GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMUS)

Reaccredited with B++ by NAAC
PUDUKKOTTAI – 622 001

DEPARTMENT OF CHEMISTRY

ACAMENIC COUNCIL

ON
28.06.2021

PG SYLLABUS
CHOICE BASED CREDIT SYSTEM
(2021-2022) ONWARDS

GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMOUS), PUDUKKOTTAI
COURSE PATTERN AND SCHEME OF EXAMINATION FOR M.Sc., CHEMISTRY

CHOICE BASED CREDIT SYSTEM
(For the candidate admitted from the academic year 2021-2022)

Sem	**S. No.**	**Code**	**Title of the Paper**	**Instrn Hrs**	**Credit**	**Exam hrs**	**Marks**		**Total**
							CIA	SE	
I	**1.**	21PCH01	Organic chemistry – I	6	5	3	25	75	100
	2.	21PCH02	Inorganic chemistry – I	6	5	3	25	75	100
	3.	21PCH03	Physical chemistry – I	6	5	3	25	75	100
	4.	21PCH04P	Organic Practical –I	6	4	6	25	75	100
	5.	21PCH05P	Inorganic Practical – I	6	4	6	25	75	100
			Total	**30**	**23**	**9**	**-**	**-**	**500**
II	**6.**	21PCH06	Inorganic chemistry- II	6	5	3	25	75	100
	7.	21PCH07	Physical Methods in chemistry –I	6	5	3	25	75	100
	8.	21PCH08	Selected topics in chemistry	6	5	3	25	75	100
	9.	21PCH09P	Organic Practical –II	6	4	6	25	75	100
	10.	21PCH10P	Inorganic Practical – II	6	4	6	25	75	100
			Total	**30**	**23**	-	-	-	**500**
III	**11.**	21PCH11	Organic chemistry – II	6	5	3	25	75	100
	12.	21PCH12	Physical chemistry – I	6	6	3	25	75	100
	13.	21PCH13P	Physical Practical– I	6	4	6	25	75	100
	14.	21PCHE1	Polymer chemistry	6	4	3	25	75	100
	15.	21PCHE2	Analytical chemistry	6	4	3	25	75	100
			Total	**30**	**23**	**-**	**-**	**-**	**500**
IV	**16.**	21PCH14	Physical Methods in chemistry –II	6	5	3	25	75	100
	17.	21PCH15P	Physical Practical –II	6	4	6	25	75	100
	18.	21PCHE3	Green Chemistry	6	4	3	25	75	100
	19.	21PCHE4	Recent Trends in chemistry	6	4	3	25	75	100
	20.	21PCHPR	PROJECT	6	4	-	-	-	100
			SELF STUDY PAPERS						
	21.	21PCHSS1	Pharmaceutical Chemistry						
	22.	21PCHSS2	Supramolecular Chemistry						
			Total	**30**	**21**				**500**
			Total	**120**	**90**				**2000**

OVERALL TOTAL – SEMESTER WISE

Semester	No. of courses	Marks	Credits
I	5	500	23
II	5	500	23
III	5	500	23
IV	5	500	21
TOTAL	20	2000	90

OVERALL TOTAL – COURSE WISE

Subject	No. of courses	Credits/courses	Total Credits
Core – theory	9	5+1	46
Core –Practical	6	4	24
Elective	4	4	16
Project	1	4	04
Total	20	23	90

M.Sc., CHEMISTRY
CHOICE BASED CREDIT SYSTEM
(For the candidates admitted from the academic year 2021-2022)

CORE COURSE

S.No.	Course	Sub. Code	Title of the Course	Instrn Hrs	Credit
1.	CC-I	21PCH01	Organic chemistry – I	6	5
2.	CC-II	21PCH02	Inorganic chemistry – I	6	5
3.	CC-III	21PCH03	Physical chemistry – I	6	5
4.	CC-IVP	21PCH04P	Organic Practical –I	6	4
5.	CC-VP	21PCH05P	Inorganic Practical – I	6	4
6.	CC-VI	21PCH06	Inorganic chemistry- II	6	5
7.	CC-VII	21PCH07	Physical Methods in chemistry –I	6	5
8.	CC-VIII	21PCHE08	Selected topics in chemistry	6	5
9.	CC-IXP	21PCH09P	Organic Practical –II	6	4
10.	CC-XP	21PCH10P	Inorganic Practical – II	6	4
11.	CC-XI	21PCH11	Organic chemistry – II	6	5
12.	CC-XII	21PCH12	Physical chemistry – I	6	6
13.	CC-XIIIP	21PCH13P	Physical Practical– I	6	4
14.	CC-XIV	21PCH14	Physical Methods in chemistry –II	6	5
15.	CC-XVP	21PCH15P	Physical Practical –II	6	4

ELECTIVE COURSE:

S.No.	Course	Sub.Code	Title of the Course	Instrn Hrs	Credit
1.	Elective-I	21PCHE1	Polymer chemistry	6	4
2.	Elective-II	21PCHE2	Analytical chemistry	6	4
3.	Elective-III	21PCHE3	Green chemistry	6	4
4.	Elective-IV	21PCHE4	Recent Trends in chemistry	6	4

PROJECT:

S.No.	Course	Sub.Code	Title of the Course	Instrn Hrs	Credit
1.	PROJECT	21PCHPR	PROJECT PAPER	6	4

SELF STUDY PAPERS

1.	Self Study	21PCHSSI	Pharmaceutical Chemistry		
2.	Self Study	21PCHSS2	Supramolecular Chemistry		

CONTINUOUS INTERNAL ASSESMENT PATTERN – PG

THEORY

Exam	Max.Marks	Converted to	Passing mark minimum		
			CIA	SE	Aggricate
Mid semester	40	5			
End semester	40	5			
Model Exam	75	5			
Seminar	5	5			
Assignment	5	5			
TOTAL		**25**	**13**	**38**	**50**

PRACTICAL

External:

Practical : 60 Marks
Viva-voice : 10 Marks
Total : 05 Marks
Passing Minimum : 75 Marks

Internal:

Model Exam : 15 Marks
Performance in the Class : 10 Marks
Viva-voice : 25 Marks
Total : 25 Marks

QUESTION PAPER PATTERN – M.Sc., CHEMISTRY THEORY

Part	Type	Question Number	Unit	Mark/Question	Total Marks
A	Answer all the Questions	1 & 2	I	2	20
		3& 4	II		
		5& 6	III		
		7 & 8	IV		
		9&10	V		
B	Internal Choice Answer all the questions	11a / 11b	I	5	25
		12a/ 12b	II		
		13a/ 13b	III		
		14a/ 14b	IV		
		15a/ 15b	V		
C	Answer any THREE Questions	16	I		
		17	II		
		18	III		
		19	IV		
		20	V		
External					**75**
CIA					**25**
Maximum Marks					**100**

SEMESTER -I

GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
PUDUKKOTTAI – 622 001
SEMESTER -I

CORE COURSE: I **HOURS/WEEKS:6**
SUB.CODE:21PCH01 **CREDITS:5**

ORGANIC CHEMISTRY-I

OBJECTIVES: The primary objective of this course is to introduce the student to the concepts of organic chemistry and to develop critical thinking skills. The objectives are

CO 1: To learn about nomenclature of cyclic compounds

CO 2: To know the nucleophilic and electrophilic substitution reactions

CO 3: To be able to interpret the reaction pathways

CO 4: To understand the stereochemistry of organic compounds

CO 5: To gain the knowledge about photochemical reactions

OUTCOMES: At the end of the course students will be able to

CO-1: Spell the basic concepts and theories of atomic structure.

CO-2: Apply the concept of aromaticity

CO-3: Examine organic stereochemistry vis-a- vis optical and geometrical isomerism.

CO-4: Analyse the knowledge in photochemical reactions.

CO-5: Extend the ability of reactive intermediate in pericyclic reactions.

UNIT – I: Structure and Bonding

1.1Nomenclature of alicyclic, bicyclic and tricyclic compounds (Basic skeletal structures only with or without ene substituent).
1.2 Localized chemical bonding: electronic structure of molecules: VB, MO, HOMO-LUMO theory.
1.3 Electro negativity, dipole moment, inductive and field effect, bond distances, bond angles and bond energies.
1.4 Delocalized chemical bonding and bond distance in compound containing delocalized bond, cross conjugation,
1.5 Resonance, steric inhibition of resonance, hyper conjugation, and keto -enol tautomerism.

UNIT – II: Reactive intermediates and Aromaticity

2.1 Carbocations, carbanions, carbenes, benzynes and nitrenes-Generation, stability and reactivity.
2.2 Aromatic character: Six-, five-, seven-, and eight- membered rings - Other systems with aromatic sextets – Huckel‟s theory of aromaticity, concept of homo aromaticity and antiaromaticity,

2.3 Electron occupancy in MO‟s and aromaticity - NMR concept of aromaticity and anti aromaticity, systems with 2,4,8 and 10 electrons, systems with more than 10 electrons, alternant and non-alternant hydrocarbons (azulene type).

2.4 Bonding properties of systems with $(4n+2)\pi$ electrons and $4n\pi$electrons, Hetero aromatic molecules.

2.5 Annulenes, hetero annulenes,sydnones and fullerenes. Craig‟s rule, Hammond’s postulate.

UNIT: III: Substitution reactions

3.1 Nucleophilic Substitution **-**Aliphatic nucleophilic substitution: SN1 and SN2 mechanism

3.2 Kinetic and stereochemical characteristics – effects of substrate structure, nature of the nucleophile and leaving group on the rate – solvent effects – examples of SNi substitution

3.3 Neighbouring group participation-Anchimeric assistance. Aromatic nucleophilic substitution: Benzyne and Meisenheimer intermediates.

3.4 Electrophilic Substitution **-**Mechanism of aliphatic electrophilic substitution reaction – SE1, SE2, SEi reaction.

3.5 Mechanism of aromatic electrophilic substitution reactions – complexes – nitration, halogenation, sulphonation, Friedel Craft alkylation and acylation – Reimer Tiemann reaction. Linear free energy relationship – Hammett equation – Significance of the σ and ρ parameters; Taft equation.

UNIT- IV: Molecular Rearrangements

4.1Definition – nucleophilic, electrophilic and free radical rearrangements

4.2 Intramolecular and intermolecular rearrangements – migratory aptitude

4.3 Hofmann rearrangement, Wagner – Meerwin, Benzil – Benzilic acid,

4.4 Schmidt, Lossen, Curtius, Beckmann, Fries Rearrangement

4.5 Baeyer-Villiger, Favorskii, Stevens and Neber rearrangements.

UNIT- V: Pericyclic Reactions

5.1 Concerted reactions – stereochemistry-orbital symmetry and concerted symmetry and correlation diagram

5.2 Frontier molecular orbital approach – Woodward and Hoffmann rules

5.3 Electrocylcic reactions – cycloaddition reactions – Chelotropic reactions; [2+2], [2+4],[6+4] and 1,3-dipolar cycloadditions

5.4 Sigmatropic rearrangements – selection rules and examples with simple molecules – 1,3 and 1,5 hydrogen shifts

5.5 Cope and Claisen rearrangements. Other molecular rearrangements.Stereochemistry of Diels – Alder reaction.

TEXT BOOKS;

1. J.E. Huheey, 1993, Inorganic Chemistry - Principles, Structure and Reactivity; IV Edition, Harper Collins, NY.

2. F.A. Cotton and G. Wilkinson, 1988, Advanced Inorganic Chemistry - A Comprehensive Text, V. Edition, John Wiley & Sons.

