VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN [AUTONOMOUS]

An ISO 9001:2015 Certified Institution, Affiliated withPeriyar University, Salem,
(Approved by AICTE and Re-Accredited with an 'A+' Grade by NAAC,
Recognized Under 2(f) and 12(b) of UGC Act, 1956).
Elayampalayam, Tiruchengode - 637 205, Namakkal Dt., Tamilnadu, INDIA.

DEPARTMENT OF CHEMISTRY

MASTER OF SCIENCE (M.Sc.)

M.Sc., CHEMISTRY
REGULATIONS AND SYLLABUS

[FOR CANDIDATES ADMITTED FROM 2023-24 ONWARDS UNDER CBCS/OBE PATTERN]

SPONSORED BY
ANGAMMAL EDUCATIONAL TRUST
Elayampalayam – 637 205, Tiruchengode Tk., Namakkal Dt., Tamil Nadu.
Veerachipalayam - 637 303, Sankari Tk., Salem Dt., Tamil Nadu.
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About the College

Vivekanandha College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust, chaired by the great Educationalist, 'Vidhya Rathna' Prof. Dr. M. KARUNANITHI, B.Pharm., M.S., Ph.D., D.Litt., sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of Tiruchengode Namakkal Main Road at Elayampalayam, 6 km away from Tiruchengode. This is the biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the chairman's dedication, work, sacrifice, and long vision, this institution has grown into a Himalayan stage. As a result of which UGC, New Delhi, awarded 2f and 12B, extended Autonomous status for the second cycle. The National Assessment and Accreditation Council reaccredited it with a grade of 'A' for its successful performance. As an Autonomous Institution, academic professionals of the college framed Curriculum and Syllabi in consultation with all its stakeholders to cater to the needs of young women to fulfil women's empowerment and present Industrial needs to the local benefits. The students are empowered with confidence and the required skills to face society.

Quality Policy

To provide professional training by establishing a high-level center of learning that provides quality education at par with international standards and provides excellent education with well-equipped infrastructure to all rural women.

Our Vision

To be an academic institution exclusively for women, in dynamic equilibrium with the social and economic environment, strive continuously for excellence in education, research, and technological service to the nation.

Our Mission

The mission of our institution is to discover, teach and apply knowledge for the intellectual, cultural, ethical, social, and economic growth of women students.

2	Organometallic, Solid state, Spectroscopy, and Bio-inorganic Chemistry
3	Physical Chemistry Electrical Practical
4	Elective-III
5	Human Rights
6	EDC
SYLLABUS FOR YEAR II (Semester IV)	
1	Electrochemistry and Photochemistry
2	Elective-IV
3	Physical Chemistry Non-Electrical – Practical
4	Project

M.Sc CHEMISTRY

REGULATIONS

I. SCOPE OF THE PREAMBLE

The uniqueness of the M.Sc. (Chemistry) program is its content and topic coverage, the teaching methodology and the faculty. The program expects a serious commitment of the students to take up challenging study schedules and assignments. The course involves a blend of theoretical education and practical training which run concurrently for a period of three years and equips a student with the knowledge, ability, skills, and other qualities.

The teaching methodologies include classroom lectures, industrial visits, orientation, and internships. The new syllabus may help the students to understand the newer aspects of chemistry and apply the same to real-life situations. Thus, the students turn more relevant and resourceful to society. It may enable young minds to think differently and forms a link between old ideas and new ideas in chemistry and gives comprehensive approaches to the very learning process and the learners. To have academic flexibility we have chosen and implemented Choice Based Credit System (CBCS) in our syllabus. To enhance the quality of students from 2018-2019, we have implemented an Outcome Based Education (OBE) education system for I PG students. The OBE pattern will be extended for the II PG students in forthcoming years.

II. SALIENT FEATURES

- The course is specially designed for higher-level career placement.
- Special guest lecturers from Industrialists will be arranged.
- Exclusively caters to students interested in pursuing higher studies. Special industry orientations and training are parts of the degree course.
- Project work is included in the syllabus to enhance conceptual, analytical, and deductive skills.

III. PROGRAMME O B J E C T I V E S

The new syllabi throw light on the recent and emerging areas of chemistry.

- ✓ Enable the students to understand chemistry and make them more relevant to society.
- ✓ Develop the analytical ability in students so that they prepared themselves in solving problems.
- ✓ Help the students to learn practical skills in a better way.
- ✓ Inculcate research aptitude in students.
- ✓ Enable the students to go to higher levels of learning chemistry.
- ✓ Improve the employability of the students.
- ✓ To inspire the students to apply their knowledge gained for the development of society in general.

IV. ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the first year PG Degree course (M.Sc. chemistry) shall be required to have passed B.Sc., (Chemistry) B.Sc., (Applied chemistry) and B.Sc., (Industrial chemistry).

