 8 – PHYSICAL CHEMISTRY - III (THERMODYNAMICS)
(Skill Development)

COURSE OBJECTIVES:

- To enable a comprehensive knowledge on thermodynamics and non –ideal systems.
- To understand quantum statistics, partition function and heat capacity of solids.

COURSE Outcomes

At the completion of the course the students will have the ability to

CO1	illustrate the fundamental aspects of classical thermodynamics and chemical potential	**K2**
CO2	describe the third law of thermodynamics	**K1**
CO3	Analyze the thermodynamic properties E, H, S, A, G, Cv and Cp.	**K4**
CO4	Relate the Fermi – Dirac and Bose- Einstein statistics.	**K2**
CO5	Explaining the thermodynamic aspects of irreversible process	**K1**

Credits:4 **Instructional Hours:75**

UNIT I: THEMODYNAMICS AND NON-IDEAL SYSTEMS (K2) (15 Hours)

Chemical potential and definition of fugacity. Determination of fugacity of gases by graphical method and from equations of state. Variation of fugacity with temperature. Fugacity and standard state for non - ideal gases. Definition of activity, activity coefficient, temperature coefficient of activity. Standard states. Applications of activity concept to solutions. Rational and practical approaches. Measurement of activity of solvent from colligative properties. Determination of activity of solute.
(Beyond the Curriculum: Industrial applications of thermodynamics based on IInd Law)

UNIT II: THIRD LAW OF THERMODYNAMICS (K1) (15 Hours)

Probability and third law. Need for third law. Nernst heat theorem and other forms stating third law. Thermodynamic quantities at absolute zero. Statistical meaning of third law and apparent exception. Mathematical introduction: theories of permutation & combination, laws of probability. Distribution laws. Gaussian distribution.
(Self-Study: Laws of thermodynamics)

UNIT III: PARTITION FUNCTION (K4) (15 Hours)

Partition Function - definition, justification of nomenclature, micro canonical and canonical ensembles. Molecular partition function and canonical function. Relation between total partition function of a molecule and separate partition functions. Translational partition function, rotational partition function. Effect of molecular symmetry on rotational partition function. Effect and para hydrogen. Vibrational partition function. Electronic partition function. Evaluation of thermodynamic properties E, H, S, A, G, Cv and Cp from monoatomic and diatomic ideal gas molecule partition functions.

UNIT IV: HEAT CAPACITIES OF SOLIDS (K2) (15 Hours)

Einstein's and Debye's theories of heat capacities of solids. Bose-Einstein and Fermi- Dirac statistics: Bose - Einstein distribution law. Entropy of Bose - Einstein gas. Plank distribution law for black-body radiation. Fermi - Dirac distribution law. Entropy of Fermi - Dirac gas.

UNIT V: THERMODYNAMICS OF IRREVERSIBLE PROCESSES (K1) (15 Hours)

Simple examples of irreversible processes, general theory of non-equilibrium processes, entropy production, phenomenological relations, Onsager reciprocal relations, application to the theory of diffusion, thermal diffusion, thermo-osmosis and thermo molecular pressure difference, electro-kinetic effects, Glansdorf - Pregogine equation.
(Self-Study: Thermodynamics of natural process, Aerosol spray, Entropy – the measure of time)

TEXT BOOKS

1. Atkins P.W. *Physical Chemistry*. 5thEdition. Oxford University Press. Jericho, (1995).
2. Glasstone Sand Lewis D. *Elements of Physical Chemistry*. 2nd Edition. Macmillan, New Delhi, (1995).

REFERENCE BOOKS

1. Atkins. P. W and Paula. J. *Physical Chemistry*, 8th Edition, Oxford Publications (2009).
2. McQuarrie, D. A. *Statistical Mechanics*. Harper and Row publishers. New York (2000).
3. Hill T. A. *An Introduction to Statistical Thermodynamics*. Dover Publications Inc. New York (1987)
4. Satya Prakash.*Statistical Mechanics*. Kedarnath Ram Nath Publishers. Meerut and Delhi (2009)
5. Keith J. Laidler. *Chemical Kinetics*. (Indian Reprint2008) 3rd Edn. Pearson Education. India (1987)

BLENDED LEARNING

UNIT IV: HEAT CAPACITIES OF SOLIDS

Topics	Links
Einstein's and Debye's Theories of Heat Capacities of Solids	https://www.youtube.com/watch?v=3UfqUjVsSV8
Bose-Einstein Statistics	https://www.youtube.com/watch?v=1aHFG7VLr-g
Fermi-Dirac Statistics	https://www.youtube.com/watch?v=_kkbOpFEU5E
Bose-Einstein Distribution Law	https://www.youtube.com/watch?v=jCJpW_dZYk0
Entropy of Bose-Einstein Gas	https://www.youtube.com/watch?v=MJ4OfGDJGlM
Plank Distribution Law forBlack-Body Radiation	https://www.youtube.com/watch?v=yVN09TdSHHg
.Fermi - Dirac Distribution Law	https://www.youtube.com/watch?v=_kkbOpFEU5E&t=623s
Entropy of A Fermi- Dirac Gas	https://www.youtube.com/watch?v=8j7x8v2nngw

MAPPING OF CO'S WITH PO'S / PEO'S

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CO1	2			3		2	1				3	2	2	
CO2	3	2	2	3	3	2	2		2	3	2	3	2	
CO3	2	1	2	2	2	2	2			2	2			
CO4	3		2	1		2			2	3	3	3	2	3
CO5	2		2	2						3	2	2	2	

(Correlation: 3 – High; 2 – Medium; 1 – Low)

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester

6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Mrs. Valli. S	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: III
COURSE CODE: 23PCH3C09
TITLE OF THE COURSE: CORE 9: ORGANIC SPECTROSCOPY
(Skill Development)

COURSE OBJECTIVES:

- To understand the basic principles of spectroscopy where electromagnetic radiation interacts with chemical substances.
- To have a deeper understanding on the different regions of the spectrum and the types of molecular transitions corresponding.

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Explain the basic principles and applications of IR Spectroscopy	**K2**
CO2	Describe the basics and applications of Ultraviolet Spectroscopy	**K1**
CO3	Make use of NMR Spectroscopic analysis to manipulate the molecular structure.	**K3**
CO4	Analyze the structure with the corresponding carbon count	**K4**
CO5	Gain knowledge on the fragmentation of the mass Spectroscopy	**K4**

Credits: 4 **Instructional Hours:75**

UNIT I: INFRARED SPECTROSCOPY (K2) (15 Hours)

Vibrating diatomic molecules - simple harmonic oscillator - diatomic rotator - vibrations of polyatomic molecules - influence of rotation on the spectrum of polyatomic molecules - factors influencing vibrational frequencies- characteristic group absorptions of organic molecules - identification of functional groups - applications to organic and inorganic compounds - medical diagnosis (cancer) – instrumentation - FTIR.

Self Study: Importance of Finger print region in IR

UNIT II: ULTRAVIOLET AND VISIBLE SPECTROSCOPY (K1) (15 Hours)

Electronic spectra of diatomic molecules - laws of photometry - electronic absorption transitions - correlation of electronic structure with molecular structure - simple chromophoric groups - effects of conjugation – Woodward - Fisher Rules - aromatic system with extended conjugation - applications to organic and inorganic compounds - instrumentation.

Self-Study: Concept of chromophore, auxochrome, bathochromic and hypsochromic shift.

UNIT III: ^{1}H NMR SPECTROSCOPY(K3) (15 Hours)

Magnetic properties of nuclei - theory of nuclear resonance - chemical shift and its measurement – factors influencing chemical shift - chemical equivalence - solvents and NMR spectra - spin–spin coupling - spin-spin splitting systems - proton exchange reactions - heteronuclear coupling - deuterium exchange - double resonances - chemical shift reagents- applications to organic and inorganic compounds – instrumentation - CW and FT NMR.

UNIT IV: ^{13}C NMR SPECTROSCOPY (K4) (15 Hours)

Magnetic moment and natural abundance - broad band decoupling - deuterium coupling - NOE effect - off-resonance decoupling - peak assignments using DEPT Spectrum- structural applications of 13C NMR spectroscopy.