3. K.F. Purcell and J.C. Kot, 1977, Inorganic Chemistry - WB Saunders Co., USA.

4. M.C. Day and J. Selbin, 1974, Theoretical Inorganic Chemistry, Van Nostrand Co., NY.

5. G.S. Manku, 1984, Inorganic Chemistry, TMG Co.,

6. D.A. Skoog, 1985, Principles of Instrumental methods of Analysis, 3rd Edition, Saunders College Publication.

REFERENCE BOOKS:

1. Peter Sykes, 2003. A Guidebook to Mechanism in Organic Chemistry, Longman, 6th Edition.

New Age International, 2ndEdition, 2002.

2. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry, Parts A & B, Plenum, 2002.

3. R.T. Morrison and R. N. Boyd's Organic Chemistry, 6th edition, Spring, 2008.

4.R.P. Narain, Fundamentals of Reaction Mechanisms in Organic Chemistry, PHI Learning Private Limited, New Delhi, 2011.

5. Peter Sykes, A Guide book to mechanism in organic chemistry, Pearson Edition (2006).

6. C. N. Pillai, Textbook of Organic Chemistry, University press (India) private Ltd (2009).

GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
PUDUKKOTTAI – 622 001
SEMESTER -I

CORE COURSE: II **HOURS/WEEKS: 6**
SUB.CODE:21PCH02 **CREDITS: 5**

INORGANIC CHEMISTRY-I

OBJECTIVES:
CO 1: To understand the knowledge of acid base concept.
CO 2: To know the basic concepts of main group elements used in synthesis.
CO 3: To study about kinetic and thermodynamic stability and mechanism
CO 4: To gain the knowledge of formation of co-ordination compounds by CFT and MOT.
CO 5: To learn the reactions and mechanism of octahedral complexes.

OUTCOMES: At the end of the course, the students will be able to
CO-1: Illustrate acid –base concepts, its measures and to evaluate various effects on acid base strength
CO-2 :Classify the characteristics of Boron, P-N,S-N compounds.
CO-3:Analyze the basic concepts, theories, mechanism of co-ordination chemistry.
CO-4:Apply the concepts of VB theory and crystal field theory to determine spectral and magnetic properties.
CO-5:Explain Kinetics and mechanism of co-ordination compounds

UNIT -I: Acids and Bases:
1.1 Bronsted and Lewis acid bases, pH, pKa,acid base concept in non-aqueous media. Buffer solution, protic acid-proton affinities-differentiating and leveling solvent –
1.2 Acidic behaviour of the binary hydrides–strength of oxy acids –hydrolysis-amphoteric oxides-non protic concept of acid-base reactions.
1.3 Lux-Flood concept-solvent ion theory of acids and bases, ammonia, acetic acid, bromine trifluoride, dinitrogen tetroxide,
1.4 Soft acid-base strength and softness – symbioses
1.5 Theoretical bases of hardness and softness – electro negativity and hardness and softness.

UNIT-II: Main Group Chemistry
2.1 Chemistry of boron – borane, higher boranes, carboranes, borazines and boron nitrides,
2.2 Cluster valence electron theory, Lipscomb’s STYX method

2.3 Chemistry of silicon – silanes, higher silanes, multiple bonded systems, disilanes,
2.4 Silicon nitrides. P-N compounds, cyclophosphazanes and cyclophosphazenes – S-N compounds – S_2N_2, S_4N_4, (SN)x, polythiazyl SxN4 compounds – S-N cations and anions.
2.5 Ionic model – lattice energy – Born-Lande equation – Kapustinskii equation.

UNIT-III: Co-ordination Chemistry:
3.1 Principles of Coordination Chemistry
3.2 Studies of coordination compounds – detection of complex formation in solution
3.3 Stability constants – stepwise and overall formation constants.
3.4 Simple methods (potentiometric, pH metric and photometric methods) of determining the formation constants.
3.5 Factors affecting stability – statistical and chelate effects – forced configurations.

UNIT-IV: Theories of Metal-Ligand Bond:
4.1 VB theory and its limitations-Crystal field theory – splitting of d-orbitals under various geometries
4.2 Factors affecting splitting – CFSE and evidences for CFSE (structural and thermodynamic effects).
4.3 Spectrochemical series – Jahn-Teller distortion – spectral and magnetic properties of complexes – site preferences.
4.4 Limitations of CFT – ligand field theory – MO theory – sigma- and pi-bonding in complexes
4.5 Nephelauxetic effect – the angular overlap model.

UNIT-V: Co-ordination chemistry- Reaction mechanism I:
5.1 Kinetics and mechanism of reactions in solution – labile and inert complexes – ligand displacement reactions in octahedral and square planar complexes – acid hydrolysis, base hydrolysis and anation reactions
5.2 Trans effect – theory and applications – electron transfer reactions – electron exchange reactions – complementary and non-complementary types – inner sphere and outer sphere processes.

5.3 Co-ordination chemistry- Reaction mechanism-II- Application of electron transfer reactions in inorganic complexes – isomerisation and racemisation reactions of complexes.
5.4 Molecular rearrangements of four- and six-coordinate complexes – interconversion of stereoisomers
5.5 Reactions of coordinated ligands – template effect and its applications for the synthesis of macrocyclic ligands – unique properties.

REFERENCES:

1. M. C. Day, J. Selbin and H. H. Sisler, Theoretical Inorganic Chemistry; Literary Licensing (LLC), Montana, 2012.
2. F. A. Cotton and G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry; 6thEd., A Wiley - Interscience Publications, John Wiley and Sons, USA, 1999.
3. J. E. Huheey, Inorganic Chemistry; 4th Ed., Harper and Row publisher, Singapore, 2006.
4. A. W. Adamson, Concept of Inorganic Photochemistry; John Wiley and Sons, New York, 1975.
5. S. F. A. Kettle, Physical Inorganic Chemistry – A Coordination Chemistry Approach, Spectrum; Academic Publishers, Oxford University Press, New York, 1996.
6. A. W. Adamson and P. D. Fleischauer, Concepts of Inorganic Photochemistry; R. E. Krieger Pubs, Florida, 1984.
7. J. Ferraudi, Elements of Inorganic Photochemistry; Wiley, New York, 1988.
8. F. Basolo and R. G. Pearson, Mechanism of Inorganic Reactions; 2nd Ed., John Wiley, New York, 1967.
9. R. K. Sharma, Inorganic Reactions Mechanism; Discovery Publishing House, New Delhi, 2007.

GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SEMESTER -I

CORE COURSE: III **HOURS/WEEKS: 6**
SUB.CODE: 21PCH03 **CREDITS: 5**

PHYSICAL CHEMISTRY-I

OBJECTIVES:
CO 1:To understand the physical and mathematical aspects of quantum mechanics.
CO 2:To learn the application of quantum chemistry to 1-D and 3-D box.
CO 3:To know the basic concepts of chemical kinetics.
CO 4:To study the partial molar property, fugacity and its significance.
CO 5:To gain the knowledge of surface chemistry and phase rule.

OUTCOMES: On successful completion of the course the students will be able to
CO-1:Derive Schrodinger wave equation and recognize the role of operators in quantum mechanics
CO-2:Apply the concepts and fundamentals of quantum chemistry to simple cubic system.
CO-3:Interpret the photochemical kinetics and enzyme catalysis using steady state approximation
CO-4:Calculate ionic activity and ionic strength
CO-5:Recall the elementary ideas related to third law of thermodynamics and familiarize the partial molar properties and its determination
CO-6:Recognize the difference between types of isotherms

UNIT-I: Quantum chemistry-I

1.1Inadequacy of classical mechanics – black body radiation – Planck's quantum concept – photoelectric effect
1.2 Bohr's theory of hydrogen atom – hydrogen spectra – wave-particle dualism – uncertainty principle.
1.3 Schrödinger equation – postulates of quantum mechanics
1.4 Operator algebra: linear operator, Hermitian operators, eigen functions and eigen values, angular momentum operator
1.5 Commutator operators –orthogonality and normalization function.

UNIT-II: Quantum chemistry-II

2.1 Application of quantum mechanics to simple system- Application of SWE to free particle moving in a one dimension box - particle moving in 3-D cubic box,degeneracy-
2.2 Quantum Mechanical tunneling
2.3 Particle in a ring- rigid rotor
2.4 Simple Harmonic oscillator
2.5 Hydrogen atom- angular momentum spin momentum- ladder operator.

UNIT III: Chemical Kinetics - I

3.1 Theories of reaction rate – absolute reaction rate theory (ARRT)
3.2 Transmission coefficient, reaction coordinate – potential energy surfaces – kinetic isotope effect

3.3 Hinshelwood theory – Kassel, Rice and Ramsperger theory (KRRT) .Microscopic reversibility – steady-state approximation
3.4 Chain reactions: thermal and photochemical reactions between hydrogen and halogens – explosions and hydrogen-oxygen reactions.
3.5 Calculation of ionic strength, mean ionic activity – Enzyme catalyst mechanism – Michaleis– Menton law derivation.

UNIT-IV: Classical Thermodynamics
4.1 Third law of thermodynamics –Need for third law- significance – Nernst heat theorem and other forms of stating the third law
4.2 Thermodynamic quantities at absolute zero – apparent exceptions to the third law.
Thermodynamics of systems of variable composition – partial molar properties – chemical potential – relationship between partial molar quantities
4.3 Gibbs Duhem equation and its applications (the experimental determination of partial molar properties not included).
4.4 Thermodynamic properties of real gases – fugacity concept – calculation of fugacity of real gas – activity and activity coefficient – concept – definition
4.5 Standard states and experimental determinations of activity and activity coefficient of electrolytes.

UNIT-V: Suface chemistry and Phase Rule
5.1Surface phenomena – Gibbs adsorption isotherm – solid-liquid interfaces – contact angle and wetting – solid-gas interface – physisorption and chemisorption
5.2 Langmuir, Frendlich and BET adsorption isotherms – surface area determination.
5.3 Kinetics of surface reactions involving adsorbed species – Langmuir – Hinshelwood mechanism, Langmuir-Rideal mechanism ,Rideal-Eley mechanism .
5.4 Some interfacial aspects on Micelles, reverse micelles,micro emulsions and membranes.
5.5 Phase Rule – Three component system phase diagram.