V. DURATION OF THE PROGRAMME

- ➢ The course shall extend over a period of two academic years consisting of four semesters. Each academic year will be divided into two semesters. The first semester will consist of the period from July to November and the second semester from December to April.
- ➢ The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.
- ➢ Each subject will have 5 or 4 hours of lecture per week apart from practical training at the end of the academic year.

VI. ASSESSMENT

Assessment of the students would be made through Continuous Internal Assessment (CIA) and External Assessment (EA) for passing each subject both theory and practical papers. A candidate would be permitted to appear for the External Examination only on earning 75 % of attendance and only when her conduct has been satisfactory. It shall be open to granting exemption to a candidate for valid reasons subject to conditions prescribed.

A. CONTINUOUS INTERNAL ASSESSMENT (CIA)

The performance of the students will be assessed continuously and the Internal Assessment Marks will be made as follows:

1. Average of two CIA tests and Model exam - 10 Marks
2. Seminar - 05 Marks
3. Assignment - 05 Marks
3. Attendance - 05 Marks

…….

Total =25 Marks

DISTRIBUTION OF ATTENDANCE MARK

S. No.	Percentage	Marks	
		Theory	Practical
1	76-80	1	2
2	81-85	2	4
3	86-90	3	6
4	91-95	4	8
5	96-100	5	10

B. EXTERNAL ASSESSMENT (EA)

The performance of the students would be assessed by examination at the end of each semester with a written test for theory for three hours and a practical examination at the end of even semesters for six hours. Question papers would be set by the selected external examiners in the prescribed format and evaluated by the

external examiners with the help of the teacher's concern. The pattern of assessment is as follows:

Distribution of Final Assessment Marks (Theory-75, Practicals-60)

PHYSICAL CHEMISTRY LABORATORY

Section	Theory	Marks (75)	Practical	Marks (60)
A	One mark (20)	20	Record work	5
B	Five marks (Either or)	25	Viva Voce	10
C	Ten marks (3/5)	30	Experimental Skill	15
			Result	30
Total		**75**	**Total**	**60**

ORGANIC AND INORGANIC CHEMISTRY LABORATORY

Practical	Marks (60)
Record work	5
Viva Voce	10
Analysis/Estimation	25
Procedure	10
Preparation	10
Total	**60**

Direct
1. Continuous Assessment Test I, II & Model 2. Assignment 3. End Semester Examinations
Indirect
1. Course End Delivery

C. COURSE ASSESSMENT METHODS (Theory)

VII. PASSING MINIMUM

INTERNAL

There is no passing minimum for the CIA

EXTERNAL

In the University Examinations, the passing minimum shall be 50 % of 75 Marks for theory (38 marks) and 50% of 60 marks for practical (30 Marks).

VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the examination of Core Courses and elective courses, and secure marks

a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the programme at first appearance itself.
b) 60% and above shall be declared to have passed the examinations in first class without Distinction.
c) 50% and above but below 60% shall be declared to have passed the examinations in second class.
d) Candidates who pass all the examinations prescribed for the programme at the first appearance itself and within a period of two consecutive academic years from the year of admission only will be eligible for university rank.

IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than two academic years comprising four semesters and passed the examinations prescribed and fulfilled such conditions have been prescribed.

X. PROCEDURE IN THE EVENT OF FAILURE

If a candidate fails in a particular subject, she may reappear for the

end-semesterexamination in the concerned subject in subsequent semesters and shall pass the examination.

XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2022-23 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2022-23 and thereafter.

SYLLABUS FRAMEWORK

SEM	Course Code	Course	Course Title	Ins. Hrs / Week	Credit	Marks		Total
						CIA	ESE	
I	22P1CH01	Core - I	Concepts of Organic Chemistry and Stereochemistry	5	5	25	75	100
	22P1CH02	Core - II	Transition metal and Nuclear Chemistry	5	5	25	75	100
	22P1CH03	Core - III	Group theory, Kinetics, and Surface Chemistry	5	5	25	75	100
	22P1CHP01	Practical	Colorimetric Estimations and Inorganic Qualitative Analysis - Practical	5	4	40	60	100
	22P1CHP02	Practical	Qualitative Analysis of Organic Mixture and Chromatographic Techniques - Practical	5	4	40	60	100
	22P1CHE01/ 02	Elective-I		4	3	25	75	100
	Library			1				
TOTAL				**30**	**26**	**180**	**420**	**600**
II	22P2CH04	Core-IV	Organic Reaction Mechanism	5	5	25	75	100
	22P2CH05	Core-V	Chemical Bonding and Coordination Chemistry	5	5	25	75	100
	22P2CH06	Core – VI	Quantum Chemistry and Thermodynamics	5	5	25	75	100
	22P2CHP03	Practical	Inorganic Estimation and Complex Preparations - Practical	5	4	40	60	100
	22P2CHP04	Practical	Organic Preparations and Estimation - Practical	5	4	40	60	100