Correlation NMR spectroscopy

Theory – ^{1}H-^{1}H COSY, ^{1}H-^{13}C COSY: hetcor, proton Detected HETCOR: HMQC, proton detected long range ^{1}H-^{13}C heteronuclear correlation: HMBC, NOESY.

UNIT V: MASS SPECTROMETRY (K4) (15 Hours)

Theory – instrumentation - isotopic abundance - determination of molecular weights and formulae, ionization techniques (CI, FD, FAB And ESI) – nitrogen rule - metastable ions and peaks - ion fragmentation mechanisms - Retro Diels Alder rearrangement - McLafferty rearrangement -

fragmentation associated with functional groups - alcohols, carbonyl compounds, amines, ether and aromatic compounds, elimination due to ortho groups.
(Beyond the Curriculum: Gas Chromatography – Mass Spectrometry)

TEXT BOOKS

1. Kemp W.*Organic Spectroscopy*. 2nd Edition. Mac Millan Publishers. New York, (2019)
2. Robert M. Silverstein, Francis X. Webster, David J. Kiemle and David L. Bryce. *Spectrometric Identification of Organic Compounds*. 8th Edition. John Wiley & Sons Ltd. New York, (2014)

REFERENCE BOOKS

1. Sharma Y.R. *Elementary Organic Absorption Spectroscopy*. 5th Revised Edition. S Chand & Company Pvt Ltd. New Delhi (2013)
2. Kalsi P.S. 2016. *Spectroscopy of Organic Compounds*. New Age International Private Limited. New Delhi, (2016)
3. Gupta, Kumar and Sharma. *Elements of Spectroscopy*. Pragati Prakashan. New Delhi, (2011).
4. Lampman, Pavia, Kriz and Vyvyan.*Spectroscopy*. 4th Edition. Cengage Learning. US. (2012)

BLENDED LEARNING
UNIT V: MASS SPECTROMETRY

Topics	Links
Theory	https://www.youtube.com/watch?v=2oPUyIbPxLo https://www.youtube.com/watch?v=NuIH9-6Fm6U
Instrumentation	https://www.youtube.com/watch?v=RuwbeA22rew https://www.youtube.com/watch?v=EzvQzImBuq8
Isotopic abundance	https://www.youtube.com/watch?v=p7lWBEWUZE4
Determination of molecular weights and formulae	https://youtu.be/HmocyWfMHTQ https://youtu.be/1zfoeM_cd9E
Ionization techniques (CI, FD, FAB) CI FD FAB	https://youtu.be/A_6jBS08VZ8 https://youtu.be/9Z9vPh6rYGM https://youtu.be/Po9Sgt2EzNg https://youtu.be/WzgudLyh0fA
Nitrogen rule	https://www.youtube.com/watch?v=zIqHhwun8VA
Metastable ions and peaks	https://www.youtube.com/watch?v=XVDtQLgc0ak
Ion fragmentation mechanisms	https://www.youtube.com/watch?v=FCCFiyoDTaM https://www.youtube.com/watch?v=mbXOP28W9z8 https://youtu.be/BSKEgvXVohg
Retro Diels Alder rearrangement	https://youtu.be/Oi5Z_xMWz5w
McLafferty rearrangement	https://youtu.be/k1IqUy_UYrM
Fragmentation associated with functional groups - alcohols, carbonyl compounds, amines, ether and aromatic compound	https://www.youtube.com/watch?v=RMTh1VXM7CY https://www.youtube.com/watch?v=deVAwFtpZxQ https://www.youtube.com/watch?v=DAKespfUors

Elimination due to ortho groups	https://youtu.be/gK6ZPcqV8E0

MAPPING OF CO'S WITH PO'S / PEO'S

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CO1	3			3		2	1				3	2	2	
CO2	2	2	2	3	3	2	3		2	3	2	3	2	
CO3	2	1	3	2	2	2	2			2	2			
CO4	3		2	2		3			2	2	3	3	1	3
CO5	2		2	2						3	2	2	2	

(Correlation: 3 – High; 2 – Medium; 1 – Low)

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Dr. J. Johncy Caroline	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: III
COURSE CODE: 23PCH3E01
TITLE OF THE COURSE: ELECTIVE III- CORROSION CHEMISTRY AND BATTERY TECHNOLOGY
(Employability)

COURSE OBJECTIVES:

- To introduce the principle of electrochemical concepts of various corrosion process, common corrosion forms, corrosion mechanism that help to perform standard corrosion tests and in depth analyses of test results and utilize corrosion prevention strategies and formulate corrosion prevention inhibitors.
- To understand the various methods of Battery Technology

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Explain the basic electrochemical corrosion processes of various corrosion forms	**K2**
CO2	Relates the thermodynamics in corrosion process	**K2**
CO3	Apply methods of corrosion based on effects of passivity and polarization on corrosion process	**K4**
CO4	Implement corrosion prevention system like cathodic and anodic protection using different corrosion inhibition mechanism	**K3**
CO5	To research on types of battery	**K4**

Credits: 4 **Instructional Hours: 60**

UNIT I:INTRODUCTION AND PRINCIPLES (K2) (12 Hours)

Corrosion – introduction – definition - cost of corrosion - importance of corrosion studies– consequences of corrosion – theories of corrosion – dry corrosion – wet or electrochemical principles of corrosion – difference – Pilling Bedworth rule - forms of corrosion - (definition, cause and effects) – galvanic – crevice – pitting – intergranular – selective leaching – erosion, stress and hydrogen damage - corrosion rate expression.

(Self-Study: Electrochemical reactions)

UNIT II: THERMODYNAMICS (K2) (12 Hours)

Thermodynamics - change of Gibbs free energy – Pourbaix diagram of water, iron and aluminium – limitation of Pourbaix diagram – polarisation – measurement – causes of polarization - concentration polarization – activation polarization – resistance polarization (basics ideas only).

UNIT III: MONITORING OF CORROSION (K4) (12 Hours)

Corrosion monitoring techniques - non-electrochemical methods: weight loss and gasometric methods - electrochemical methods: – electrical resistance measurement – linear polarization resistance - potentiodynamic and galvanodynamic polarization and electrochemical impedance spectroscopy.

UNIT IV: CORROSION PREVENTION AND CONTROL (K3) (12 Hours)

Corrosion prevention – material selection – change of environment – proper design - cathodic and anodic protection – application of coating - types of coating – hot dipping -metal cladding – cementation – electroplating – surface or chemical conversion coating - anoding – vitreous or porcelain enamel coating – paints (basic idea only).

Corrosion inhibitor – definition – types – advantages of using inhibitors – industrial application of inhibitors - classification of inhibitors - mechanism of inhibition adsorption isotherms (basic ideas only) – green inhibition - definition.

UNIT V: BATTERY TECHNOLOGY (K4) (12 Hours)

Batteries – basic concept – battery characteristics – classification of batteries – primary, secondary and reverse batteries – classical batteries – construction, working and applications of lead acid battery and nickel – cadmium battery – modern batteries – construction and working and application of zinc – air, nickel – metal hydride and Li – MnO_2batteries.

Fuel cells – introduction, types of fuel cells – alkaline, phosphoric acid, molten carbonate, solid polymer electrolyte and solid oxide fuel cells – construction and working of H_2- O_2fuel cells.***(Self-Study: Importance of Batteries)***

TEXT BOOKS

1. Raj Narayan. *An Introduction to Metallic Corrosion and Its Prevention*. Oxford and IBH Publishing CO, New Delhi, (1983).
2. Mars Fontana. *Corrosion Engineering*. (3rd Edition), Tata McGraw Hill Education Private Limited, New Delhi, (2010).

REFERENCE BOOKS

1. Kenneth R. Tretheway and John Chamberlain, *Corrosion for Science and Engineering*, 2nd Edition, Addison Wesley Longman Limited, England, (1996).
2. Philip A. Schweitzer. *Fundamentals of Corrosion – Mechanism, Causes and Preventive Methods*. CRC Press Taylor & Francis group, New York, (2012).
3. Angal R.D. *Principles and Prevention of Corrosion*. Narosa Publishing House, New Delhi, (2010)
4. Daniel Yesudian, C. *Text Book of Engineering Chemistry*. Hi-Tech Publications, Mayiladuthurai, (1999).
5. Gopalan, R, Venkappayya, D and Nagarajan, S. *Engineering Chemistry*. Vikas Publishing House Pvt Ltd, New Delhi, (1999).