REFERENCES:

1.D. A. Mcquarrie, Quantum Chemistry; University Science Books, Herndon, 2008.
2. J. P. Lowe, and K. A. Peterson, Quantum Chemistry; 3rd Ed., Academic Press, Cambridge, 2005.
3. I. N. Levine, Quantum Chemistry; 7th Ed., Prentice Hall, New Jersey, 2013.
4. R. K. Prasad, Quantum Chemistry; 4th Ed., New Age International Publishers, New Delhi, 2014.
5. F. A. Cotton, Chemical Applications of Group Theory; 3rd Ed., Wiley Eastern, New Delhi, 1990.
6. P.Atkins and J. de Paula, Physical Chemistry; 9th Ed.,W.H.Freeman Publications, New York, 2009.
7.G. W. Castellan, Physical Chemistry; Narosa, New Delhi, 1986.
8. K. J. Laidler, Chemical Kinetics; 3rd Ed., Prentice Hall, New Jersey, 1987.
9. J. W. Moore and R. G.Pearson, Kinetics and Mechanism; 3rd Ed., John Wiley and Sons, New York, 1981.
10. M. Mortimer and P.G.Taylor,Chemical Kinetics and Mechanism; 1st Ed., Royal Society of Chemistry, UK, 2002.
12. I. Amdur and G. G. Hammes,Chemical Kinetics Principles and Selected Topics; 3rd Ed., McGraw Hill, New York, 2008.
13. M. Gratzel and K. Kalyanasundaram, Kinetics and Catalysis in Micro heterogeneous Systems; Academic Press, New York, 1991.
14. J. Rajaram and J. C. Kuriacose, Thermodynamics for Students of Chemistry - Classical, Statistical and Irreversible; Pearson Education, New Delhi, 2013.
15. R. K. Dave, Chemical Kinetics; Campus Books, 2000.
16. S.Glasstone, Thermodynamics for Chemists; 3rd Ed., Narahari Press, Bangalore, 2007

GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SEMESTER - I

CORE COURSE: IV P **HOURS/WEEKS: 6**
SUB.CODE:21PCH04P **CREDITS: 4**

ORGANIC CHEMISTRY PRACTICAL –I

OBJECTIVES:
CO1: To perform the qualitative analysis of a given organic mixture
CO2: To carry out the preparation of organic compound**s.**

OUTCOMES: At the end of the course, the students will be able to

CO-1: Apply the analytical procedure to separate the organic mixture by chemical methods
CO-2: Identify the elements and functional groups in a given organic mixture
CO-3: Show the derivatives of the given compound
CO-4:Take part in the synthesis of organic compound

1.Qualitative analysis of an organic mixture containing two compounds.
Pilot separation and purified bulk separation analysis and derivative

2.Preparation of Organic compounds(single stage)
a) Glucose pentaacetate from glucose (Acetylation)
b) Acetophenone from resorcinol (Acetylation)
c) Benzophenone oxime from benzophenone (Addition)
d) Methyl-m-nitrobenzoate from methyl benzoate (Nitration)
e) Phenyl azo,2-napthol from aniline (Diazotization)
f) o-chlorobenzoic acid from anthranilic acid (Sandmayer Reaction)
g) p-benzoquinone from hydroquinone (Oxidation)

REFERENCES:

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

GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SEMESTER - I

CORE COURSE:V P1 **HOURS/WEEKS: 6**
SUB.CODE:21PCH05P **CREDITS: 4**

INORGANIC CHEMISTRY PRACTICAL – I

OBJECTIVES:
CO1: To study the principles of distribution of common and rare metal ions in different groups.
CO 2:To learn the basic principles involved in the colorimetric estimation

OUTCOMES: At the end of the course, the students will be able to

CO-1:Get the practical experience in the semi-micro qualitative analysis of cations.
CO-2:Estimate various ions using photoelectric colorimeter
CO-3:Make up to work well in the research institutes and quality control laboratories.
CO-4:Develop the laboratory skill of qualitative as well as quantitative analysis of metal ions
CO-5:Improve the skill in the semi-micro qualitative analysis of inorganic mixture containing two familiar cations and two less familiar cations.

QUALITATIVE ANALYSIS AND COLORIMETRIC ESTIMATION

1. Semi-micro Qualitative Analysis:

Analysis of two common and two rare cations in a given inorganic mixture
Common: Pb, Cu, Bi, Cd, Co, Ni, Zn,Ba,Ca,Sr, Mg,NH_4
Rare : W, Se, Mo, Ce, Th, Zr, Ti,V,Li

2. Colorimetric Estimation:

Estimation of Copper, Ferric, Nickel, Manganese and Chromium ions using photoelectric colorimeter.

REFERENCES:

1.V.V.Ramanujan,Inorganic Semi micro Qualitative Analysis, 3rdEd,National Publications,London,1998
2.A.I.Vogel - A Text Book of Quantitative Inorganic Analysis 6thEd,Longman,New Delhi,2000.
3. O.P.Vermani&A.K.Narula, Applied Chemistry (Theory & Practice), , Wiley Eastern, 1989.
4.A.I.Vogel. Text book of macro and Semimicro Qualitative Inorganic Analysis Ed G.Svehla Orient Longman 1982.
5.J.Bassette,.R.C.Denny Jeffery and J.Hendham – Vogel’s ELBS, Longman,New Delhi,2000.

SEMESTER - II

GOVERNMENT ARTS COLLEGE FOR WOMEN(A),
PUDUKKOTTAI – 622 001
SEMESTER – II

CORE COURSE: VI **HOURS/WEEKS:6**
SUB.CODE:21PCH06 **CREDITS:5**

INORGANIC CHEMISTRY-II

OBJECTIVES:

CO 1:To understand the nuclear structure and nuclear reactions and artificial radio activity.
CO 2:To study about solid state chemistry.
CO 3:To know organometallics and metal clusters
CO 4:To learn the concept of photochemistry and its applications
CO 5:To understand the various organometallic reaction mechanism

OUTCOMES: At the end of the course students will be able to

CO-1:Outline the basic concepts and applications of nuclear chemistry and radioactive techniques.
CO-2:Analyze the structure of packing arrangement of atoms and defects in metals.
CO-3:Calculate M-M bond and applying 18 electron rule in complexes.
CO-4:Get an idea about inorganic photochemistry.
CO-5:Identify the organometallic chemistry and transition metal catalyst.

UNIT –I: Nuclear Chemistry

1.1Nuclear structure - composition of nuclei,– nuclear forces-its characteristics - meson field theory nuclear models - liquid drop, shell and collective models.

1.2 Properties of nucleus. Nuclear stability factors affecting the nuclear stability; Mode of decay - alpha, beta, gamma and orbital electron capture; Q value - nuclear cross section; isobars- nuclear isomerism.

1.3 Radioactive decay - theories of decay processes – Laws of radioactivity, series of radioactivity.

1.4 Detection and measurements of radiations.

1.5 Application of nuclear Chemistry.C^{14} dating – agriculture - biology – neutron activation and isotopic dilution analysis.

UNIT – II: Solid State Chemistry

2.1Crystal structure of solids Close packing of atoms and ions –HCP, FCC and BCC types of solids-calculation of packing voids – radius ratio rule –its influence on structures.

2.2 Classification of ionic structures - AX, AX_2, AX_3 types – AX type (ZnS, NaCl, CsCl) structures only - AX_2 type (fluorite, rutile, beta-cristobolite) structure only.

2.3 Layer structure – CdI_2- Nickel arsenite structure. Defects in crystal Schottky and Frenkel defects -explanation and calculation of number defects per cm^3 .

2.4 Metal excess defect - F-centers and interstitial ions.

2.5 Metal deficiency defect - positive ions absent - extra interstial negative ions.

UNIT – III: Organometallics

3.1Metal clusters – Types of metal clusters – Metal carbonyls-synergic effect.

3.2 Calculation of terminal metal and bridging carbonyls,18-electron rule - isolobal concept and its usefulness – uses of typical organometallics such as metal alloys and organometallic hydrides in organic synthesis.

3.3 Nitrosyl complexes – bridging and terminal nitrosyls, bent and linear nitrosyls – dinitrogen complexes – metallocene and arene complexes – metal carbenes, carbenes, and carboxylate anions.

3.4 Classification based on captivity and polarity of M-C bond, organometallic compounds of lanthanides and actinides – fluxional organometallic compounds.
3.5 Organometallics in medicine, agriculture, horticulture and industry. Spinels – normal, inverse and inverse types, site preferences in spinnels.

UNIT –IV: Inorganic Photochemistry
4.1 Electronic transitions in metal complexes, metal-centered and charge-transfer transitions – various photo physical and photochemical processes of coordination compounds.
4.2 Unimolecular charge-transfer photochemistry of cobalt(III) complexes – mechanism of CTTM, photoreduction
4.3 Ligand-field photochemistry of chromium(III) complexes – Adamson's rules, photoactive excited states, V-C model –
4.4 Photo physics and photochemistry of ruthenium.
4.5 Polypyridine complexes, emission and redox properties.

UNIT –V: Reactions and Catalysis by Organometallics
5.1 Organometallic reactions – ligand association and dissociation – oxidative addition and reductive elimination.
5.2 Insertion reactions. Reactions of coordinated ligands in organometallics.
5.3 Hydrogenation of alkynes(Lindlar's catalyst).
5.4 Hydrogenation of alkenes(Wilkinson's catalyst) - hydroformylation(oxo-process),epoxidation, metathesis.
5.5 Polymerization of olefins (Zeigler-Natta catalyst) -Oxidation of olefins(Wacker process).

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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
PUDUKKOTTAI – 622 001
SEMESTER - II

CORE COURSE: VII **HOURS/WEEKS:6**
SUB.CODE:21PCH07 **CREDITS:5**

PHYSICAL METHODS CHEMISTRY-I

OBJECTIVES: The primary objective of this course is to introduce the student to the advanced concepts of applications of spectroscopy.
CO 1:To learn about the theory and applications of UV-Visible spectroscopy.
CO 2:To be familiar with the principles and applications of IR spectroscopy.
CO 3:To understand the theory and principles of ESR spectroscopy
CO 4:To know the theory and applications of NMR and C^{13}-NMR Spectroscopy.
CO 5:To learn the principles and general rules for Mass spectroscopy and ORD&CD

OUTCOMES: At the end of the course students will be able to
CO-1:Explain different spectroscopes work and their applications in structure elucidations
CO-2:Recognize and distinguish the different molecules by applying the spectroscopies
CO-3:Solve spectral problems
CO-4:Develop the importance and usefulness of various spectroscopies in organic and inorganic chemistry.
CO-5:Illustrate the concepts of ESR spectroscopy and its application.
CO-6:Interpret the spectra and work out conjoined problems in spectroscopies.

UNIT – I: UV-Visible spectroscopy

1.1 UV-Visible spectroscopy Basic Principles
1.2 Electronic excitations-solvent effects - factors affecting position and intensity of absorption bands
1.3 Instrumentation of UV spectroscopy
1.4 Application of UV-Visible spectroscopy Applications – Qualitative analysis - Quantitative analysis
1.5 Spectra of dienes - - unsaturated ketones and aromatic carbonyl compounds – Woodward –Fieser rules - charge transfer complexes.

UNIT - II: IR-Spectroscopy

2.1 Basic principles of IR spectroscopy
2.2 Instrumentation of IR spectroscopy
2.3 Stretching vibrations - Hook's law - Bending vibrations –Overtone and combination bands Fermi resonance
2.4 Sampling techniques- factors influencing group frequencies – Both internal and external – quantative studies.
2.5 Application of IR-Spectroscopy-Applications to organic compounds -characteristic frequencies - effects of substitution, conjugation, bond angle and hydrogen bond - vibrational frequencies.

UNIT - III: NMR Spectroscopy

3.1 Instrumentatrion of ^{1}H NMR Spectroscopy -Theory of ^{1}H NMR spectroscopy

3.2 Chemical shift – factors affecting chemical shift – spin –spin coupling, vicinal and germinal coupling constants.

3.3 First order and non-first order spectra - shift reagents.

3.4 ^{1}H NMR Spectral Technique Double resonance - spin tickling - Nuclear Overhauser Effect - Deuterium exchange reactions – Applications.