	22P2CHE03/ 04	Elective-II		4	3	25	75	100
	Library			1				
TOTAL				**30**	**26**	**180**	**420**	**600**
III	22P3CH07	Core - VII	Natural products, Pericyclic reactions, and Retro synthesis	5	5	25	75	100
	22P3CH08	Core - VIII	Organometallic, Solid state, Spectroscopy, and Bio-inorganic Chemistry	5	5	25	75	100
	22P3CHP05	Practical	Physical Chemistry Electrical Practical	5	4	40	60	100
	22P3CHE05/ 06	Elective-III		4	3	25	75	100
	22P3HR01	Human Rights		2	1	25	75	100
	22P3CHED01 /02	EDC		4	3	25	75	100
	22P3CHEC1	Extra Credit Course-I		-	4*	-	-	500
TOTAL				**25**	**21**	**165**	**435**	**1100**
IV	22P4CH09	Core – IX	Electrochemistry and Photochemistry	5	5	25	75	100
	22P4CHE07/ 08	Elective-IV		4	3	25	75	100
	22P4CHP06	Practical	Physical Chemistry Non-Electrical - Practical	5	4	40	60	100
	22P4CHPR01	Project		16	5	40	60	100
	22P4CHEC2	Extra Credit Course-II		-	4*	-	-	100*
TOTAL				**30**	**18**	**130**	**270**	**500**
GRAND TOTAL				**115**	**91**	**655**	**1545**	**2800**

*Not considered for grand total and CGPA

ELECTIVE COURSES (Chemistry Department)

SEM	Course code	Course Title
I	22P1CHE01	Nanoscience and Nanotechnology
	22P1CHE02	Instrumental Methods of Analysis
II	22P2CHE03	Supramolecular chemistry
	22P2CHE04	Organic Spectroscopy
III	22P3CHE05	Physical methods in Chemistry
	22P3CHE06	Industrial Chemistry

IV	22P4CHE07	Environmental Chemistry
	22P4CHE08	Green Chemistry

EXTRA DISCIPILINARY COURSES (Other Department)

SEM	Course code	Course Title
I	22P3CHED01	Applied Polymer Chemistry
	22P3CHED02	Dairy Chemistry

XIII.BLOOM'S TAXONOMY-BASED ASSESSMENT PATTERN

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

1. Theory: 75 Marks

(i)Test - I & II and ESE:

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (One Mark)	20 x 01=20	Objective	**75**
K2	B (Either /or pattern)	05 x 05=25	Descriptive	
K3, K4 & K5	C (Three out of five)	03 x 10=30	Detailed	

PROGRAMME OUTCOMES

PO 1	Capable of demonstrating comprehensive knowledge and understanding of the disciplines.
PO 2	Ability to express thoughts and ideas effectively in writing and orally Communicating with others.
PO 3	Capability to apply analytical thoughts to a body of knowledge,analyze and evaluate evidence, arguments, claims,and beliefs based on empirical evidence.
PO 4	Capacity solves different kinds of problems and appliesone learning to real-life situations.
PO 5	Ability to analyzeinterprets and concludes quantitative qualitative data.
PO 6	The capability to use ICT in a variety of learning situations demonstratesthe ability to access evaluate, use a variety of relevant information sources and use appropriate software for the analysis of data.
PO 7	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.
PO 8	Ability to acquire knowledge and skills including learning how to learn that are necessary for participating in learning activities throughout life through self-paced.

PROGRAMME SPECIFIC OUTCOMES

PS01: To foster a theoretical and practical knowledge of chemistry and its applications and to make responsible citizenships.

PS02: To deepen learner capacity for productive scientific thinking both within and beyond the classroom through extensive programs.

PS03: To cultivate problem-solving skills through chemical knowledge to address environmental problems, and to complement and reflect on social needs.

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN(AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	ProgrammeCode	**PCH**			Regulations	**2022-2024**	
Department	**Chemistry**		Semester				**1**	
Course Code	Course Name		Hours per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P1CH01	CORE PAPER I: Concepts of Organic Chemistry and Stereochemistry		5	-	-	05	25	75	100
Course Objectives	To enable the students to learn about the chemistry of organic compounds to enrich their knowledge in various organic reactions.							