BLENDED LEARNING
UNIT V: BATTERY TECHNOLOGY

Topics	Links
Batteries – Basic Concept – Battery Characteristics	https://learn.sparkfun.com/tutorials/what-is-a-battery/all
Classification Of Batteries – Primary, Secondary and Reverse Batteries – Classical Batteries	https://www.youtube.com/watch?v=Tye3dcBOqtY&vl=en
Working And Applications of Lead Acid Battery -	https://www.youtube.com/watch?v=HhxtfULIO7c
Nickel – Cadmium Battery – Modern Batteries	https://turbofuture.com/misc/The-Nickel-Cadmium-Battery
Construction And working And Application of Zinc – Air	https://www.youtube.com/watch?v=OcGWbt1mcrc
Nickel – Metal Hydride	https://www.youtube.com/watch?v=-V3MrmYVC50
Li – MnO_2 Batteries	https://eduladder.com/viewquestions/3635/Discuss-the-construction-and-working-of-Li---MnO2-battery
Fuel Cells – Alkaline, Phosphoric Acid, Molten carbonate.	https://www.youtube.com/watch?v=erGwIRHioHo
Solid Polymer Electrolyte and Solid Oxide Fuel Cells	https://www.bloomenergy.com/blog/everything-you-need-know-about-solid-oxide-fuel-cells
Construction and working of H_2 - O_2 Fuel Cells	https://www.aboutcircuit.com/hydrogen-oxygen-fuel-cell/

MAPPING OF CO'S WITH PO'S / PEO'S

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CO1	2			3		2	3			2		2	1	
CO2	3	2	2	3	3	2	2		2	2	2	2	2	3

CO3	2	1	2	2	2	2	2		2	2	2	3	2	2
CO4	3		2	1		2						2	2	
CO5	2		2	2								2	1	

(Correlation: 3 – High; 2 – Medium; 1 – Low)

ASSESSMENT TOOLS

S.No.	**Assessment Methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Mrs. J. Antonette Luciana Sherryn	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: III
COURSE CODE: 23PCH3E02
TITLE OF THE COURSE: ELECTIVE III– ENVIRONMENTAL CHEMISTRY
(Employability)

COURSE OBJECTIVES:

- To enable a comprehensive knowledge about the fundamentals of water and atmospheric Chemistry.
- To understand the importance of soil chemistry and industrial pollution

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Illustrate the fundamental aspects of environmental chemistry	**K2**
CO2	Describe the properties and characteristics of water chemistry	**K1**
CO3	Discuss the nature and reactions of atmospheric chemistry	**K2**
CO4	Analyze the toxic chemicals in soil pollutants.	**K4**
CO5	Narrate different industrial pollutants and their proper disposal.	**K2**

Credits: 4 **Instructional Hours: 60**

UNIT I: FUNDAMENTALS (K2) (12 Hours)

Fundamentals of environmental chemistry- chemical potential, chemical equilibria, acid base reactions and carbonate system, sampling techniques for air, water, and soil. Composition of atmosphere – Biogeochemical cycles of Carbon, Nitrogen, Phosphorous, Sulphur, Oxygen and Water.

(Self-study: Scope and importance of Environmental Chemistry, Components of Environment)

UNIT II: WATER CHEMISTRY (K1) (12 Hours)

Water chemistry- properties of water, nature of metal ions in water, solubility of gases in water, occurrence of chelating agents in water; Redox potential, Significance of redox equilibria in natural and waste water; microorganisms; The catalyst of aquatic chemical reactions, water pollution and its effects, eutrophication concept of DO, BOD, COD, Sedimentation. Coagulation and filtration.

UNIT III: ATMOSPHERIC CHEMISTRY (K2) (12 Hours)

Atmosphere- Nature and composition of atmosphere, chemical and photochemical, reactions in the atmosphere – OZONE and PAN ions and radicals in the atmosphere; gaseous organic and inorganic pollutions in the atmosphere; Global warming and effects of CO, SO_2, NOx. Green house effect, acid rain, air pollution controls and their chemistry.

UNIT IV: SOIL CHEMISTRY (K4) (12 Hours)

Soil chemistry- inorganic and organic components of soil, Nitrogen pathways.NPK in soils; Toxic chemicals in the environment pesticides and their toxicity; biochemical aspects of arsenic, cadmium, lead & mercury-causes and effects-industrial wastes-urban wastes-agricultural practices-radioactive pollutants-control of soil pollution.

(Self-study: Renewable and Non-renewable resources, Forest resources, uses and their over exploitation)

UNIT V: INDUSTRIAL POLLUTION (K2) (12 Hours)

Cement, sugar, distillery, drug paper and pulp, thermal power plants, nuclear power plants, metallurgy polymers drugs etc., radionuclide analysis, disposal of wastes and their management. Environmental chemistry of hazardous wastes, hazardous wastes in hydrosphere, geosphere and atmosphere, Health effects of hazardous wastes.

TEXT BOOKS

1. Sharma and Kaur. *Environmental Chemistry*, Krishna Publishers. New Delhi, (2000).
2. De A. K, *Environmental Chemistry*. Wiley Eastern Ltd. New Delhi, (1989).

REFERENCE BOOKS

1. J. Rose Gordon and Breach (Ed.) *Environmental Toxicology*, Science Publication, NY, (1993)
2. Manahan S.E. *Environmental Chemistry*. Lewis Publishers. London, (2001).
3. Khopkar S.M. *Environmental Pollution analysis*. Wiley Eastern. New Delhi, (1994).

BLENDED LEARNING

UNIT V: INDUSTRIAL POLLUTION

Topics	Links
Disposal of wastes and their management	https://youtu.be/LzMEb30o_PU,https://youtu.be/fZNgnh7jvTc
Sugar, distillery	https://youtu.be/QnHAUx0dMnk
Drug paper and pulp	https://youtu.be/gucn1aFDoCU
Thermal power plants, nuclear power plants-	https://youtu.be/hFZt8xMzwXc
Metallurgy polymers wastes	https://youtu.be/qP5YIR66L58

Environmental chemistry of hazardous	https://youtu.be/4usR910eqeU
Hazardous wastes in hydrosphere, geosphere and atmosphere-	https://youtu.be/Hs2x6_Hw4a8
Health effects of hazardous wastes	https://youtu.be/LUSguoVk2sc https://youtu.be/Pp5507x1bCk

MAPPING OF CO'S WITH PO'S / PEO'S

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3			3		2	1				3	2	1	
CO2	2	2	2	3	3	2	3		2	3	2	3	2	
CO3	2	1	3	2	2	2	2			2	2			
CO4	3		2	1		1			2	2	3	3	1	3
CO5	2		2	2						3	2	2	2	

(Correlation: 3 – High; 2 – Medium; 1 – Low)

ASSESSMENT TOOLS

S.No.	**Assessment Methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Mrs. J.Antonette Luciana Sherryn	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: IV
COURSE CODE: 23PCH4C10
TITLE OF THE COURSE: CORE 10: ORGANIC CHEMISTRY- IV
(DISCONNECTION APPROACH AND ORGANIC SYNTHESIS)
(Skill Development)

COURSE OBJECTIVES:

- To gain knowledge to synthesis the target products from available substrates.
- To rationalize of the reactivity of hetero aromatic compounds

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Apply the retrosynthetic approach to planning organic syntheses	**K3**
CO2	Identify the mechanisms of naming reactions	**K3**
CO3	Identify the reaction mechanism and applications of poly carbonyl compounds	**K3**
CO4	Examine the applications of organometallic compounds	**K4**
CO5	Explain the importance of various catalysts in organic synthesis	**K2**

Credits: 5 **Instructional Hours: 90**

UNIT I: DISCONNECTION APPROACH (K3) (18 Hours)

Retro synthetic analysis – Definition of some terms used in synthesis-target molecule – functional group inter conversion (FGI), retro synthetic arrow-synthons and synthetic equivalents - guidelines for choosing disconnections - functional group addition - one group C-X disconnections - two group C-X disconnections - one group C-C bond disconnections – regio selectivity - two group C-C disconnections - 1,3 difunctional, 1,5 difunctional compounds and Robinson annellation reaction - importance of the order of events in organic synthesis- Chemo selectivity - reversal of polarity. Protecting groups - protection of alcohols, carbonyl groups, carboxylic group and amino group. Ring synthesis-synthesis of saturated heterocycles (three, four, five and six membered rings) **(IND 4.0)**

UNIT II: ORGANIC REACTIONS – MECHANISM AND APPLICATIONS (K3) (18 Hours)

Brood reaction, Strecker and Peterson synthesis, Ullman reaction, Hell – Volhard - Zelensky (HVZ) reaction, Reformatsky reaction, Sandmeyer reaction, Stephen reaction, Willgerdot reaction, Prins reaction – Staudinger reaction, Henry reaction, Fittig reaction, Pechmann reaction, Julia Olefination and Haller –Bauer reaction.