3.5 ^{13}C- NMR Spectroscopy – Basic theory of FT – NMR, Relaxation- Broad band decoupling

UNIT – IV: ESR Spectroscopy

4.1Principles of ESR spectroscopy

4.2 g-factor, experimental method, spectrum, fine and hyperfine structures

4.3 Applications - (H-atom, CH_3 radical, p-1,4 benzo semiquinone radical anion)

4.4 Applications- Naphthalene anion, anthracene negative ion,

4.5 Applications-Triphenylmethy lradical, DPPH radical, Tempol)

UNIT –V: Mass Spectroscopy &ORD,CD

5.1 Principles of Mass Spectroscopy parent ion - Meta stable ion - isotopic ions - Basic peak- Nitrogen rule.

5.2 Instrumentation – General rule of fragmentation – Mc-lafferty rearrangement. Structural elucidation.

5.3 ORD and CD - Principle – Circular birefringence and Circular dichroism

5.4 Cotton effect - ORD curves-axial haloketone rule - octant rule

5.5 Applications for determination of conformation and configuration.

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GOVERNMENT ARTS COLLEGE FOR WOMEN(A),
PUDUKKOTTAI – 622 001
SEMESTER - II

CORE COURSE: VIII **HOURS/WEEKS:6**
SUB.CODE:21PCH08 **CREDITS:5**

SELECTED TOPICS IN CHEMISTRY

OBJECTIVES:

CO 1:To learn the about water treatment and food chemistry.
CO 2:To be familiar with chemotherapy and clinical chemistry.
CO 3:To understand the theory, instrumentation methods of ESR spectroscopy
CO 4:To know the theory organic photochemistry.
CO 5:To get the knowledge of colour and chemical constitution of dyes.
CO 6:To be able to know nucleic acid and synthesis of proteins.

OUTCOMES: At the end of the course students will be able to

CO-1:Evaluate different parameters in water and gain the knowledge various methods of preservation in food.
CO-2:Recognize and distinguish the different tests by applying sugar test in urine and detection of diabetes
CO-3:Apply the basic concepts of photochemical organic reactions in Norrish Type I &II reactions.
CO-4:Plan the importance and usefulness of various synthesis of dyes.
CO-5:Distinguish the primary and secondary structure of protein and types of RNA.

UNIT-I: Water Treatment and Food chemistry

1.1 Water treatment: Introduction- Treatment of water for municipal purpose.Chemical and physical methods of sterilization,hard and soft water.

1.2 Types of hardness,softening of water,lime soda process. Permutit or zeolite process,ion exchange process.

1.3 Water analysis- BOD ,COD.Types of industrial wastes – treatment of wastes or effluent with organic impurities – treatment of wastes or effluent with inorganic impurities – treatment of some important chemical wastes.

1.4 Food chemistry: Food processing, Food preservatives-definition-classification, Food Spoilage-1.5Definition-prevention-methods of preservation- classification-Low and high temperature-Dehydration-osmotic pressure – food irradiation.

UNIT-II: Chemotherapy and Clinical Chemistry

2.1Chemotherapy: Chemotherapy with compounds of certain non- essential elements.
2.2 Platinum complexes in cancer therapy – cis platin and its mode of action – cytotoxic compounds of other metals.
2.3 Gold containing drugs as anti rheumatic agents and their mode of action.
2.4 Clinical Chemistry -Determination of sugar (glucose) in serum – o-toluidine method – diagnostic test for sugar in urine – Benedict's test – detection of diabetes.
2.5 Detection of cholesterol in urine – detection of anaemia – estimation of haemoglobin (Hb concentration) – red cell count.

Unit- III: Organic photochemistry

3.1Photochemistry – Fundamental concepts of photo chemistry.
3.2 Jablonski diagram .

3.3 Energy transfer, characteristics of photoreactions, photo-reduction and photo-oxidation, photo reactions of ketones and enones,
3.4 Norrish Type I and II reactions. Photochemistry of alkenes, dienes and aromatic compounds,
3.5 Photoadditions – Barton reaction – ParternoBuchi.

Unit IV : Dyes

4.1Colour and chemical constitution - Chromophore and auxochromes.
4.2 Requirements of a colured compound to act as a dye.
4.3 Natural and synthetic dyes.
4.4Classification of dyes, synthesis of dyes- triphenylmethane dyes-malachite green,crystal violet,rosaniline,nitro and nitroso dyes, azo dyes-bisazodyes-congored, bismark brown and napthol blue black **B,** phthalein and xanthen dyes
4.5 Phenolphthalein ,fluorescein, anthhroquinone dyes-alizarin, indigo dye – indigo.

Unit -V:Nucleic Acids and Protein Synthesis

5.1 Nucleotides and nucleosides.
5.2 DNA-Primary and secondary structure-replication of DNA,RNA and protein synthesis.
5.3Messenger RNA synthesis-trancription,Ribosomes –rRNA,Transfer RNA,genetic code translation.
5.4 Detemination of base sequence of DNA.Polymerase Chain reaction(PCR),Antisense technology in chemotherapy and other nucleic acid
5.5 Targeted drugs- intercalaters,sequence specific drugs.A brief account of ribosyme and iRNA.

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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SEMESTER - II

CORE COURSE: IX **HOURS/WEEKS: 6**
SUB.CODE: 21PCH09P **CREDITS: 4**

ORGANIC CHEMISTRY PRACTICAL – II

OBJECTIVES:

CO 1:To understand the principle behind the estimation of organic compounds and get practical knowledge.
CO 2:To carry out the double stage preparation of organic compound**s.**

OUTCOMES: At the end of the course, the students will be able to

CO-1:Apply the analytical procedure to separate organic compound by double stage
CO-2:Estimate various organic compounds
CO-3:Examine in the preparation of double stage organic compounds.
CO-4:Take part in the preparation of organic compound
CO-5:Develop the laboratory skill of quantitative analysis of organic compound

1.Quantitative analysis of Organic Compounds.

a) Estimation of phenol
b) Estimation of Aniline
c) Estimation of Glucose
d) Saponification value of an oil
e) Iodine value of oil

2.Two stage preparation of organic compounds:

a) Acetylsalicylic acid from methylsalicylate(Hydrolysis and Acetylation)
b) 1,3,5-tribromobenzene from aniline(Bromination,Diazotization and Hydrolysis)
c) p-nitroaniline from acetanilide (Nitration and Hydrolysis)
d) p-bromoaniline from acetanilide (Bromination and Hydrolysis)
e) p-bromoacetanilide from aniline(Acetylation and Bromination)
f) Benzilic acid from benzoin (Rearrangement)
g) Benzanilide from benzophenone (Rearrangement)

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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SEMESTER - II

CORE COURSE:XP **HOURS/WEEKS:6**
SUB.CODE:21PCH10P **CREDITS:4**

INORGANIC CHEMISTRY PRACTICAL – II

OBJECTIVES:

CO 1: To understand the basic principles of volumetric and gravimetric analysis.
CO 2: To estimate the elements by volumetric and gravimetric methods.
CO 3: To learn the skills of preparing inorganic complexes.

OUTCOMES: At the end of the course, the students will be able to

CO-1:Get the practical knowledge in the estimation of various volumetric and gravimetric methods
CO-2:Design to develop research skills
CO-3:Take part in the preparation of complexes.
CO-4:Develop the laboratory skill of quantitative as well as qualitative analysis of metal; ions

1. Titrimetry and Gravimetry

A mixture of solution(s) should be given for estimation

Cu (V) and Ni (G)
Cu (V) and Zn (G)
Fe (V) and Zn (G)
Fe (V) and Ni (G)
Zn (V) and Cu (G)

2. Preparation of complexes

1. Tetraamminecopper (II) sulphate
2. Potassium trioxalatoaluminate(III)
3. Potassium trioxalatochromate(III)
4. Tristhioureacopper(I) chloride
5. Tristhioureacopper(II)sulphate

REFERENCES:

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SEMESTER - III

GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
PUDUKKOTTAI – 622 001
SEMESTER -III

CORE COURSE:XI **HOURS/WEEKS:6**
SUB.CODE:21PCH11 **CREDITS:5**

ORGANIC CHEMISTRY-II

OBJECTIVES: To make the student

CO 1:To understand the basic concept of carbon-carbon and carbon-hetero multiple bonds
CO 2:To identify the conformation and reactivity of dynamic stereochemistry
CO 3:To enable students to understand the oxidation and reduction reactions
CO 4:To gain insight on natural products
CO 5:Emphasis the study of steroids, alkaloids and terpenoids.

OUTCOMES: At the end of the course,the students will be able to

CO-1:Describe different kinds of carbon-carbon and hetero multiple bonds
CO-2:Determine the conformational analysis of cyclic and acyclic system.
CO-3:Recognize the mechanism of oxidation and reduction reactions.
CO-4:Classify the natural products.
CO-5:Explain the importance of steroids, alkaloids and terpenoids.

UNIT- I: ADDITION TO CARBON-CARBON AND CARBON-HETERO MULTIPLE BONDS

1.1Electrophilic, nucleophilic and neighboring group participation mechanism- Addition of Halogen and nitrosyl chloride to olefins.
1.2 Hydration of Olefins and acetylenes. Hydroboration, Hydroxylations,.
1.3 Michael addition.Diels Alder Reaction, 1, 3-dipolar additions.
1.4 Carbenes and their addition to double bonds - Simmon Smith Reaction. Mannich, Stobbe, Darzen, Wittig, Wittig Horner and benzoin reactions.
1.5 Stereochemical aspects to be studied wherever applicable. Nitrene : Methods for generating nitrenes and their reactions.

UNIT – II: DYNAMIC STEREOCHEMISTRY CONFORMATION AND REACTIVITY

2.1 Conformation and reactivity in acyclic systems.
2.2 Stereo electronic and steric factors – simple examples illustrating E2 and cis eliminations, intramolecular rearrangements and neighbouring group participation.
2.3 Curtin-Hammett principle. WinsteinElliel Equation, Steric assisted and steric hindered reaction.Simple reactions illustrating stereo and stereoelectronic factors.
2.4 Esterfication, oxidation, nucleophilic substitution at ring carbons and elimination reactions - reactions involving intramolecular rearrangements.
2.5 Formation and cleavage of epoxides and neighbouring group participation – reactions of enols and enolates.

UNIT – III: OXIDATION AND REDUCTION REACTION

3.1Reduction reactions: Reduction reactions with $LiAlH_4$, $NaBH_4$,
3.2 Tritertiarybutyloxy aluminium hydride, sodium cyano borohydride, trialkyl tin hydride, lithium di isopropyl amide.
3.3 DIBAL, 9-BBN and diisopinocamphenyl borane. Gilman's reagent, Hydrazines.
3.4 MPV reduction, Clemmensen reduction and Wolff-Kishner reduction, Birch reduction.

3.5 Oxidation reactions: Oxidation with chromyl chloride, periodic acid, selenium dioxide, lead tetraacetate, Osmium tetroxide and H_2O_2 - Oppanauer oxidation.

UNIT- IV: NATURAL PRODUCTS

4.1Carbohydrate: Types of naturally occurring sugars, deoxy sugars, amino sugars, branched chain sugars, sugar methyl ethers and acid derivatives of sugars.

4.2 Polysaccharides of industrial and biological importance.

4.3 Dextrin, chemistry of sialic acids, cell-cell recognition and blood group substances.

4.4 Configuration and conformation of glucose, fructose and maltose –photosynthesis of carbohydrates.

4.5 Vitamins: Physiological importance – Classification, occurrence, chemistry of Vitamins A, C and E, structure elucidation and synthesis, deficiency syndromes.

UNIT- 5: STEROIDS, ALKALOIDS AND TERPENOIDS

5.1 Steriods: Classification.

5.2 Structural elucidation of cholesterol (synthesis not required)

5.3 Structural elucidation and synthesis of androsterone, testosterone, Oestrone, progesterone, ergosterol, stigmasterol and equilenin. Biosynthesis of steroids.

5.4 Alkaloids: General method of determining structure, classification of alkaloids, structural elucidation of Morphine, Atropine, Reserpine. Biosynthesis of Alkaloids.