COs	**COURSE OUTCOMES**
CO 1	Students will be known to name the organic compounds systematically and they will be able to identify the aromaticity of any organic compound.
CO 2	Students will be able to understand the role and formation of intermediates in organic reactions and can determine the mechanism of new organic reactions.
CO 3	Students will be well-known for nucleophillic substitution reactions.
CO 4	Students can understand the difference between nucleophillic and Electrophilic substitution reactions, which will be well-known Electrophilic substitution reactions. Various types of substitution reactions will help the students to carry out the research in future
CO 5	Knowledge of students will be enriched with fundamentals of stereochemistry
Pre-requisites	

KNOWLEDGE LEVELS (KLs)

1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing

CO / PO / PSO/ KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**

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

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Nomenclature and aromaticity**	Hours	15
	Nomenclature of aromatic heterocyclic compounds (containing one or two hetero atoms) – Nomenclature of alicyclic, bicyclic, and tricyclic compounds. Structure and reactivity: Localised and delocalized covalent bond - Concept of resonance and aromaticity - Huckel's rule for aromaticity in benzenoid and non-benzenoid compounds including pyrrole and pyridine, annulenes, sydnones, and fullerenes. Antiaromaticity, homo-aromaticity, and non-aromatic compounds. Concept of alternant and non-alternant hydrocarbons (azulene type). Effect of aromaticity on bond length, resonance energy, and induced ring currents.		
Unit – II	**Reactive intermediates and methods of determining reactions**	Hours	15
	Reactive intermediates: Structure stability and reactivity of intermediates, generation and structure of carbocation, the concept of classical and non-classical carbocations, reactions involving carbocations, carbanion, structure and reactivity,generation and reactions. Structure and reactivity of free radicals, carbenes, and nitrenes as intermediates, their structure, generation, and reactions. Aryne' mechanism and ways of generation and their reactions. Introduction to hetarynes and reactions. Thermodynamic and kinetic aspects, Hammond's postulate, isotope effects. Energy profile diagrams – Intermediate versus transition state, Product analysis, and its importance, crossover experiments, kinetic methods, stereochemical studies, Isotopic and substituent effects.		
	Nucleophilic substitution reactions	Hours	15

Unit -III	Aliphatic Nucleophilic substitution – mechanisms (S_N1, S_N2,S_Ni) – Effect of structure - stereochemical factors – neighbouring group participation, substitutions at allylic and vinylic carbons. Correlation of structure with reactivity – Solvent effects. Aromatic nucleophilic substitution – S_N1 S_NAr, Benzyne mechanism – reactivity orientation.		
Unit - IV	**Electrophilic substitution reactions**	Hours	15
	Aliphatic Electrophilic Substitution: SE2, SEi and SE1mechanisms, Diazonium coupling reactions. Aromatic electrophilic substitution reaction - Orientation, reactivity and mechanisms based on transition state theory with suitable reactions, – Origins of Hammett equation – Principles of Hammett correlation – Effect of structure on reaction mechanisms Hammett, modified forms of Hammett equation. Taft Equation. ρ and σ parameters;		
Unit - V	**Stereochemistry**	Hours	15
	Principles of symmetry- the concept of chirality, Molecular symmetry and chirality, Newmann, Sawhorse, Fischer, and Wedge representations and interconversions. Types of molecules exhibiting optical activity. Configurational nomenclature of acyclic and cyclic molecules: cis-trans, E & Z, D & L, (+ or –), d & l, R & S, erythro and threo; syn&anti. Stereospecific, Chemo, Regio, Enantio and stereoselective organic transformations, asymmetric synthesis – Crams rule. Conformational analysis – 1,2disubstitutd ethane derivatives – disubstituted cyclohexanes and their stereochemical features. Conformation and reactivity of substituted cyclohexanols (oxidation) cyclohexanones (reduction) and conformations of heterocycles.		
Total Hours			**75**

Text Books	
1	Stereochemistry of Organic Compounds by D. Nasipuri
2	Reaction Mechanisms in Organic Chemistry, S. M. Mukherjee and S. P. Singh
3	Raj K. Bansal, , Hill Publishing Company Ltd 2006.
4	Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, 1975.
5	Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL finar ELBS.
6	Organic Chemistry (fifth Edn) by Morrison and Boyd, PHI, India.
References	
1	Finar I.L., Organic chemistry Pearson Education P Ltd 2011
2	F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry, Parts A & B, Plenum, 2002

3	J. March, Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 5th ed., Wiley, 2000.
4	Advanced organic chemistry by Jerry March (4th Edition) Wiley Eastern. .
E-References	
1	www.masterorganicchemistry.com/2017/02/23/rules-for-aromaticity
2	www.introorganicchemistry.com

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2022-2024**
Department	**Chemistry**		Semester				**1**
Course Code	Course Name	Hours per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
22P1CH02	CORE PAPER II: Transition metal and Nuclear Chemistry	5	-	-	05	25	75	100
Course Objectives	1. To gain knowledge on the physical and chemical properties of transition and inner transition elements. 2. To give elaborate insight into the field of nuclear chemistry.							