UNIT III: VITAMINS (K3) (18 Hours)

Structure and synthesis of vitamin B complex: vitamin B1 (aneurin) - vitamin B2 (riboflavin) - pantothenic acid - folic acid - vitamin H (biotin) - vitamin B6 (pyridoxine) - vitamin B12 (cyanocobalamin) structure only - vitamin E (alpha- tocopherol) - vitamin K1 (phylloquinone) and vitamin K2.

(Self study: Vitamin A and Vitamin C)

UNITIV: ORGANOMETALLIC COMPOUNDS(K4) (18 Hours)

Reactivity, preparation and reactions of Grignard reagents, organo lithium compounds, organo cadmium compounds, organo zinc compounds, organo copper compounds, organo silicon compounds, organo palladium compounds, organo tin compounds, organo mercury compounds, organo aluminium compounds, organo titanium compounds and organo cerium compounds.

(Self study: Applications of Organometallic compounds in Industry)

UNIT V: ORGANIC SYNTHESIS USING BIOCATALYST AND POLYMER SUPPORTED CATALYST (K2)

(18 Hours)

Introduction-biochemical (microbial) oxidations and reductions-enzymes catalyzes hydrolytic processes-enantioselective hydrolysis of meso diesters-hydrolysis of N-acylamino acids-polymer supported catalyst-introduction-polymer bound anhydrous aluminium chloride, polymeric super acid catalyst, polystyrene metalloporphyrin-polymer supported photosensitizers, polymer supported phase transfer catalysts-polymer supported crown ethers.

(Beyond the Curriculum: Importance of biocatalyst in Pharma products)

TEXT BOOKS

1. Jagadamba Singh and Yadav L.D.S. *Organic Chemistry* - Vol I & II. Pragati Prakashan. New Delhi, (2010).
2. Stuart Warren and Paul Wyatt. *Organic Synthesis: The Disconnection Approach*. 2nd Edition. Wiley. New York, (2008).

REFERENCE BOOKS

1. Mukherji.S.M. *Organic Chemistry*-volume III. New age international publishers. New Delhi, (2014)
2. Ahluwalia V.K. and Rakesh K. Parashar. *Textbook of Organic Chemistry*. Viva Student Edition. Viva Books. New Delhi, (2012).
3. Agarwal O.P. *Organic Chemistry Reactions & Reagents*. Krishna's Educational Publishers. Goel Publishing House. New Delhi, (2008).
4. Jagadamba Singh and Yadav L.D.S. *Advanced Organic Chemistry*. Pragati Prakashan. New Delhi, (2011).
5. Ratan Kumar Kar. *Fundamentals of Organic Synthesis: The Retrosynthetic Analysis* - Vol II. 2nd Edition. New Central Book Agency. New Delhi, (2014).
6. Finar I.L. Organic Chemistry - Vol I. 6th Edition. Pearson Education Ltd. New Delhi, (2012).
7. Ahluwalia. *Green chemistry*. Narosa publishers. New Delhi, (2013).

8. Harish K. Chopra, Anupama Parmar and Parmjit S. Panesar. 2013. Bio - Organic Chemistry. Narosa Publishing House. New Delhi, (2013).

BLENDED LEARNING
UNITIV: ORGANOMETALLIC COMPOUNDS(K4)

Topic	Link
Reactivity, Preparation And Reactions Of Grignard Reagents	https://www.youtube.com/watch?v=QDju_r4y3Y
Organo Lithium Compounds	https://www.youtube.com/watch?v=wAgsX_2Bk3s
Organo Cadmium Compounds	https://www.youtube.com/watch?v=4TCXu7MRQ6w
Organo Zinc Compounds	https://www.youtube.com/watch?v=BCrwsWtC3g8
Organo Copper Compounds	https://www.youtube.com/watch?v=SrinrUTvqD4
Organo Silicon Compounds	https://www.youtube.com/watch?v=76pMooiua7U
Organo Palladium Compounds	https://www.youtube.com/watch?v=MlZ2LBIJ1xs
Organo Tin Compounds	https://www.youtube.com/watch?v=Fddna5_uu5c
Organo Mercury Compounds	https://www.youtube.com/watch?v=inecTcspkbo
Organo Aluminum Compounds	https://www.youtube.com/watch?v=T1_6MaT_Qk
Organo Titanium Compounds	https://www.youtube.com/watch?v=R4frAlsxglQ
Organo Cerium Compounds	https://www.youtube.com/watch?v=KYPvlr8yF_g

MAPPING OF CO'S WITH PO'S / PEO'S

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CO1	2			3		2	3			2		2	1	
CO2	2	2	2	3	3	2	2		2		2	2		3
CO3		2	2	3	2	2	1		2		2	3	2	2
CO4	3		2	1		2							2	
CO5	2		2	2									1	

Correlation: Low – 1, Medium – 2, High – 3

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Dr.J. Johncy Caroline	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: IV
COURSE CODE: 23PCH4C011
TITLE OF THE COURSE: CORE 11: INORGANIC CHEMISTRY – III
(ORGANOMETALLICS AND BIOINORGANIC CHEMISTRY)
(Skill Development)

COURSE OBJECTIVES:

- Learn about the development of organometallic chemistry and their applications in various organic trans formations.
- Gain the knowledge about Structure and Function of Various metallo enzymes.

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Understand the historical development of organometallic chemistry and uniqueness in various bonding behaviour of organometallic compounds	**K1**
CO2	Organometallic alkylidene, alkylidyne and alkyne chemistry recognition of Noble prize in Chemistry 2005	**K2**
CO3	Inferring the importance of metallocene chemistry and acquire intense knowledge about structure and function of various metalloenzymes	**K3**
CO4	The applications of metallocenes in stereospecific polymerization of 1-alkenes and fluxional behaviour of π-electron systems and importance of organometallic chemistry in catalysis	**K4**
CO5	Gain the knowledge about structure and function of various metalloenzymes.	**K1**

Credits:4 **Instructional Hours: 75**

UNIT I: BONDING IN ORGANOMETALLIC COMPLEXES AND METAL ALKYLS(K1) (15 Hours)

Definition of organometallic compound - - classification of organometallic compounds - metal carbon bond types - ionic bond- sigma covalent bond - electron deficient bond - delocalized bond - dative bond. metal alkyl complexes - stability and structure - synthesis by alkylation of metal halides – by oxidative addition - by nucleophilic attack on coordinated ligands - reactivity of metal alkyls - m-c bond cleavage reactions - insertion of CO to M-C bonds - double carbonylation
(Self study: reactivity of metal alkyls)

UNIT II: METAL ALKYLIDENE ALKYLIDYNE AND ALKYNE COMPLEXES (K2) (15 Hours)

Alkylidene and alkylidyne complexes - synthesis of alkylidene complexes in low oxidation states and in high oxidation states - bonding in alkylidene complexes - synthesis and bonding in alkylidyne complexes - reactivity of alkylidene and alkylidyne complexes. Nobel prize in chemistry 2005 - olefin metathesis in organic synthesis. alkyne complexes - bonding in alkyne

complexes - reactivity of alkynes - alkyne complexes in synthesis - cobalt catalysed alkyne cycloaddition.
(Self-Study: Nobel Prize in Chemistry 2005)

UNIT III: ORGANOMETALLIC SANDWICH COMPLEXES (K3) (15 Hours)

Cyclopentadienyl complexes - metallocenes - synthesis of metallocenes - bonding in metallocenes - reactions of metallocenes - Cp 2 Fe / Cp 2 Fe + couples in biosensors – bent sandwich complexes - bonding in bent sandwich complexes - metallocene halides and hydrides - metallocene and stereospecific polymerization of 1- alkenes - cyclopentadiene as a non-spectator ligand - monocyclopentadienyl (half-sandwich) complexes - synthesis and structures of allyl complexes - arene complexes - synthesis - structure and reactivity of arene complexes - Multidecker complexes.