5.5 Terpenoids: Structural elucidation and synthesis of -Pinene, Camphor,α Zingiberene, Fernesol and Squalene.

TEXT BOOKS;

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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
PUDUKKOTTAI – 622 001
SEMESTER - III

CORE COURSE: XII **HOURS/WEEKS: 6**
SUB.CODE:21PCH12 **CREDITS: 6**

PHYSICAL CHEMISTRY-II

OBJECTIVES:
CO 1:To understand the basic concepts of group theory
CO 2:To study the theories of electro chemistry
CO 3:To know the applications of electro chemistry
CO 4:To learn the fundamental concepts of statistical thermodynamics.
CO 5:To gain the knowledge of photochemistry and radiation chemistry.

OUTCOMES: At the end of the course students will be able to
CO-1:Construct the character table for C_{2v} and C_{3v} point groups and to determine the modes of vibration
CO-2:Apply the theories and basic principles of the electrochemical phenomena involved in electrochemical systems for electrical energy production and storage.
CO-3:Identify and analyze various factors influencing the ionic conductivities of the various types of electrodes
CO-4:Calculate microstates and macorstates in statistical thermodynamics
CO-5:Use the experimental techniques in photochemistry and evaluate the application of radiation chemistry.

UNIT-I: Group Theory
1.1 Symmetry elements – Symmetry operations - Properties of a group and sub group – Classes
1.2 Abelian group and non-abelian groups – isomorphism groups, point group of molecules
1.3 Group multiplication tables – matrix representation theory
1.4 Consequences of GOT and construction of character tables of C_{2v} and C_{3v} point groups –reducible and irreducible representation
1.5 Modes of vibration in H_2O and NH_3 molecules.

UNIT – II: Electrochemistry – I
2.1Theories of strong electrolytes – inter ionic attraction theory
2.2 Debye-Huckel theory of strong electrolytes –Debye Huckel model of ionic atmosphere
2.3 Debye -Huckel-Onsager equation – derivation, verification and modification
2.4 Debye-Falkenhagen effect and Wien effect, Debye-Huckel limiting law
2.5 Determination of activity coefficients and ionic strength using Bronsted equation.

UNIT – III: Electrochemistry – II

3.1 Application of conductivity measurements – Nernst equation and its signification –

3.2Reversible and irreversible cells – Electrodes – SHE – calomel electrode – glass electrode – platinum electrode – glassy carbon electrode – ion selective electrode - measurement of pH.

3.3 Over voltage – application of over voltage – hydrogen and oxygen over voltage.

3.4 Butler-Volmer equation – Tafel equation- Derivation.

3.5 Principles of electro deposition of metals – corrosion and passivity – Pourbaix and Ellingham diagrams – methods of protection of metals from corrosion.

UNIT IV: Statistical Thermodynamics

4.1 Thermodynamic probability – probability theorems

4.2 Relation between entropy and probability (Boltzmann-Planck equation).

4.3 Ensembles, Ergodic hypothesis, microstates and macrostates

4.4 Maxwell-Boltzmann distribution law – partition functions – translational, rotational, vibrational and electronic partition functions.

4.5 Bose-Einstein (B.E.) and Fermi-Dirac (F.D.) distribution equations – comparison of B.E. and F.D. statistics with Boltzmann statistics.

UNIT – V: Photochemistry and Radiation chemistry

5.1 Photo-physical processes of electronically excited molecules – Jablonski diagram - Stern-Volmer equation and its applications

5.2 Experimental techniques in photochemistry – chemical actinometers – lasers and their applications.

5.3 Differences between radiation chemistry and photochemistry – sources of high energy radiation and interaction with matter – radiolysis of water, solvated electrons

5.4 Definition of G value, Curie, linear energy transfer (LET) and Rad – scavenging techniques – use of dosimetry and dosimeters in radiation chemistry.

5.5 Applications of radiation chemistry.

REGERENCES:

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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
PUDUKKOTTAI – 622 001
SEMESTER - III

CORE COURSE:XIIIP **HOURS/WEEKS: 6**
SUB.CODE:21PCH13P **CREDITS: 4**

PHYSICAL PRACTICAL –I
(NON-ELECTRICAL)

OBJECTIVES:

CO 1:To Know the molecular weight of the solute component

CO 2:To Understand the concept of physical chemistry

CO 3:To understand and apply the concept of Rast method.

OUTCOMES: At the end of the course, the students will be able to

CO-1: Determine the miscibility temperature of phenol water system.

CO-2: Find transition temperature of hydrated salt

CO-3: Apply the concept of phase diagram in one component and two component system.

CO-4: Develop the skills for perfect value for physical method

CO-5: Compare the strength of acids and ester hydrolysis method

NON-ELECTRICAL METHODS

1. Determination of molecular weight of substance by transition temperature method.
2. Determination of molecular weight of substances by Rast method.
3. Determination of critical solution temperature (CST) of phenol-water system impurity on CST.
4. Study of phase diagram of two components forming a simple eutectic system.
5. Study of phase diagram of two components forming a compound.
6. Distribution law – study of Iodine- Iodine equilibrium.
7. Distribution law- study of association of benzoic acid in benzene.
8. Kinetics – Acid hydrolysis of ester – comparisonof strength of acid.
9. Kinetics-persulphate-Iodine reaction- Determination of order effect of Iodine – strength on rate constant
10. Determination of Equilibrium constant of KI

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2. K. K.Sharma, and, D. S.Sharma, Introduction to Practical Chemistry, Vikas Publishing House, New Delhi (2005).
3. A.R.Kulandaivelu, Basic Principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997).
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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SEMESTER -III

ELECTIVE COURSE: I **HOURS/WEEKS:6**
SUB.CODE:21PCHE21 **CREDITS:4**

POLYMER CHEMISTRY

OBJECTIVES:

CO 1:To understand the different types of polymers

CO 2:To learn Polymerization Mechanisms

CO 3:To learn the characters and structures of polymers

CO 4:To know the degradation polymerisation

CO 5:To study the preparation, properties and uses of important polymers

OUTCOMES: At the end of this course students should be able to

CO-1:Classify the various types of polymerisation and synthesis of polymer

CO-2:Explain the of mechanism of free radical, cationic and anionic polymerization.

CO-3:Outline the chemical and geometrical structure of polymer and GTT.

CO-4:List the different types of polymer degradation.

CO-5:Analyse the preparation, properties and uses of polymers.

UNIT-I: Classification and synthesis of polymer

1.1 Basic concepts and classification of polymers.
1.2 isotactic, atactic and syndiotactic polymers.
1.3 Chain polymerization, Condensation (Step growth) polymerization. Polyadditionpolymerisation-Ring opening Polymerisation.
1.4 Polyesters, polyamides-Nylon-66, Nylon-6, phenol-formaldehyde resins urea-formaldehyde resins,polyurethanes.
1.5 Polymerisation Techniques-Bulk Polymerisation, Solution Polymerisation, Suspension and Emulsion polymerisation.

UNIT-II: Polymerisation Mechanisms

2.1 Free-radical chain polymerization-Equation for Kinetic chain length.

2.2 Degree of polymerization-Chain transfer reactions-Mayo Equation-Ceiling temperature.
2.3 Cationic polymerization. Anionic polymerization.

2.4 Free radical versus ionic mechanism.

2.5 Co-ordination polymerisation(Zeigler-Natta polymerisation)

UNIT-III: Characterization and structure

3.1Chemical and geometrical structure of polymer molecules.

3.2 Polymer micro structure-micro structures based on the chemical structure-micro structures based on the geometrical structure

3.3 Stereo –regular polymers. Glass Transition Temperature (GTT)

3.4 Determination of GTT-properties associated with GTT.

3.5 Factors influencing GTT, Importance of GTT.

UNIT-IV: Polymer Degradation

4.1 Types of degradation

4.2 Thermal degradation and mechanical degradation.

4.3 Degradation by Ultrasonic waves-Photodegradation. Degradation by high radiation-Oxidative degradation

4.4 Hydrolytic degradation.Average molecular weight, Number average and weight average molecular weight.

4.5 Sedimendation and viscosity average molecular weight

UNIT-V: **Important Polymers -Preparation, Properties and uses:**

5.1 Polyethylene, Polypropylene

5.2 Polystyrene, Polyacrylonitrile, Polymethyl methacrylate.

5.3 Polyesters, Polyvinyl chloride, Polytetrafluoroethylene.

5.4 Polyisoprenes, epoxy resins and Elastomers

5.5 Synthetic rubbers-natural rubber-silicone rubber, plasticizers.

References:

1.V.R. Gowarikar, N.K. Viswanathan and Jeydev Sreedhar, Polymer Science, Wiley Eastern Ltd., New Delhi, 1986.

2. R.B.Seymour, Introduction to Polymer chemistry, Mc Graw Hill ,New York,1971.

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SEMESTER -III

ELECTIVE COURSE: II	**HOURS/WEEKS: 6**
SUB.CODE:21PCHE2	**CREDITS: 4**

ANALYTICAL CHEMISTRY

OBJECTIVES:

CO 1:To learn the instrumental methods of analysis

CO 2:To know the nature of errors and their types.

CO 3:To understand the various techniques in chromatography.

CO 4:To gain the principles and instrumentation of thermoanalytical techniques.

CO 5:To study in detail the electro analytical techniques.

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

CO-1: Explain principles and applications of extended absorption fine structure

CO-2:Get the knowledge of various types of errors.

CO-3:Recognize principles of chromatography

CO-4:Describe the instrumentation and applications of thermogravimetric analysis.

CO-5:Interpret the important techniques in electro analytical methods.

UNIT I: Instrumental Methods of Analysis:

1.1Principles and applications of extended X-ray absorption fine structure (EXAFS)
1.2 Surface extended X-ray absorption fine structure (SEXAFS)
1.3 Atomic absorption spectroscopy (AAS)- theory and applications
1.4 Flame emission spectroscopy (FES) – theory and applications
1.5 Turbidimetry – theory and applications.

UNIT II: Data and Error Analysis:

2.1Various types of error – accuracy, precision, significant figures
2.2 Describing data, population and sample, mean, variance, standard deviation.
2.3 Hypothesis testing, levels of confidence and significance, test for an outlier(Q-test), testing variances, means t-Test, paired t-Test – analysis of variance (ANOVA)
2.4 Correlation and regression. Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals – r and its abuse.
2.5 Multiple linear regression analysis, elementary aspects.

UNIT III: Chromatography:

3.1Solvent extraction – principles and applications
3.2 Principles of ion exchange, paper, thin-layer and column chromatography techniques
3.3 Columns, adsorbents, methods, Rf values, McReynold's constants and their uses
3.4 HPTLC, HPLC techniques – adsorbents, columns, detection methods, estimations, preparative column

3.5 GC-MS techniques – methods, principles and uses.

UNIT IV: Thermoanalytical Methods and fluorescence spectroscopy:
4.1Principles – instrumentations and applications of thermogravimetry analysis (TGA),
4.2Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC)
4.3 Thermometric titrations – principles and applications
4.4 Basic aspects of synchronous fluorescence spectroscopy – spectral hole burning
4.5 Flow cytometry – fluorometers (quantization) – instrumentation – applications.

UNIT V: Electroanalytical Techniques
5.1Electrochemical sensors, ion-sensitive electrodes, glass- membrane electrodes, solid-liquid membrane electrodes
5.2 Ion-selective field effect transistors (ISFETs) – sensors for the analysis of gases in solution
5.3 Polarography – principles and instrumentation – dropping mercury electrode – advantages – Ilkovic equation Applications of polarography .
5.4 Cyclic voltammetry-Principles and instrumentation.
5.5 Amperometric titrations: principles – techniques – applications.