COs	**COURSE OUTCOMES**
CO 1	Students will learn the metallurgy and general properties of transition, and inner transition elements.
CO 2	Students can explore the constructive application of nuclear chemistry.
CO 3	Students will know the present national and international status of nuclear missions.
CO 4	Students will analyze the various nuclear decay process.
CO 5	Students will evaluate the present methodologies in nuclear waste treatment.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Transition Elements**	Hours	15
	Position in the periodic table - Electronic configuration - General characteristics - metallic character-Ionisation potential- Variable valency - Colour - Magnetic properties - Catalytic property - Non-stoichiometry - Stabilization of unusual oxidation states – Formation of coloured complexes and colorimetry-Structure (only) of d-block complexes - $[Nb_6Cl_{12}]^{2+}$ -$[Re_2Cl_8]^{2-}$ - $[Mo_6Br_8]^{4+}$ -$[Ni_2(DMG)_2]$.		
Unit - II	**Inner Transition Elements**	Hours	15
	Position in the periodic table - Electronic configuration - Oxidation state - Solubility - Magnetic properties - Separation of lanthanides – production of lanthanide metals from lanthanide salt- Lanthanide contraction - Cause and consequences - Gadolinium break - Shift reagents - Extraction of Thorium and Uranium - Comparison of lanthanides and actinides- applications of lanthanides and actinides.		
	Fundamentals of Nuclear Chemistry	Hours	15

Unit - III	Nuclear structure-mass and charge - Nuclear moments -Nuclear models (shell model and liquid drop model) - Binding energy - Stability rules - Magic numbers - n/p ratio - PF-Relation between stability of a nucleus and its PF value- Energy spectrum - Geiger-Nutta's rule, Theories of alpha decay - Tunnel effect - Beta decay - β^+ and β^- decay - Electron capture - Absorption - Range and Energy - Gamma ray - radioactive de-excitation - decay constant - Nuclear isomerism - Internal conversion - Auger effect.		
Unit - IV	**Nuclear Reactions and Instrumental Techniques**	Hours	15
	Nuclear reactions-Types of disintegration-Alpha-Beta-Gamma emission-Bethe's notation - Q value - Reaction cross section - Threshold energy - Various types of special nuclear reactions - Scattering - evaporation - photonuclear - Spallation - Fragmentation - Fission - Fusion - Stripping - Pick-up reactions - Detection and measurement of radioactivity - Proportional counter - Geiger-Muller counter - Scintillation counter - Semiconductor detector - Cloud chamber - Charged particle accelerator - Linear accelerator - Cyclotron - Beatron - Synchroton.		
Unit - V	**Nuclear Energy and Trace Elements**	Hours	15
	Nuclear fission and Nuclear fusion- Fissionable materials-Fission energy-Fission neutrons-Atom bomb- Theories of fission - Fissile and fertile isotopes - Nuclear fusion and stellar energy - Fusion bomb - synthetic elements - Nuclear wastes - nuclear reprocessing - radiation hazards and prevention. Applications of radioactive isotopes - neutron activation analysis - isotopic dilution analysis - Uses of tracers in structural and mechanistic studies, agriculture, medicine and industry - Radio carbon dating - hot atom chemistry - Atomic Power Projects in India- nuclear holocaust.		
	Total Hours		**75**

Text Books

1	H.J. Arnikar, Essentials of Nuclear Chemistry, 4th Edn., New Age International 2005.
2	J.D. Lee, Concise Inorganic Chemistry, 6th Edn., ELBS, London 1998.
3	B.R,Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, 32nd Edn., Milestone Publishers & Distributers, New Delhi 2016.

References

1	D. Shriver, M. Weller, T. Overton, J. Rourke, and F. Armstrong, Inorganic Chemistry, 6th Edn., WH Freeman and Company, New York 2014.
2	C.E. Housecroft, and A.G. Sharpe, Inorganic Chemistry, 4th Edn., Pearson Education Limited, Essex 2012.

E-References	
1	chemed.chem.purdue.edu/genchem/topicreview/bp/ch23/history.php

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**			Regulations		**2022-2024**
Department	**Chemistry**		Semester					**1**
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P1CH03	CORE PAPER III: Group theory, Kinetics, and Surface Chemistry		5			05	25	75	100
Course Objectives	1. To teach the knowledge of classifying the molecules based on symmetry and gain knowledge in identifying the point group of the unknown molecules. 2. Understand the conception of kinetics and catalysis.							