UNIT IV: ORGANOMETALLIC CHEMISTRY APPLICATIONS IN CATALYSIS (K4) (15 Hours) Organometallic compounds in homogeneous catalytic reactions - coordinative unsaturation - acid-base behaviour reaction - migration of atoms or groups from metal to ligand – insertion reaction - reactions of coordinated ligands - catalytic reactions of alkenes isomerisation of alkenes-hydrogenation-hydroformylation and hydrosilation of alkenes– alkene polymerization and oligomerisation - fluxional molecules.
(Beyond the curriculum: Organometallic compounds in heterogenous catalysis)

UNIT V: STRUCTURE AND FUNCTION OF VARIOUS METALLOENZYMES (K1) (15 Hours)

Metalloenzymes - definition - examples - active site structure and mechanism of action of - carboxy peptidase - a and carbonic anhydrase - structure and function of superoxide dismutase (SOD) (Fe-SOD, Mn-SOD, Cu-Zn Couple SOD and Ni-SOD), peroxidase and catalase enzymes - xanthine oxidase – nitrogenase, hydrogenase, urease.

TEXT BOOKS

1. Manfred Bochmann. *Organometallics 1. Complexes with Transition Metal-carbon σ-bonds.* Oxford Science Publications, Oxford (1994).
2. Manfred Bochmann. *Organometallics 2. Complexes with Transition Metal- carbon π- bonds.* Oxford Science Publications, Oxford, (1994)
3. Huheey J. E, Kieter E. A and Keiter R. L. *Inorganic Chemistry*.4th Edition. Addison Wesley Publishing Company.
4. Dr Asim K Dass. *Bioinorganic Chemistry*. Books and Allied (P) Limited. (2007).

REFERENCE BOOKS

1. Haiduc J and Zuckerman J. J. *Basic Organometallic chemistry*. Walter de Gruyter, Berlin, (1985).
2. Huheey Harper J. E. *Inorganic Chemistry.Priniciples of structure and reactivity*. International Edition. Harper and Rone New Yor, (1978)
3. Cotton F. A, Wilkinson G. *Advanced Inorganic Chemistry*. Fourth Edition.
4. Keith F. Purcell and John C. Kotz.*Inorganic Chemistry*.3rd Edition.

5. Bertini I, Gray H. B, Lippard S. J, Valentine. J. S. *Bioinorganic Chemistry*. University Science Books.
6. Lippard S. J, Berg J. M, *Principles of Bioinorganic Chemistry*. University Science Books (1994)

BLENDED LEARNING
UNIT V: STRUCTURE AND FUNCTION OF VARIOUS METALLOENZYMES (K1)

TOPIC	LINK
Metalloenzymes - Definition – Examples	https://youtu.be/sC3EPz_cZds
Active site structure and mechanism of action of - Carboxy peptidase-A-	https://youtu.be/7HR_b4t8c1k
Carbonic anhydrase	https://youtu.be/E-7Bb97Er4I, https://youtu.be/wAbm_rw5K50
Structure and function of Superoxide dismutase (SOD) (Fe-SOD, Mn-SOD, Cu-Zn couple SOD and Ni-SOD)-	https://youtu.be/yCSL1wj1Iys
Peroxidase	https://youtu.be/Dzipj9s2Z3E
catalase enzymes	https://youtu.be/h-b1EOYKl3c
Xanthine oxidase	https://youtu.be/Bp717R82rbI
Nitrogenase	https://youtu.be/6_1R3lmEQ9Q
Hydrogenase-	https://youtu.be/phM2hfrmQCY
Urease	https://youtu.be/AarYS8Ai1cM

MAPPING OF CO'S WITH PO'S / PEO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2		2		2	2			1		2		
CO2	2	2	2	3	3	2	2		2	2	2	2		
CO3	2	3	2	2	2	2	2		2	2	2	1	2	

CO4	3		2	2		1						3	3	2
CO5	2	3	2	2								2		1

Correlation: Low – 1, Medium – 2, High – 3

ASSESSMENT TOOLS

S.No.	**Assessment Methods**	**Frequency of Assessment**
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Ms.J. Antonette Luciana Sherryn	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: IV
COURSE CODE - 23PCH4E01
TITLE OF THE COURSE: ELECTIVE IV - MEDICINAL CHEMISTRY
(Employability)

COURSE OBJECTIVES:

- To introduce the principle of drugs and its action
- To acquire knowledge about the chemotherapy
- To understand the various methods in phytochemical analysis

COURSE OUTCOMES:

At the completion of the course the students will have the ability to

CO1	Explain the basics terminology of drugs and its action	**K2**
CO2	Relates the mode of action, synthesis and uses of drugs	**K2**
CO3	Compile the cause and treatment of cancer and its therapy	**K3**
CO4	Associate the analysis and isolation techniques of plant products	**K3**
CO5	To research on the invitro biochemical assay	**K4**

Credits:4 **Instructional Hours:60**

UNIT I: DRUG CHEMISTRY (K2) (12 Hours)

Introduction, nature and sources of drugs, pharmacologically active principles in plants. Terminology used in drug chemistry (pharmacy, pharmacology, pharmacokinetics, pharmacophore and pharmacodynamics), biological classification of drugs. drug design and drug action. Mechanism of drug action and metabolism of drugs, absorption of drugs and assay of drugs. causes of common diseases and their treatment - insect borne diseases (malaria and plague), airborne diseases (diphtheria and tuberculosis), water borne diseases (cholera and typhoid) and disorders of digestive system –jaundice.

UNIT II: ANTIMICROBIAL AGENTS (K2) (12 Hours)

Introduction, general mode of actions, synthesis, side effects and uses of antibacterial agents (sulpha drugs - sulphanilamide and prontosil), antimalarial drug (chloroquine and primaquine), antibiotic drug (chloramphenicol and streptomycin), anti-inflammatory drug (phenyl butazone), analgesics (pethidine and analgin).

UNITIII: CHEMOTHERAPY - ANTICANCER DRUGS (K3) (12 Hours)

Introduction, classification, common causes and treatment, antineoplastic drugs - classification. role of antimetabolites in cancer chemotherapy. types of cancer (skin cancer, breast cancer, lung cancer, bladder cancer and bone cancer) antitubercular drugs – synthesis and uses of para-amino salicylic acid (PAS), thioacetazone and isonicotinyl hydrazide (INH)**AIDS -** Introduction, general symptoms, prevention and treatment, anti - hivagents. synthesis and uses of anti-epileptic drug (hydantoin), antimigraine drug (sumatriptan).

UNITIV: PHYTOCHEMICAL ANALYSIS (K3) (12 Hours)

Introduction – classification (primary and secondary metabolites). Estimation of secondary metabolites. Qualitative and quantitative phytochemical screening. **Characterization techniques used for isolation and identification of plant products -** CC, TLC, HPLC, UV, NMR and GCMS Analysis.

(Self-Study: Sample preparation techniques)

UNIT V: DRUGS II (K4) (12 Hours)

Central nervous system (CNS) stimulants – mode of action, synthesis of caffeine and nikethamide. Antipyretic analgesics – mode of action, synthesis and uses of paracetamol, aspirin and salol. Expectorants and antitussives – synthesis of acetylcysteine, guaifenesin and benzonatate. Disinfectants and antiseptics – distinction and types.

(Self-Study: Limitations and advantages of CNS stimulants.)