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2. J. Topping, Errors of Observation and Their Treatment; 4th Ed., Chapman Hall, London, 1984.
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SEMESTER -IV

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SEMESTER - IV
CORE COURSE:XIV HOURS/WEEKS: 6
SUB.CODE:21PCH14 CREDITS: 5

PHYSICAL METHODS IN CHEMISTRY-II

OBJECTIVES:
CO 1:To understand the basic concepts of electronic spectroscopy
CO 2:To study the theories of IR and Raman spectroscopy
CO 3:To know the applications of NMR spectroscopy
CO 4:To learn the theories of ESR and magnetic properties
CO 5:To gain the knowledge of Mossbauer Spectroscopy and Photoelectron spectroscopy

OUTCOMES: At the end of the course the students will be able to
CO-1:Summarize the applications of electronic spectroscopy and identify term term for complexes.
CO-2:Explain the modes of vibrations in molecules and vibration spectra of metal carbonyl
CO-3:Calculate quadrupole splitting of inorganic compounds in NMR spectroscopy.
CO-4:Develop their knowledge in ESR spectra of metal complexes and different types of magnetic properties.
CO-5:Have an idea about the advantages of iron and tin complexes in Massbauer spectroscopy.

UNIT I: Electronic Spectroscopy

1.1Electronic spectra: selection rules
1.2 John–Teller Distortion – splitting of spectral terms - L.S Coupling scheme- Russel- Saunders method
1.3 Microstates-Atomic Term Symbols, Spectroscopic molecular term symbols, Micro states Orgel and Tanabe-Sugano diagram.
1.4 Evaluation of 10 Dq and beta d2, d3, d7, d8 systems.
1.5 Charge transfer spectra -Electronic spectra of lanthanides and actinides.

UNIT II: Infrared and Raman Spectroscopy

2.1 Vibrations in simple molecules (H_2O, CO_2) and their symmetry notation for molecular vibrations – group vibrations and the limitations
2.2 Combined uses of IR and Raman spectroscopy in the structural elucidation of simple molecules like N_2O, ClF_3, NO_3^-, ClO_4^- effect of coordination on ligand vibrations.
2.3 Uses of groups vibrations in the structural elucidation of metal complexes of urea, thiourea, cyanide, thiocyanate and dimethyl sulfoxide.
2.4 Effect of isotopic substitution on the vibrational spectra of molecules – vibrational spectra of metal carbonyls with reference to the nature of bonding – geometry and number of C-O stretching vibrations (group theoretical treatment).
2.5 Applications of Raman spectroscopy – resonance Raman spectroscopy.

UNIT III: NMR Spectroscopy

3.1Examples for different spin systems – chemical shifts and coupling constants (spin-spin coupling) involving different nuclei (^{1}H, ^{19}F, ^{31}P, ^{31}C) interpretation and applications to inorganic compounds.
3.2 Effect of quadrupolar nuclei ^{1}H, ^{10}B, ^{11}B) on the ^{1}H NMR spectra.

3.3 Systems with chemical exchange – evaluation of thermodynamic parameters in simple systems – study of fluxional behaviour of molecules .
3.4 NMR of paramagnetic molecules – isotropic shifts contact and pseudo-contact interactions.
3.5 Lanthanide shift reagents.

UNIT IV: EPR Spectroscopy and Magnetic properties

4.1 Theory of EPR spectroscopy – spin densities and McConnell relationship.
4.2 Factors affecting the magnitude of ‘g’– zero-field splitting and Kramer’s degeneracy.
4.3 ESR spectra of V(II), Mn(II), Fe(II), Co(II), Ni(II) and Cu(II), Trans$[Ti(H_2O)_4(NH_3)_2]^{2+}$,Trans$[Cr(H_2O)_4(NH_3)]^{2+}$complexes .
4.4 Magnetic properties : Types of magnetism – dia-, para-, ferro- and antiferromagnetism – magnetic properties of free ions.
4.5 First-order Zeeman effect – second-order Zeeman effect – states KT – states<<<KT.

UNIT V: Mossbauer Spectroscopy and Photoelectron spectroscopy

5.1 Isomer shifts – quadrupole splitting – magnetic interactions.
5.2 Applications to iron and tin compounds.
5.3 NQR spectroscopy – quadrupole movement, coupling constant, quadrupole transition-electric field gradient and molecular structure ($_7N^{14}$,$_5B^{11}$, $_{17}C^{l3}$)
5.4 Mossbauer spectroscopy – recoilless emission and resonance absorption, experimental method, isomeric shift and electric quadrupole splitting in Fe^{57}.
5.5 Photo electron spectroscopy –Orbital energies of atoms, Orbital energies of molecules and binding energy of core electron

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SEMESTER - IV

CORE COURSE: XVP **HOURS/WEEKS: 6**
SUB.CODE:21PCH15P **CREDITS: 4**

PHYSICAL PRACTICAL –II
(ELECTRICAL)

OBJECTIVES:

CO 1:To know the basic principles of various physical chemistry experiments.
CO 2:To learn the skills of drawing graph, handling of some precision instruments.
CO 3:To learn to do some experiments in different cycles.
CO 4:To provide deep knowledge and hands on experimenting conductometry, potentiometry,

OUTCOMES: At the end of the course the students will be able to

CO-1:Carry out electrical experiments such as Conductometry and Potentiometric Titrations

CO-2:Determine the dissociation constant of weak acid

CO-3:Calculate the strength of given mixture of acid by conductometric and potentiometric titrations.
CO-4:Apply the operations of instrumentals techniques for quantitative estimation.
CO-5:Improve the knowledge of electrochemistry in redox titrations.

EXPERIMENTS:

1. Determination of the equivalent conductance at different concentrations and to examine the validity of the Onsager's theory as limiting law at high dilutions for a strong electrolyte.

2. Verification of Ostwald's dilution Law and determination of dissociation constant of weak acid or weak base.

3. Condutometric titration of mixture of strong and weak acids with a strong base...

4. Determination of solubility product of inorganic compounds using conductometer.

5. Determination of the strength of Fe (II) by potentiometric redox titration(FAS vs K_2Cr2O_7 and FAS vs $KMnO_4$)

6. Determination of pH of the given solution with the help of quinhydrone powder using buffer solutions and by potentiometric method.

7. Calibration of a pH meter and measurement of pH of different buffer solutions.

8. Potentiometric titration of mixture of strong and weak acids with a strong base.

9. Determination of dissociation constant of weak acid by potentiometric method.

10. Conductometric precipitation titration.

REFERENCES:

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SEMESTER - IV

ELECTIVE COURSE: III	**HOURS/WEEKS:6**
SUB.CODE:21PCHE3	**CREDITS: 4**

PHARMACEUTICAL CHEMISTRY

OBJECTIVES:

CO 1:To understand the basics of pharmaceutical chemistry.
CO 2:To study the antibiotics and their activity.
CO 3:To learn the analgesic and antipyretic activities.
CO 4:To study the basic concepts of green chemistry.
CO 5: To analyze the various techniques involved in green chemistry.

OUTCOMES: At the end of this course the student will be able to
CO-1:Analyze the causes of diseases and symptoms.
CO-2:Improve the knowledge of biological actions of antibiotics.
CO-3:Distinguish analgesic and antipyretics.
CO-4:Distinguish between recyclable and non-recyclable materials.
CO-5:Apply basic principles of green chemistry.

UNIT I: Basics of Pharmaceutical Chemistry

1.1 Definitions – the terms – drugs, pharmacology, pharmacy, chemotherapy
1.2 Therapeutics – pharmacologically active principles in plants.
1.3 First aid – important rules of first aids, cuts, fractures, bleeding for blood, maintaining breathing burns and first aid box.
1.4 Tuberculosis (T.B.), jaundice, piles, typhoid, malaria, cholera – causes – symptoms, diagnosis – prevention and treatment.
1.5 Medicinally important compounds of iron – ferrous gluconate, ferrous sulphate and ferric ammonium citrate.

UNIT II: Antibiotics

2.1 Antibiotics - Introduction
2.2 Antibiotics - Definition – classification and biological actions.
2.3 Penicillin, chloramphenicol, streptomycin and tetracycline – structure, properties and therapeutic uses
2.4 Chemical structure and pharmacological activity.
2.5 Effect of unsaturation, chain length, isomerism, halogens, amino groups, hydroxyl groups and acid groups.

UNIT III: Analgesic and Antipyretics

3.1 Narcotic analgesic – analgesic action of morphine.
3.2 Derivatives of morphine – heroin and apomorphine.
3.3 Synthetic analgesics – pethidine, methadone.
3.4 Non-narcotic analgesic – aspirin, paracetamol –– preparation, properties and uses
3.5 Phenacetin – analgin – preparation, properties and uses.

UNIT-IV: Need for Green chemistry
4.1Introduction – Definition- need for green chemistry
4.2 Goals of green chemistry
4.3 Twelve principles of green chemistry
4.4 Designing a green chemistry
4.5 Choice of starting material- Choice of solvent-Choice of catalyst – process with suitable examples.

UNIT-V: Green Synthesis
4.1 Synthesis involving basic principles of green chemistry.
4.2 Catechol,4-aminodiphenylamine,
4.3 Benzyl bromide, acetaldehyde,
4.4 Disodium iminodiacetate (DSIDA),
4.5 Citral,isoprofen,paraacetamol and furfural.

REFERENCES:

1.V. Kumar,an Introduction of Green chemistry 1st Ed(2007),vishal publishing w.,Jalandhar.
2.K.R. Desai,Green chemistry –Micro synthesis 1st Ed, Himalaya publishing house,Mumbai.
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SEMESTER - IV

CORE COURSE: IV **HOURS/WEEKS: 6**
SUB.CODE:21PCHE4 **CREDITS: 4**

RECENT TRENDS IN CHEMISTRY

OBJECTIVES:

CO 1:To understand the basic concepts in modern synthetic reaction
CO 2:To know Retero synthesis.
CO 3:To learn the details of Supra molecular chemistry
CO 4:To study the supra molecular reactivity and catalysis.
CO 5: To analyse the various techniques involved in Sono chemistry

OUTCOMES: At the end of the course the student will be able to

CO-1:Identify the molecular complexity of carbon skeletons and the presence of functional groups and their relative positions.
CO-2:Apply disconnection approach and identifying suitable synthon to effect successful organic synthesis.
CO-3:Describe some of the applications of supramolecular chemistry including industrial applications and supramolecular catalysis
CO-4:Synthesize the nano structural inorganic materials-nano structured supported egg shell catalyst
CO-5:Gain knowledge about general research methods and analytical skills required to carry out chemistry research projects

Unit- I : Modern Synthetic Reactions

1.1 Sommelet oxidation, Oppenauer oxidation.
1.2 Fenton’s reagent, Sharpless asymmetric epoxidation.
1.3 Leukart reaction (reductive amination), Diborane as reducing agent, Baker’s yeast reduction.
1.4 Named Reactions: Vilesmeir -Heck reaction, Dieckmann reaction, Negishi reaction. Baylis-Hillman reaction, Henry reaction,
1.5 Nef-reaction,Ullmann coupling reactions, 1,3 –dithiane anions.

Unit – II: Retro synthetic analysis;

2.1 Synthons – Synthetic equivalent.
2.2 Alternate synthetic routes. Synthesis of organic mono and bifunctional compounds via disconnection approach.
2.3 Key intermediates, available starting materials and resulting yields of alternative methods.
2.4 Convergent and divergent synthesis, Synthesis based on Umpolung concepts of seebach (polarity inversion).
2.5 Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups.