COs	**COURSE OUTCOME**
CO 1	Students will be able to identify point groups using symmetry elements and recognize symmetry operations.
CO 2	Students will learn to integrate knowledge to make rational answers in solving chemical problems.
CO 3	Students can measure the rate of a chemical reaction.
CO 4	Students will learn to evaluate the effect of catalysts, and temperature on the rate of a chemical reaction and determine the activation energy.
CO 5	Students will learn and understand the importance, applications, and basic aspects of surface chemistry.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Basics of Group Theory**	Periods	15
	Symmetry - Symmetry elements and Symmetry operations. Group - Properties of group – Types of groups - Abelian, non Abelian, sub groups and cyclic groups. Group multiplication tables, Classes and similarity transformation. Representation of groups - Matrix representation of symmetry elements, Reducible and irreducible representations. Properties of irreducible representation - Great orthogonality theorem and its consequences - Molecular point groups – Determination of point group of molecules. Construction of character table for point groups (C_{2v}, C_{3V} and C_{2h}).		
Unit - II	**Applications of Group Theory**	Periods	15
	Standard reduction formula and conversion of reducible representation and irreducible representation, direct product representation. Hybridization schemes for atoms in molecules of different geometry - AB_4 tetrahedral and AB_3triangular planar. Symmetries of vibrational modes in non linear molecules (H_2O, NH_3 and BF_3). Selection rules for vibrational spectroscopy – IR & Raman active, mutual exclusion rule and electronic transitions in formaldehyde.Crystal point group, crystal symmetry - screw axis and glide plane, space groups,translational elements of symmetry, differences between molecular symmetry and crystalsymmetry.		
	Chemical Kinetics	Periods	15

Unit - III	Reactions in solution: Comparison between gas phase and liquid phase reactions. Effect of dielectric constant on reactions in solutions, effect of ionic strength on reactions in solutions - Primary salt effect and secondary salt effect. Debye-Smoluchowski equation.Kinetics of fast reactions: Pulse methods and relaxation methods. Branched chain reactions – Stationary, non stationary chain and explosion, explosion limits and explosive reaction of H_2O_2.		
Unit - IV	**Kinetics and Catalysis**	Periods	15
	Catalysis - Types –Functions-Characteristics- Theories: Theory of Homogeneous catalysis. Kinetics: Homogeneous catalysis, Autocatalytic reactions, Acid-base catalyzed reactions – effect of pH on reaction rates and enzyme catalysis reactions-mechanism and factors governing the enzyme catalysis-use of catalysis in industry. Inhibition ofenzymecatalyzed reactions (any one).		
Unit - V	**Surface Chemistry**	Periods	15
	Adsorption - Types of adsorption. Physical Adsorption isotherm: Freundlich's adsorption isotherm, Langmuir's adsorption isotherm, Brunauer-Emmett-Teller (BET) adsorption isotherm and its limitations. Estimation of surface areas – B.E.T method, Point B method and Benton and White method. Chemisorption: kinetics of chemisorptions and Heat of adsorption. Difference between physical and chemical adsorptions – Application of Adsorption.		
Total Periods			75

Text Books	
1	K.V. Raman, Group Theory, Tata McGraw - Hill Education (2004).
2	V.Ramakrishnan and M.S. Gopinathan, Group theory in chemistry, Vishal Publications, 1988.
3	A.S. Kunju, G. Krishnan, Group Theory and Its Applications in Chemistry, 2nd Edn, PHI learning private Ltd (2015).
4	B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co. (2016).
5	K.J. Rajaram and J.C. Kuriakose, Kinetics and mechanism of chemical transformations, Macmillan India Ltd (1993).
6	K.J. Laidler, Chemical Kinetics, Pearson (2009).
7	K. Veera Reddy, Symmetry and Spectroscopy of Molecules, New age international (2009).
8	Gurudeep Raj, Advanced Physical Chemistry, Goel Publishing House, (2014).
9	Gurudeep Raj, Surface Chemistry, Goel Publishing House, (2002).
References	
1	F.A. Cotton., Chemical Applications of Group Theory 2nd Edn, Wiley Eastern Ltd (1989).

2	Capellos and B.H.J. Bielski, Kinetic systems, Willey interscience, Newyork, 1968.
3	P.W. Atkins., Physical Chemistry, 6th Edn, Oxford University Press, (1998).
4	Alan Vincent, Molecular Symmetry and Group theory – Programmed Introduction to chemical applications, Wiley, Newyork, 1977.
E-References	
1	http://vlab.amrita.edu/?sub=2&brch=193&sim=1013&cnt=1
2	http://unicorn.mcmaster.ca/teaching/4PB3/SymmetryLectureNotes2009-Vallance-Oxford-level2.pdf
3	http://cbc.arizona.edu/~salzmanr/480a/480ants/kinintro/kinintro.html
4	http://nptel.ac.in/courses/122101001

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			1		
Course Code	Course Name		Hours per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P1CHP01	Practical Calorimetric Estimation and Inorganic Qualitative Analysis-Practical				5	04	40	60	100
Course Objectives	1. To acquire training in microscale experimental techniques. 2. To acquire knowledge of the properties of ions and their compounds. 3. To promote the students toward research activity and job opportunities							