TEXT BOOKS

1. Daniel. M *Medicinal Plants Chemistry and Properties*. Oxford and IBH Publishing CO, New Delhi, (2006).
2. Alagarsamy M .*Text Book of Medicinal Chemistry*.CBS Publishers & Distributors Pvt Ltd. Delhi, (2016)

REFERENCE BOOKS

1. Sriram D. Yogeshwar. P. *Medicinal Chemistry*. Second Edition. Pearson India Education Service Pt.Ltd.India, (2010)
2. Ahluwalia V.K. *Textbook of Green Chemistry*. Narosa Publishing House. New Delhi, (2013)
3. SatoskarR.S. and Bharkar S.D. *Pharmacology & Pharmatherapeutics*.Volume. 1 & 2. Popular Publishing House Pvt Ltd. Mumbai, (2015)

BLENDED LEARNING

UNITIV: PHYTOCHEMICAL ANALYSIS (K3)

TOPIC	LINK
1. Introduction – Classification (Primary and Secondary Metabolites)-	https://youtu.be/1YbDwKSPTKA
2. Estimation of Secondary Metabolites	https://youtu.be/xHR36uf6zEI
3. Qualitative and Quantitative Phytochemical Screening-	https://youtu.be/GSHez85LKeohttps://youtu.be/c-q4bIGsqNA
4. Characterization Techniques Used for Isolation and Identification of Plant	https://youtu.be/HJ2z366lEhIhttps://youtu.be/APMkpGLxQl8

Products - CC, TLC, HPLC, Uv, NMR and GCMS Analysis. -	

MAPPING OF CO'S WITH PO'S / PEO'S

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CO1	2			3		2	1			2		3	2	
CO2	3	2	2	3	3	2	2		2	2	1	2	2	3
CO3	2	2	3	2	2	2	3		3	2	2	3	2	2
CO4	3		2	1		3						2	2	
CO5	2		2	3								2	1	

Correlation: Low – 1, Medium – 2, High – 3

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester
4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:**

	Principal

SEMESTER: IV
COURSE CODE - 23PCH4E02
TITLE OF THE COURSE: ELECTIVE IV – PHYTOCHEMISTRY
(Employability)

COURSE OBJECTIVES:

- To learn about the importance of Phytochemistry
- To gain knowledge of natural products and various biochemical assays

COURSE OUTCOMES:
At the completion of the course the students will have the ability to

UNITS	learning objectives	LEVEL
CO1	To expose the important terminologies in phytochemistry	**K2**
CO2	To analyze vital role of drugs	**K4**
CO3	To know some medically important organic compounds from plant and animal sources	**K1**
CO4	To gain knowledge on chemotherapy	**K1**
CO5	To learn the significance of reagents and reactions in natural product synthesis	**K3**

Credits: 4 **Instructional Hours: 60**

UNIT I: NATURAL PRODUCTS (K2) (12 Hours)
Introduction, sources, classes (primary and secondary metabolites). estimation of secondary metabolites. Plant and animal-based phytochemicals – basic structure, classification and biological importance of steroids, saponins, alkaloids, flavonoids, carotenoids, anthocyanins, terpenoids, lipids, proteins, glycosides and phenols. Qualitative and quantitative phytochemical screening. Medicinal plants and their importance: *Lantana camara*, *Xanthium parviflorum*, *Cassia italic*, *Nerviliaaragoana*and*Justiciawynaadensis*. Characterization techniques used for isolation and identification of plant Products-CC, TLC, HPLC and GC-MS Analysis.
(Self-Study: Medicinal value of plants)

UNIT II:DRUGS(K4) (12 Hours)
The life saving agent- structure, properties and mechanism of action of the following: antibacterial drugs – sulpha drugs: sulphanilamide, sulphadiazine, sulphapyridine. antibiotics –

chloramphenicol, penicillin, streptomycin. antiseptics and disinfectants: phenol and its derivatives and halogen compounds. analgesics: morphine, heroin, pethidine, morphine. anticonvulsant: barbiturates, oxazolindiones. diabetes: control of diabetes, insulin. Drugs in cancer therapy-chlorambucil and doxorubicin.

(Self-Study: Importance of Drugs)

UNIT III:NATURALPIGMENTS (K1) (12 Hours)

Introduction, occurrence, properties, structural determination and synthesis of flavones, isoflavones, anthocyanins, cocaine, stigmasterol, limonene, beta carotene and quercetin. Structural elucidation using proton and C^{13} NMR, IR, UV Analysis.

UNIT IV:*IN-VITRO* BIOCHEMICAL ASSAYS (K1) (12 Hours)

Antibacterial activity-agar diffusion and agar dilution methods, antifungal- broth dilution method, antioxidant activity - free radical scavenging activity, hydroxyl radical scavenging activity and nitric oxide scavenging activity. anti-diabetic activity- amylase inhibition assay. anti-hypertensive activity- angiotensin- converting enzyme (ACE) inhibition assay anti-inflammatory activity-hyaluronidase inhibition assay.

UNIT V: MARINE DRUGS AND HERBAL COSMETICS(K3) (12 Hours)

Marine natural products- general methods of isolation and purification, study of marine toxins, examples of marine drugs. cosmetics from natural origin-physiology and chemistry of skin and pigmentation-hair growth formulation, colorants and hair oil, anti sun burn preparations, bleaches, bath products, dentifrices, cleansing cream and deodorants.

TEXT BOOKS

1. Harborne J.B. *Phytochemical Methods*. 3rd Edition. Chapman& Hall Ltd. London, (1973).
2. Satoskar R.S. and Bharkar S.D. *Pharmacology &Pharma therapeutics* Volume I, Popular Publishing House Pvt.Ltd. India, (2015).

REFERENCE BOOKS

1. Gurdeep R.Chatwal. *Organic Chemistry of Natural Products* – Volume -I. Himalaya Publishing House. Delhi, (2010)
2. Finar I.L. *Organic Chemistry Volume*. II. Stereochemistry and the Chemistry of Natural Products. 5th Edition. Pearson Education Ltd. London, (2011).
3. Agarwal O.P. *Organic Chemistry Natural Products*- Volume – I. Geol Publishing House, India, (2008)
4. Panda.H. *Herbal Cosmetics (hand book)*, Asia pacific business press inc. New Delhi, (2015).
5. Paul Scheer. *Chemistry of Marine Natural Products*. England, (1973).

BLENDED LEARNING

UNIT V MARINE DRUGS AND HERBAL COSMETICS (K3)

TOPIC	LINK
1. Marine natural products, general methods of isolation and purification	https://youtu.be/wVcIGaBZW1A ,https://youtu.be/lIlkq5RW2L0
2. Cosmetics from natural origin-physiology and chemistry of skin and pigmentation	https://youtu.be/qokFYUbwcBw
3. Hair growth formulation, colorants and hair oil	https://youtu.be/NFIGrKcE8yc
4. Anti-sun burns preparations	https://youtu.be/AnDkR0oBpek
5. Cleansing cream and deodorants	https://youtu.be/AeJFPURO4_I

MAPPING OF CO'S WITH PO'S / PEO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3			3		2	1			2		3	2	
CO2	3	3	2	3	3	3	2		2	3	1	2	3	3
CO3	2	3	3	2	2	2	3		3	2	2	3	2	2
CO4	3		2	1		3						3	2	
CO5	2		3	2								2	1	

Correlation: Low – 1, Medium – 2, High – 3

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	End Semester Examination	Once in a Semester
2.	CIA I Examination	Once in a Semester
3.	CIA II Examination	Once in a Semester

4.	Model Examination	Once in a Semester
5.	Unit - I & II Assignment	Twice in a Semester
6.	Unit – III & IV Quiz	Twice in a Semester
7.	Unit – V Other component: Group Discussion	Once in a Semester

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER: III & IV
COURSE CODE: 23PCH3CP4
TITLE OF THE COURSE CODE – PRACTICAL – IV – ORGANIC CHEMISTRY II

Credits: 4 **Instructional Hours: 120**

COURSE OBJECTIVES:

- To study the estimation of various organic compounds with the aid of volumetric analysis.
- To analyse the principles about double stage preparation of organic molecules.
- To infer the importance of natural product isolation process

COURSE OUTCOMES:
At the completion of the course, the student will have the ability to

CO1	Organic Estimations	**K2**
CO2	Organic Double stage Preparation & Extraction and Estimation of active Constituents	**K3**
CO3	**Record** Transfer the results of experimental work through record presentation	**K2**
CO4	**Viva Voce Examination** To check the student's knowledge on the respective practical	**K4**

1. **Quantitative Estimation**

Phenol, aniline, acetone, glucose (Bertrand's and Fehling's methods) nitro, amino and methoxy group, and unsaturation.