UNIT-III: Supramolecular chemistry

3.1 Introduction- supramolecular chemistry
3.2 Molecular forces, molecular recognition
3.3 Basic concept of Host-guest complexation with examples from ionophore chemistry
3.4 Non covalent interactions- molecular receptors for different types of molecules.

3.5Ligand design, synthesis of exo-receptors, endo receptors and co-receptor molecules, triangle, square,rectangular supramolecules.

UNIT-IV: Supramolecular Reactivity and catalysis

4.1 Catalysis by macrocyclic cation receptor molecules.
4.2 Catalysis by reactive receptor molecules.
4.3 Catalysis with cyclophane type receptors.
4.4 Supramolecular metallo catalyst – cocatalyst-catalysis of synthetic reactions-biomolecular and abiotic catalysis.
4.5 Supramolecular chemistry in solution – cyclodextrin,micelles, dedrimers, gelators – classification and typical reaction – applications.

UNIT-V: Sonochemistry

5.1 Instrumentation – Sonochemistry
5.2 Physical aspects-Acoustic cavitation
5.3 Sonoluminescence Types- Homogeneous liquid phase-Heter**o**geneous solid-liquid reaction.
5.4 Synthetic applications-Synthesis of nano structural inorganic materials- nano structured supported egg shell catalyst- sonochemical modification of inorganic materials
5.5 Esterification-Saponification- Hydrolysis/ Solvolysis, Alkylation-Oxidation and reduction reactions – Bouveault reaction..

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SEMESTER - IV
EXTRA CORE COURSE: I **HOURS/WEEKS: 6**
CREDITS: 5

ORGANICCHEMISTRY

OBJECTIVES: To make the student

CO 1:To understand the basic concept of reagents in organic chemistry
CO 2:To know stereoisomerism
CO 3:To enable students to understand confirmation analysis
CO 4:To gain the knowledge of kinetics reaction mechanism.
CO 5:Emphasis the study of cyclic and alicyclic conformational analysis

OUTCOMES: The student shall be able to

CO-1: Compare the different kinds of reagents using in organic chemistry
CO-2: Explain R and S nomenclature in stereoisomerism.
CO-3: Recognize determining configuration and Z nomenclature
CO-4: Identify the kinetic methods for determining organic reaction mechanisms.
CO-5: Describe the study of Topicity and NMR distinction of organic compounds

UNIT I: Reagents in Organic Synthesis

1.1Oxidation: Baeyer-Villiger, Jacobsen epoxidation, Shi epoxidation, Jones reagent.
1.2 PCC, PDC, IBX, DMP, CAN, TPAP, NOCl, $Mn(OAc)_3$, Cu(OAC)2, Bi_2O_3.
1.3 Swern oxidation, Sommelet reaction, Elbs reaction, Oxidative coupling of phenols, Prevost reaction and Woodward modification.
1.4 Reduction: palladium /platinum /rhodium /nickel based heterogeneous catalysts for hydrogenation, Wilkinson’s catalyst, Noyori asymmetric hydrogenation.
1.5 Reductions using Li/Na/Ca in liquid ammonia.

UNIT II: Stereochemistry

2.1 Stereoisomerism – symmetry – enantiomers and diastereomers.
2.2 R and S nomenclature – optical activity and chirality.
2.3 Types of molecules exhibiting optical activity.
2.4 Absolute configuration – chirality in molecules with noncarbon stereocenters (N, S and P).
2.5 Molecules with more than one chiral centre – atropisomerism.

UNIT – III: Conformational Analysis

3.1Molecular chirality – allenes, spiranes, biphenyls, helicenes and cyclophanes.
3.2 Methods of determining configuration – E and Z nomenclature – determination of configuration of geometrical isomers.
3.3 Stereochemistry of addition and elimination reactions – stereospecific and stereoselective synthesis [elementary examples].
3.4 Basic concepts of conformational analysis – conformations of cyclopentane, cyclohexane, cyclohexene and fused (decalin) and bridged (norbornane type) ring systems.
3.5 Anomeric effect in cyclic compounds.

UNIT – IV: Kinetics of reaction mechanisms

4.1Classification of organic reactions - Principle of microscopic reversibility.

4.2 Hammond postulate - Kinetic and thermodynamic control of chemical reactions .
4.3Kinetic and non- kinetic methods for determining organic reaction mechanisms.
4.4 Carbocation Structure and stability of carbocations, Classical and non-classical carbocations,
4.5Neighbouring group participation and rearrangements including Wagner-Meerwein, Pinacol-pinacolone, semi-pinacol rearrangement

UNIT –V:Conformational analysis of acyclic and cyclic systems
5.1Conformational analysis of acyclic and cyclic systems – substituted n-butanes – cyclohexane and its derivatives.
5.2Decalins –fused and bridged bicyclic systems – conformation and reactivity some examples.
5.3Topicity and NMR distinction of organic compounds.
5.4Topicity and prostereoisomerism – topicity of ligands and faces, and their nomenclature
5.5 NMR distinction of enantiotopic/diastereotopic ligands

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1. J. March and M. B. Smith, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure; 7thEd., Wiley, New York, 2013.
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SEMESTER - IV

EXTRA CORE COURSE:II **HOURS/WEEKS: 6**
CREDITS: 5

INORGANIC CHEMISTRY

OBJECTIVES: To make the student

CO 1:To understand the general principles in bioinorganic chemistry
CO 2:To know electronic structure of atom
CO 3:To enable students to understand inorganic chains,rings and cages
CO 4:To gain the knowledge of halogens and noble gas chemistry
CO 5:Emphasis the study of extraction and uses of metals

OUTCOMES: The students will be able to

CO-1:Describe the Occurrence and availability of inorganic elements in biological systems.
CO-2:Compare Periodic properties.
CO-3:Explain the biological role of alkali and alkaline earth metal ions and ionophores
CO-4:Mention and explain Halogen oxides and oxo compounds:
CO-5:Predict the reactivity,preparation and uses of the important compounds in metals

UNIT I: GENERAL PRINCIPLES OF BIOINORGANIC CHEMISTRY

1.1Occurrence and availability of inorganic elements in biological systems
1.2Biomineralization – control and assembly of advanced materials in biology.
1.3 Nucleation and crystal growth – various biominerals – calcium phosphate –calcium carbonate – amorphous silica, iron biominerals.
1.4 Strontium and barium sulphate.Function and transport of alkali and alkaline earth metal ions: characterization of K^+, Na+, $Ca^{2+}$and Mg^{2+}– complexes of alkali and alkaline earth metal ions with macrocycles – ion channels – ion pumps.
1.5 Catalysis and regulation of bio energetic processes by the alkaline earth metal ions – $Mg^{2+}$and Ca^{2+}

UNIT –II: ELECTRONIC STRUCTURE OF ATOM

2.1Modern views on atomic structure: Wave mechanical description of electron and orbitals, radial density functions and orbital energies, angular functions and orbital shapes
2.2 Term symbol- term symbols for d1-d9 configurations
2.3Modern periodic table: Periodic properties-Ionisation potential, Ionic radii and covalent radii.
2.4 Electron affinity, Electronegativity and their trend in the periodic table.
2.5 Comparison of transition metals of 3d, 4d and 5d series.

UNIT-III : INORGANIC CHAINS,RINGS AND CAGES

3.1Catenation and hetero catenation:
3.2 Allotropes of carbon,graphite, diamond, fullerenes, carbon nano tubes and graphene.
3.3 Hetero catenation-by coupling cyclic silicon and phosphorous compounds.
3.4Alkali and alkaline earth metal complexes: complexes of α-diketones, crown ethers, cryptands, and Calixarenes.
3.5 Biological roles of alkali and alkaline earth metal ions and ionophores.

UNIT -IV:HALOGEN AND NOBLE GAS CHEMISTRY

4.1 Halogen oxides and oxo compounds: Dichlorinemonoxide, chlorine dioxide, dibromine monoxide, and iodine pentoxide-preparation and properties.

4.2 Halogen oxyfluorides,trioxohalo fluorides) and ionic oxyhalogenspecies.

4.3 Xenon oxides and fluorides: xenon trioxide, difluoride,tetrafluoride, xenon oxofluoride.

Halogen compounds of nitrogen: nitrogen trifluoride,tetrafluoro hydrazine, dinitrogen difluoride, haloamines, oxohalides, and nitrogen trifluoride oxide.Sulfur fluorides.

4.4 Synthesis and reactivity of disulfurdifluoride, sulfur tetrafluoride, substituted sulfurfluorides.

4.5 Structure of halogen oxides and halogen oxo compounds with the aid of VSEPR model. Reactivity of the halidesof N, S, and Xe and applications

UNIT-V: EXTRACTION AND USES OF METALS

5.1Metallurgy of Zr, Ge, Be and Th - preparation and uses of their important compounds.

5.2 Metal clusters -dinuclear clusters – structure of Re_2C_8.

5.3 Qualitative M.O diagrams for dinuclear rhenium and molybdenum complexes to explain the strength of quadrupole bond.

5.4 Bioinorganic chemistry of toxic metals - lead, cadmium, mercury, aluminium, chromium, iron, copper and plutonium.

5.5 Detoxification by metal chelation.

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2. T. Moeller, Inorganic Chemistry, A Modern Introduction; John Wiley: New York, 1982.
3. A. K.Srivatsava and P. Jain, P. Essential of NuclearChemistry; S. Chand, New Delhi, 1989.
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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SEMESTER - IV

EXTRA CORE COURSE:I **HOURS/WEEKS: 6**
CREDITS: 5

PHYSICAL CHEMISTRY

OBJECTIVES: To make the student
CO 1:To understand the basic concept of Characterisation of Nanoscale Materials
CO 2:To know Fundamentals of Nuclear Chemistry
CO 3:To understand Quantum Chemical Approach to Chemical Bonding and Molecular Structure
CO 4:Emphasis the study of Magnetic Materials and Optical Properties.
CO 5:To gain the knowledge of X-Ray diffraction

OUTCOMES: The student shall be able to
CO-1:Demonstrate Principles of Atomic Force Microscopy (AFM)v
CO-2:Compare different types of nuclear reactions with accelerated particles.
CO-3:Recognize applications to simple systems and hybridization schemes
CO-4:Explain the Selected examples of magnetic materials and their properties – metals and alloys.
CO-5:Identify types of lattice.

UNIT II: Characterisation of Nano scale Materials

1.1Principles of Atomic Force Microscopy (AFM)
1.2 Transmission Electron Microscopy(TEM)
1.3 Resolution and Scanning Transmission Electron Microscopy (STEM) – Scanning.Tunneling Microscopy (STM).
1.4 Scanning Near field Optical Microscopy (SNOM).
1.5 Scanning ion conductance microscope, scanning thermal microscope, scanning probe microscopes and surface plasmon spectroscopy.

UNIT II: Fundamental of Nuclear Chemistry

2.1The nucleus – subatomic particles and their properties – nuclear binding energy –nuclear structure – Liquid-drop model and nuclear-shell model – n/p ratio – nuclear forces – modes of radioactive decay – alpha, beta and gamma particles – orbital electron capture – nuclear isomerism – internal conversion.
2.2 Q-Values of nuclear reaction,coloumbic barrier, nuclear cross section, threshold energy and excitation function.
2.3 Different types of nuclear reactions with accelerated particles. Projectile capture and particles emission, spallation, fragmentation, nuclear fission,nuclear fusion – proportional counter.
2.4 Geiger-Muller counter, scintillation counter and Cherenkov counter.
2.5 Linear accelerator, cyclotron and synchrotron.