COs	**COURSE OUTCOMES**
CO 1	Students will learn how to conduct a process systematically and precisely.
CO 2	The qualitative analysis gives a type of mental training and develops a power of reasoning not equal to any other course in chemistry.
CO 3	The students will learn the nature, significance, and influence of errors and how they may best be avoided or minimized during the qualitative and quantitative examination of a chemical compound.
CO 4	Students will analyse the use of complexometric estimations.
CO 5	Students will evaluate the rare cations using qualitative analysis.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Complexometric titrations**	Hours	45
	Estimation of Ca, Cu, Mg, Ni & Zn using complexometric titration		
Unit - II	**Qualitative Analysis**	Hours	45
	Qualitative analysis employing semi-micro methods and spot tests - mixtures of common cations and ions of the following less familiar elements molybdenum, tungsten, selenium, tellurium, cerium, thorium, titanium, zirconium, vanadium, uranium and lithium.		
	Total Hours		**90**

Text Books	
1	V.V. Ramanujam, Inorganic semi-micro qualitative analysis, The National Publishing Co., Ltd., Madras 2002.
References	
1	Vogel, Inorganic quantitative analysis, Pearson Education 2001.
E-References	
1	http://lib.hku.hk/Press/9622092128.pdf
2	http://www.kvsunjuwan.com
3	http://science-blogs.ucoz.com/resources/notes/msc/pract1/CationGuide.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			1		
Course Code	Course Name		Hours per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P1CHP02	Practical Qualitative Analysis of Organic Mixture and Chromatographic Techniques-Practical				5	04	40	60	100
Course Objectives	1. The objective of this lab is to provide hands-on opportunities to apply the knowledge of chemical reaction in functional group analysis. 2. It also gives hands-on training to synthesize organic compounds via a variety of organic reactions. 3. To promote the students towards research activity and job opportunities.							

COs	**COURSE OUTCOMES**
CO 1	Students can able to investigate and report an unknown compound systematically.
CO 2	Students will be known to synthesize, recrystallize, and findamelting point of an organic compound. It will help them to carry out their research in the future.
CO 3	Students can apply knowledge to identifying various functional groups.
CO 4	Students will analyze the various separation methods.
CO 5	Students can evaluate different binary organic mixtures.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Qualitative analysis of a binary mixture of organic compounds:**	Hours	45
	Preliminary pilot analysis, pilot report, bulk separation, systematic analysis of each component inclusive of preliminary identification, confirmatory tests, derivative preparation, and recording melting point/boiling point of components.		
Unit - II	**Chromatographic techniques**	Hours	45
	Thin layer chromatography and Paper chromatography-step-by-step procedures-Retention factor-Uses		
	Total Hours		**90**

Text books	
1	Antony J. Hannaford, Austin R. Tatchell, Brian S. Furniss, Peter W.G. Smith, Vogel's Text Book of practical organic chemistry, Pearson Education (2006).
References	
1	V. Venkateshwaran, R. Veerasamy, A. R. Kulandaivelu, Basic principles of practical chemistry, Sultan Chand &Sons,New Delhi, 2016

E-References	
1	http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html
2	http://vlab.amrita.edu/?sub=2&brch=191&sim=345&cnt=1
3	http://amrita.olabs.edu.in/?sub=73&brch=8&sim=116&cnt=1

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**			Regulations		**2022-2024**
Department	**Chemistry**		Semester					**1**
Course Code	Course Name		Hours per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P1CHE01	Elective: Nanoscience and Nanotechnology		4	-	-	4	25	75	100
Course Objectives	1. To introduce the students to the world of nanotechnology. 2. To enrich the knowledge of students in novel synthetic methods to prepare nanoparticles.							

COs	**COURSE OUTCOMES**
CO 1	Students will acquire knowledge on various synthetic methods of nanoparticles and techniques to characterize them.
CO 2	Students will be able to understand various types of nanoparticles and their properties.
CO 3	Students learn about the promising applications of nanotechnology.
CO 4	Students will analyse the properties of various dimensional nanoparticles.
CO 5	Students will evaluate the recent advancements in nanotechnology.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Introduction to Nanoscience**	Hours	15
	Introduction, history, nanoscale &*nanotechnology*, nanotech generation-nanoscience, nanocomposites, zero dimensional nanomaterials: metal and metal oxide nanoparticles, one dimensional nanomaterial nanostructures: nanowires and nanorods, - two dimensional materials nanostructures: thin films - three dimensional nanomaterials: Carbon fullerenes and carbon nanotubes.		
Unit - II	**Synthesis of Nanomaterials**	Hours	15
	Physical methods- Physical Vapour Deposition (PVD). Chemical methods -Chemical precipitation and Sol-gel synthesis; Chemical vapour deposition (CVD) and Thermolysis routes, Microwave heating synthesis chemical Reduction method, Hydrothermal method, Solvothermal method, Photochemical synthesis and electrochemical synthesis.		
Unit - III	**Characterizations of nanomaterials**	Hours	15
	X-ray Diffraction (XRD), Photo Electron Spectroscopy (XPS). Thermal gravimetric analysis (TGA), Differential Scanning Calorimetry (DSC), Electron Microscopy: Scanning Electron Microscopy (SEM), Energy-dispersive X-ray analysis EDAX, High Resonance Transmission Electron Microscopy (HR-TEM)., Atomic Force Microscopy (AFM).		
	Properties and Applications of Nanoparticles	Hours	15