2. Analysis of Oil

Reichert – Meisel value, Iodine value, saponification value and acetyl value

3. Extraction and Estimation of active Constituents: (Group Experiment)

a) Lactose from milk
b) Caffeine from tea leaves.
c) Nicotine from tobacco extract.
d) Citric Acid or ascorbic acid from tablet or from a natural source.

4. Preparations: At least five two stage preparations from literature.

TEXT BOOKS

1. Gnanaprakasam and Ramamurthy 2000. Organic Chemistry Laboratory Manual.Ananda BookDepot.Chennai.
2. Ahluwalia V.K. BhagatP. Aggarwal.R.2005. Laboratory Techniques in Organic Chemistry. I.K. International. India

REFERENCE BOOKS

1. Vogel A.I. Tatchell A. R. Furnis B.R. Hannaford A.J. Smith P.W.G. 1996.Vogel's Textbook of Practical Organic Chemistry. 5th Ed.Prentice Hall. London
2. Ahluwalia V.K.2006. Comprehensive Practical Organic Chemistry. Universities Press. India.

MAPPING OF CO'S WITH PO'S / PEO'S

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2			1		2	3			3		2	3	
CO2	3	2	2	3	3	2	2	3	2	2	3	2	2	3
CO3	2	1	2	2	2	3	3		3	3	2	3	3	2
CO4	3		3	1		2						2	3	

Correlation: 1- Low , 2- Medium , 3- High

ASSESSMENT TOOLS

S.No.	**Assessment Methods**	**Frequency of Assessment**

1.	Observation	Once in a year
2.	Record	Once in a year
3.	Model Practical Examination I	Once in a year
4.	Model Practical Examination II	Once in a year
.5.	End Semester Examination	Once in a year

Course Designed by: Dr.K.Anbarasi	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESER III &IV

SUBJECT CODE: 23PCH3CP5

PRACTICAL – V -INORGANIC CHEMISTRY – II

Credits: 4 **Instructional hours: 120 Hrs**

COURSE OBJECTIVES:

- To motivate the students to understand separation and gravimetric techniques
- To impart knowledge of synthesis and characterization of the inorganic complexes.

COURSE OUTCOMES:

At the completion of the course, the student will have the ability to

CO1	**Estimation of Metal Ions** To impart knowledge on gravimetry and volumetry estimations of metal ions	**K4**
CO2	**Preparation of Inorganic Complexes** To skillfully prepare the inorganic complexes	**K4**
CO3	**Record** Transfer the results of experimental work through record presentation	**K3**
CO4	**Viva Voce Examination**	**K3**

	To check the student's knowledge on the respective practical	

Industrial analysis: a. Analysis of two of the following alloys – brass, bronze, stainless steel, solder type metal. B. Analysis of any one of the following – cement, dolomite, glass.

Titrimetry: Oxidation using ceric and vanadium salts: Complexometric titrations involving estimation of calcium, magnesium, nickel, zinc and hardness of water.

Chromatography: Column, paper, thin layer and ion exchange. Titrations in non-aqueous solvents.

Preparation, analysis and study of the properties of co-ordination complexes.

Note: Quantitative analysis (involving volumetric and gravimetric estimations) of at least five mixtures of cations should be done by a student. The volumetric procedure may also include EDTA titration for estimation of mixtures of cations.

TEXT BOOKS

1. G. Svehla, Vogel's Text book of Inorganic Qualitative Analysis, 7th Ed, Pearson,1996.
2. Woollins, J. D. Ed., Inorganic Experiments; VCH: Weinheim,1994.

REFERENCE BOOKS

1. H.A. O Hill and P. Day, Practical methods in Advanced Inorganic Chemistry, John Wiley, 1968.
2. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd Ed.,The National Publishing Company, Chennai,2010.
3. Palmer, W. G. Experimental Inorganic Chemistry; Cambridge University Press,1954.

MAPPING OF CO'S WITH PO'S / PEO'S

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2			2		2	1			1		2	1	
CO2	3	2	3	3	3	2	2	2	2	2	2	2	2	3
CO3	2	1	2	2	2	3	2		2	3	2	3	2	2
CO4	3		2	1		1						2	2	

(Correlation: 3 – High, 2- Medium, 1 – Low)

ASSESSMENT TOOLS

S.No.	Assessment Methods	Frequency of Assessment
1.	Estimation of metal ions	Once in a year
2.	Preparation of Inorganic complexes	Once in a year
3.	Record	Once in a year
4.	Viva voce Examination	Once in a year
3.	Model Practical Examination I	Once in a year
4.	Model Practical Examination II	Once in a year
5.	End Semester Examination	End of each year

Course Designed by: Dr.J.Johncy Caroline	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

SEMESTER III & IV
COURSE CODE: 23PCH3CP6
TITLE OF THE COURSE: PRACTICAL VI – PHYSCIAL CHEMISTRY - II

Credits: 4 **Instructional Hours: 120**

COURSE OBJECTIVES:

- To motivate the students to understand the principles of chemical kinetics, potentiometric and conductometric titrations.
- To impart knowledge with respect to the phase transformation of different systems.

COURSE OUTCOMES:

At the completion of the course, the student will have the ability to

CO1	**Electrical Experiments (Conductometric)** To gain knowledge on Conductivity experiments, to evaluate the catalytic constants of strong and weak acids	**K4**
CO2	**Non Electrical Experiments** To understand the principles of chemical kinetics	**K4**
CO3	**Record**	**K3**

	Transfer the results of experimental work through record presentation	
CO4	**Viva Voce Examination** To check the student's knowledge on the respective practical	**K3**

I: Conductivity Experiments

Determination of

i) Equivalent conductance of a strong electrolyte and the verification of Debye- Huckel Onsagerlaw.
ii) Verification of Ostwald dilution law and Kohlrausch law for weak electrolytes.

Conductometric determination of Pak of a weak acid. Hydrolysis constant of aniline hydrochloride. Determination of the solubility of a sparingly soluble salt.

Conductometric titrations: Acid-base and precipitation titrations (including mixture of halides).

Colorimetric estimation using Beer-Lambert law (copper, nickel).

Dropping mercury cathodes – half-wave potentials and estimations by differential method of cadmium, copper, zinc and lead.

II: Chemical Kinetics

i. Evaluation of Arrhenius parameters using acid hydrolysis of anester.
ii. Base catalysed hydrolysis of an esterconductometrically.

Rate of reaction between persulphate and iodide ions study of salt effects over the persulphate Iodide reaction.
Study of rate of polymerization of monomer solutions by viscosity.
Evaluation of i) Catalytic constant of a strong acid for the iodination of acetone or hydrolysis of an ester.
ii) Catalytic constants for weak acids and verification of Bronsted catalysis law.

III: Adsorption Experiments

Adsorption of oxalic, acetic, formic acids on activated charcoal – Freundlich isotherm – surface determination.

TEXT BOOKS

1. Practical Physical Chemistry – A.J. Findlay.
2. Experimental Physical Chemistry – F. Daniels etal.
3. Selected Experiments in Physical Chemistry –Latham.
4. Experiments in Physical Chemistry – James andPrichard.
5. Experiments in Physical Chemistry –Shoemaker.
6. Advanced Physico-Chemical Experiments – J. Rose.

REFERENCE BOOKS

1. Practical Physical Chemistry – S.R. Palit
2. Experiments in Physical Chemistry – Yadav, Geol Publishing House.

3. Experiments in Physical Chemistry –Palmer.
4. Experiments in Chemistry – D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994)
5. Experimental Physical Chemistry – R.C. Das. and B. Behera, Tata Mc GrawHill.
6. P.N. Kapil, Advanced College Practical Chemistry-Vol - II

MAPPING OF CO'S WITH PO'S / PEO'S

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2			2		2	1			1		2	1	
CO2	3	2	3	3	3	2	2	2	2	2	2	2	2	3
CO3	2	1	2	2	2	3	2		2	3	2	3	2	2
CO4	3		2	1		1						2	2	

(Correlation: 3 – High, 2- Medium, 1 – Low)

ASSESSMENT TOOLS

S.No.	**Assessment Methods**	**Frequency of Assessment**
1.	Electrical experiments	Once in a year
2.	Non Electrical experiments	Once in a year
3.	Record	Once in a year
4.	Viva voce Examination	Once in a year
3.	Model Practical Examination I	Once in a year
4.	Model Practical Examination II	Once in a year
5.	End Semester Examination	End of each year

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Course Designed by: Mrs.S.Valli	**Verified by HOD: Dr. N.Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

VALUE ADDED COURSE
CERTIFICATE COURSE
COURSE CODE: 22PCCCCD1
TITLE OF THE COURSE: CHEMISTRY OF COSMETICS AND DETERGENTS

COURSE OBJECTIVES:

- Understanding and recognition of various raw materials and their properties.
- To formulate herbal cosmetics and home care products.
- Analysis and testing methods in cosmetics & Detergents.
- Entrepreneurship in cosmetic and detergent making arenas.