UNIT III: Quantum Chemical Approach to Chemical Bonding and MolecularStructure

3.1 Diatomic molecules: Born-Oppenheimer approximation .
3.2 MO theory (H_2 and H_2+), VB theory (H_2 and H_2+).
3.3 Comparison.HMO calculations – evaluation of coefficients and eigen values for simple molecules
3.4 Electron density – bond order and free valence index.
4.5 Extended HMO theory –applications to simple systems – hybridization schemes.

UNIT IV: Magnetic Materials and Optical Properties

4.1 Selected examples of magnetic materials and their properties.

4.2 Metals and alloys,transition metal oxides, spinels, garnets, ilmenite and perovskites.

4.3 Magneto plumbites – applications structure/property relations – transformer,information storage, magnetic bubble memory devices, permanent magnets.

4.4 Luminescence, Lasers and phosphors – definitions and general comments,configurational coordinate model, some phosphor materials, anti-Stokes phosphors.

4.5 Lasers – the ruby laser, Neodymium lasers

UNIT V: X-Ray Diffraction

5.1 X-Ray diffraction by single crystal method – space groups – systematic absences in X-ray data and identification of lattice types, glide planes and screw axes .

5.2 X-ray intensities – structure factor and its relation to intensity and electron density – phase problem.

5.3 Structure solution by heavy atom method and direct method – determination of absolute configuration of molecules.

5.4 A brief account of Cambridge Structural Database (CSD) and Protein Data Bank (PDB). Electron diffraction by gases –scattering intensity vs. scattering angle, Wirel equation –measurement techniques.

5.5 Neutron diffraction by crystals – magnetic scattering – measurement techniques – elucidation of structure of magnetically ordered unit cell.

REFERENCES:

1.T. Pradeep, Nano: The Essentials in Understanding Nanoscience and Nanotechnology; 1st Ed., Tata McGraw Hill, New York, 2007.

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4.H. J. Arnikar, Essentials of Nuclear Chemistry; 4th Ed., New Age InternationalPublishers, New Delhi, 2005.

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GOVERNMENT ARTS COLLEGE FOR WOMEN (A), PUDUKKOTTAI – 622 001

SELF STUDY COURSE:I

SUB CODE:21PCHSS1 **GREEN CHEMISTRY**

OBJECTIVES:
CO 1:To study the basic concepts of green chemistry
CO 2:To learn about the basic principle and the importance of microwave chemistry
CO 3:To know the details of ultrasound assisted reactions
CO 4:To know the activities of anaesthetics and local anaesthetics.
CO 5:To gain the knowledge of drug chemistry.

OUTCOMES: At the end of the course the students would be able to
CO-1:Distinguish between recyclable and non recyclable materials.
CO-2:Explain and analyzing micro wave assisted reactions.
CO-3:Predict the ultrasound assisted reactions.
CO-4:Compare the advantages and disadvantages of anaesthetics and local anasthetics.
CO-5:Classify drugs.

UNIT-I: Need for Green chemistry
1.1Introduction – Definition- need for green chemistry
1.2 Goals of green chemistry
1.3 Twelve principles of green chemistry
1.4 Designing a green chemistry
1.5 Choice of starting material- Choice of solvent-Choice of catalyst – process with suitable examples.

UNIT-II: Microwave assisted organic synthesis(MAOS)
2.1 Introduction- Microwave assisted reactions in water
2.2 Hofmann elimination, hydrolysis of benzyl chloride to benzyl alcohol,
2.3 Oxidation of toluene to benzoic acid.
2.4 Microwave assisted reaction in organic solvents.
2.5 Microwave assisted solvent free reactions(solid state reactions)

UNIT-III: Ultrasound Assisted Reactions
3.1Introduction -Uitrasound assisted reaction
3.2 Esterification-Saponification .
3.3 Substitution reactions-Alkylations-oxidations-Reduction
3.4 Coupling reaction- Cannizaro reaction.
3.5 Strecker synthesis- Refermatsky reaction.

UNIT IV: Anaesthetics and Local Anaesthetics
4.1Characteristics of anaesthetics.
4.2 Classification of anaesthetics .
4.3 General anaesthetics – volatile anaesthetics – ether, chloroform and halothane.

4.4 Aadvantages and disadvantages – non-volatile anaesthetics (intravenous anaesthetics)
4.5 Methohexitone and propanidid – structure and uses – cocaine and amethocaine – structure and uses – benzocaine and procaine – structure, synthesis and uses.

UNIT –V:Drugs
5.1Drugs- classification
5.2Drug action
5.3Bactericidal-sulphadrugs,antibiotics,
5.4Antimalarials-Chloroquine,primaquine,plasmoquine,proguanil,mepacrine,HIV / AIDS-Zidovudine,carbovir,immunoglobulins,vaccins.
5.5Tranquilliers,sedatives,antidepressants,Antitubercular drugs-p-aminosalicylic acid, thiacetazole,isonicotinylhydrazide.

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1. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry; 5thEd., S. Chand and Company Ltd., New Delhi, 2014.
2. S.Lakshmi; Pharmaceutical Chemistry; 1st Ed., S. Chand and Company Ltd., New Delhi, 1995.
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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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SELF STUDY COURSE:II
SUB CODE:21PCHSS2 SUPRAMOLECULAR CHEMISTRY
OBJECTIVES

CO 1:To know the fundamentals of supramolecules.
CO 2:To understand metallo organic frameworks
CO 3:To learn co-receptor molecules and multiple recognition
CO 4:To study the supramolecular reactivity and catalysis.
CO 5:To gain the knowledge of supramolecular devices and sensors.

OUTCOMES: At the end of this course the student will be able to
CO-1:Distinguish the various types of non-covalent interactions and hydrogen bonds
CO-2:Apply the frame work in organometallic system
CO-3:Predict multiple recognition in metallorecptors
CO-4:Analyze the supramolecular chemistry in solutions
CO-5:Recognize the overview of supramolecular photo chemistry

UNIT I: Concepts of Supramolecular Chemistry
1.1Concepts and languages of supramolecular chemistry – various types of non-covalent interactions – hydrogen bonds.

1.2 C-H…X interactions, halogen bonds – π-π interactions, non–bonded interactions – various types of molecular recognition.
1.3 Crystal engineering of organic solids – hydrogen bonded supra molecular patterns involving water / carboxyl / halide motifs – concepts of different types of synthons based on non-covalent interactions
1.4 Principles of crystal engineering and non-covalent synthesis – polymorphism and pseudo polymorphism.
1.5 Supramolecular isomorphism / polymorphism – crystal engineering of pharmaceutical phases.

UNIT II: Metallo Organic Frameworks
2.1M.O.F (Metallo Organic Frameworks)
2.2 Organometallic systems
2.3 Combinations of different interactions to design molecular rods, triangles, ladders, networks, etc.
2.4 Design of nanoporous solids – interligand hydrogen bonds in metal complexes.
2.5 Implications for drug design – crystal engineering of NLO materials, OLED.

UNIT III: Co-receptor Molecules and Multiple Recognition
3.1 Dinuclear and polynulclear metal ion cryptates
3.2 Linear recognition of molecular length by ditopic co-receptors.
3.3 Heterotopic co-receptors – cyclophane receptors, amphiphilic receptors and large molecular cages
3.4 Multiple recognition in metalloreceptors.
3.5 Supramolecular dynamics.

UNIT IV: Supramolecular Reactivity and Catalysis
4.1 Catalysis by reactive macrocyclic cation receptor molecules.
4.2 Catalysis by reactive anion receptor molecules.
4.3 Catalysis with cyclophane type receptors .
4.4 Supramolecular metallocatalysis– cocatalysis – catalysis of synthetic reactions – biomolecular and abiotic catalysis.
4.5 Supramolecular chemistry in solution – cyclodextrin, micelles, dendrimers, gelators – classification and typical reactions – applications.

UNIT V: Supramolecular Devices
5.1Supramolecular devices and sensors – various types of supra molecular devices.
5.2 An overview – supra molecular photochemistry – molecular and supramolecular photonic devices – light conversion and energy transfer devices.
5.3 Molecular and supramolecular electronic devices – electronic conducting devices – molecular wires, modified and switchable molecular wires.
5.4 Molecular and supramolecular ionic devices – tubular mesophases, molecular protonics – switching devices – electro-photo switch – ion and molecule sensors –
5.5 Role of supramolecular chemistry in the development of nanoscience and technology.

REFERENCES:

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GOVERNMENT ARTS COLLEGE FOR WOMEN (A),
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EXTRA ELCTIVECOURSE:III **HOURS/WEEKS: 6**
CREDITS: 5

BIO-ORGANIC CHEMISTRY

OBJECTIVES

CO 1:To learn the preparation, properties of amino acids and proteins.
CO 2:To study the activity of enzymes and cofactors.
CO 3:To know basics of lipids and nucleic acids.
CO 4:To learn the concept of bioenergetics.
CO 5:To learn the principles of lead and analogue synthesis.

OUTCOMES: At the end of this course the student will be able to

CO-1:Distinguish the various types of amino acids.
CO-2:Derive Michalis menton equation.
CO-3:Classify Lipids and explain describe nucleic acids.
CO-4:Distinguish the relationship between standard free energy change and equilibrium constant
CO-5:Design organic synthesis.

UNIT I: Amino Acids and Proteins

1.1 Structure, classification, synthesis and properties of amino acids.
1.2 Biosynthesis of amino acids – peptide.
1.3 N-terminal and C-terminal residue analysis – solid phase peptide synthesis.
1.4 Proteins – classification and properties (denaturation, isoelectric point and electrophoresis).
1.5 Primary, secondary, tertiary and quaternary structures of proteins – biological roles of proteins.

UNIT II: Enzymes and Cofactors

2.1 Chemical nature of enzymes.
2.2 Characteristics of enzymes – colloidal nature, catalytic nature.
2.3 Mechanism of enzymes – Michaelis-Menten hypothesis.
2.4 Fischer’s lock and key model – regulation of enzyme activity.
2.5 Structure and biological functions of coenzyme A, NAD+, FAD and vitamin B12.

UNIT III: Lipids and Nucleic Acids

3.1Lipids – definition – simple lipids – fats and oils – compound lipids – phospholipids, glycolipids.

3.2 Physical properties of lipids – solubility, melting point, surface tension, emulsification and geometric isomerism.

3.3 Chemical properties of lipids– reaction involving -COOH group, -OH group and double bonds.

3.4 Nucleic Acid – definition – nucleosides and nucleotides – deoxyribonucleic acid (DNA)

3.5 Internucleotides linkages – base composition – double helical structure.

UNIT IV: Bioenergetics

4.1Concept of energy – thermodynamic principles – first law, second law, combining the two laws.

4.2 Relationship between standard free energy change and equilibrium constant.

4.3 Standard free energy values of chemical reactions.

4.4 Adenosine triphosphate (ATP) as universal currency of free energy in biological systems – ATP hydrolysis and equilibria of coupled reactions .

4.5 Inter conversion of adenine nucleotides.

UNIT V: Lead and Analogue Synthesis

5.1 Designing organic synthesis – disconnection approach.

5.2 Synthons and synthetic equivalents.

5.3 One group disconnections: alcohol, acid and ketone – functional group interconversions.

5.4 Asymmetric synthesis – basic principles – stereoselective and stereospecific reactions – reagents, catalysts and their applications (wherever applicable) in alkylation and hydrogenation.

5.5 Jacobsen's catalyst – Evan's catalyst.

REFERENCES:

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2. N. C. Price and L. Stevens, Fundamental of Enzymology; Oxford University Press, UK, 1999.

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