Instructional Hours: 30

UNIT I: Introduction of Cosmetics (6 Hours)

Purposes of Cosmetics meaning of Cosmetics and cosmeceuticals. Classification of Cosmetics Quality characteristics and Quality Assurance Development Process of Cosmetics. Scientific background technology and its future.

UNIT II: Preparation of Cosmetic Formulations (6 Hours)

Cosmetics Ingredients & Nomenclature-Emulsions-Creams & Lotions-Face washes & Face Masks-Shaving Preparations-Sunscreens- Antiperspirant and Deodorants. Fragrances-Toxicology in Cosmetics-Rheology fundamentals and application in cosmetic formulations-Claims support: Principles and Practice-Cosmetic product Packaging-Consumer testing & Evaluation

UNIT III: Cosmeceuticals (6 Hours)

Preparation of Herbal Soaps & Shampoos, Hair Spray using Essential oils, Herbal face powder, face pack & face scrubber, Herbal Tan remover, Herbal moisturizers & body lotions, Organic lip sticks, lip balms and perfumes. Quality check by different tests.

UNIT IV (6 Hours)

Soaps and Detergents

Introduction – Soaps and Detergents - Characteristics of Soap - Properties of Detergents. different types of detergents. Manufacturing process of soaps. Cleansing Action of Soaps and Detergents.

Manufacturing of detergents. Difference between soaps and detergents. Advantages and dis advantages of detergents and soaps. Safety measures taken in manufacturing of Soaps and Detergents

UNIT V (6 Hours)

Formulations of Cleaning Products

Preparation of scouring powder, Detergent for fabric cleaning,liquid blue, Liquid hand wash, Liquid detergent for floor and bathroom cleaning-white phenyle. Making soaps and detergents using castor oil and coconut oil. Preparation of multiflavored bathing soaps for different age groups and quality checking.

TEXT BOOKS

1.Handbook of Cosmetic Science and Technology –edited by Andre O. Barel et al., Publisher: Informa Healthcare.
2.The Chemistry and Manufacture of Cosmetics-edited by Mitchell L. Schlossman, Allured Publishing Corporation.
3.Ajay Kumar Gupta, Soaps, Detergents and Disinfectants Technology Handbook (3rd Revised Edition), Niir Project Consultancy Services,(2021)

REFERENCE BOOKS

1.Textbook of Herbal Cosmetics Paperback -by Vimaladevi M.
2.Herbal Cosmetics Handbook- by H Panda
3.International Cosmetic Ingredient Dictionary & Handbook- by The Personal Care Products Council.
4.Manufacturing process book of soaps and detergents, Engineers India Research Institute , New Delhi.

EVALUATION

Theory	Practical	Total Marks
50	50	100

ASSESSMENT TOOLS

S. No	Assessment Methods	Frequency of Assessment
1	End Semester Examination	Semester
2	Practical – Hands on	Semester

OBE Question Pattern for End Semester Exam		
Five Units (50 Marks)		
Section A	MCQ Answer all the Questions	5 X 1 = 5 Marks
Section B	Short Answer (200 Words) Internal Choice	5 x 3 = 15 Marks
Section C	Long Answer (800 Words) Internal Choice	5 x 6 = 30 Marks
	Total	**50 Marks**

Course Designed by: **Dr. K.Anbarasi**	**Verified by HOD: Dr. N. Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**

VALUE ADDED COURSE
CERTIFICATE COURSE
COURSE CODE: 23PCCCCD2
TITLE OF THE COURSE: AGRO CHEMISTRY

COURSE OBJECTIVES

- To study detailed about fertilizers, pesticides, Insecticides, fungicide and herbicide
- To learn about Soil characteristics and soil testing

Instructional Hours: 30

UNIT – I Fertilizers (6 hours)

Classification, macronutrients -role of nitrogen, potassium and phosphorus on plant growth – manufacture of urea, muriate potash and triple superphosphate. urea, triple super phosphate, Complex fertilizers, mixed fertilizers & biofertilizers – their composition. Micronutrients –their role in plants. Manures : Bulky organic manures – Farm yard manure- -oil cakes- blood meal – fish manures- Composting process – handling and storage .

UNIT – II Pesticides (6 hours)

Definition- Classification of Pesticides based on the use and chemical composition– examples - general methods of application –Benefits of pesticides-Potential hazards. Safety measures -first aid. Insecticides : Plant products – Nicotine, pyrethrin – Inorganic pesticides – borates. Organic pesticides – D.D.T. and BHC. Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture. Herbicides : Acaricides – Rodenticides. Attractants – Repellants.

UNIT –III Soil & Irrigation (6 hours)

Origin of soil- definition of soil-rock system-weathering of rocks and minerals- main components of soil-organic, inorganic constituents-soil formation-factors favouring soil formation.Crop seasons - seeds, seed development organization, natural seeds project phase-III, new policy on seed development; Soil- soil reclamation, alkali soil, saline soils, methods for soil reclamation; Irrigation- Environmental degradation and irrigation projects.

UNIT –IV Characteristics of soil (6 hours)

Physical aspects-soil texture- pore space-bulk density, particle density-soil colour-surface area-soil colloids-plasticity, shrinkage-flocculation and deflocculation,soil air, soil temperature and their importance in plant growth. Acid, alkaline and saline soils-diagnosis- Methods of reclamation and after care.

UNIT –V Soil testing (6 hours)

Concept and objectives – soil sampling , tools, collection, processing, dispatch of soil sample. Estimation of total organic compound, available nitrogen and phosphorus in the soil sample. Determination of pH, EC, moisture content, bulk density and particle density of the soil sample.

TEXT BOOKS

1. B.K.Sharma, Industrial Chemistry, Goel Publishing House, Meerut,1992.
2. N.C. Brady, The nature and properties of soils, Eurasia Publishing House, New Delhi, 1977.
3. G.N. Pandey, *A Textbook of Chemical Technology*, Vol. I & II, Vikas Publishing House Pvt Ltd.

4. Soil Fertility & Fertilisers – Samuel L.Tisdale,Werner L.Nelson, James D.Beaton, John L. Havlin. Fifth edition, Macmillan

REFERENCE BOOKS

1. Biswas,T.D *Textbook of Soil Science*.Second edition, Tata McGraw-Hill Education
2. *Chemistry for Agriculture and Ecology*-Y.Mido M.Satake, Discovery Publishing House.
3. *Nature and properties of soils*-Harry, O Buckman N Yle C. Brandy, Macmillan
4. V.S. Jones, Fertilizers and soil fertility, Prentice Hall of India, New Delhi,1993.
5. D.E.H. Freer, Chemistry of pesticides, D.Van Nostrand Co, Reinhold,1969.
6. Insecticides, Pesticides and Agro based Industries – R.C.Paliwal, K.Goel, R.K.Gupta, Small Business Publications

EVALUATION

Theory	Practical	Total Marks
50	50	100

ASSESSMENT TOOLS

S. No	Assessment Methods	Frequency of Assessment
1	End Semester Examination	Semester
2	Practical – Hands on	Semester

OBE Question Pattern for End Semester Exam		
Five Units (50 Marks)		
Section A	MCQ Answer all the Questions	5 X 1 = 5 Marks
Section B	Short Answer (200 Words) Internal Choice	5 x 3 = 15 Marks
Section C	Long Answer (800 Words)	5 x 6 = 30 Marks

	Internal Choice	
	Total	**50 Marks**

Course Designed by: **Dr. J.Johncy Caroline**	**Verified by HOD: Dr. N. Gunavathy**
Checked by CDC: Dr. G. Chitra	**Approved by:** **Principal**