Unit -IV	Size dependence of Properties - Chemical Reactivity – Solubility - Optical properties - surface plasmon resonance, Magnetic properties - size dependent properties such as coercivity and saturation magnetization. Applications: Medicine, Nanoelectronics, supercapacitorsbatteries, environmental protection, food and agriculture, energy, and nanomaterial-based products. Risks of nanomaterials.		
Unit - V	**Nano biomaterials**	Hours	15
	Introduction: Biological building blocks - size of building blocks and nanostructures - protein nanoparticles. Nucleic Acids - DNA Double Nanowire, Genetic code and protein synthesis - Biological nanostructures - Multilayer films. Biopolymers, Biomaterials.		
	Total Hours		**75**

Text Books	
1.	Mark Ratner,Daniel Ratner, Nanotechnolgy, Pearson Education,Inc.2007
2.	G.SchmidEds,Nanoparticles, Wiley-VCH, 2004.
3.	G.HodesEds, Electrochemistry of Nanomaterials, Wiley-VCH, 2001.
4.	M.Kohler, W.Fritzsche, Nanotechnology, Wiley-VCH, 2004
References	
1.	K.L.Choy, Process principles and applications of novel and cost- effective ESAVD based methods, World Scientific Publishing, Singapore, 2002
2.	A.Jones and M.Mitchell, Nanotechnology-Commercial Opportunity, Evolution Capital Ltd. London, 2001.
3.	Mick Wilson, Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Nanotechnology basic science and emerging technologies, overseas press
4.	Charles P. Poole, Jr., Frank J. Owens, Introduction to Nanotechnology, Wiley reprint 2012
E-References	
1.	nptel.ac.in/courses/103103033/module9/lecture1.pdf
2.	http://folk.ntnu.no/fredrol/Nanomaterials%20and%20Nanochemistry.pdf
3.	https://www.ceitec.eu/nanoparticles-for-biomedical-applications/f33079
4.	nptel.ac.in/courses/103103033/module9/lecture1.pdf
5.	http://folk.ntnu.no/fredrol/Nanomaterials%20and%20Nanochemistry.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2022-2024**
Department	**Chemistry**		Semester				**1**
Course Code	Course Name	Hours per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P1CHE02	Elective: Instrumental Methods of Analysis	4			04	25	75	100
Course Objectives	1. To enable the students to handle instruments. Acquire the fundamentals and principles of spectroscopic techniques. 2. Enhance the knowledge in thermo electro-analytical methods.							

COs	**COURSE OUTCOMES**
CO 1	Students will understand the fundamentals of molecular spectroscopy.
CO 2	Students will learn about the concepts of electronic spectroscopy.
CO 3	Students will apply their knowledge in absorption and emission spectroscopy.
CO 4	Students will analyze the various electro analytical methods.
CO 5	Students can evaluate the thermal stability of various materials using TGA.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Fundamentals of spectroscopy**	Hours	15
	Electromagnetic spectrum: Electromagnetic radiation - properties, wave parameters interaction of light with matter - types of spectroscopy: Atomic & Molecular spectroscopy -Absorption and Emission spectra.		
Unit - II	**UV And IR spectroscopic techniques**	Hours	15
	UV-Visible spectroscopy- Principle, Electronic transitions, chromophores, auxochromes, the solvent effect on absorption spectra, instrumentation-detectors-Applications. Infrared spectroscopy-principle,polyatomic and diatomic molecules, sample handling, factors affecting vibrations. instrumentation- detector and recorders Applications.		
Unit - III	**Atomic absorption and emission spectroscopic techniques**	Hours	15
	Flame photometry, Atomic Absorption Spectroscopy (AAS): Principle, theory, instrumentation and application. Luminescence Spectroscopy, Fluorescence Spectroscopy: Principle, theory, instrumentation and application.Quenching, instrumentation and applications		
	Electro analytical methods	Hours	15

Unit - IV	Polarography-principle-concentrationpolarization-droppingmercuryelectrode-advantage and disadvantage - convection, migration and diffusion currents – Illkovicequation (derivation not needed) and its significance -Chrono potentiometry basic principles, applications and advantages.		
Unit - V	**Thermo analytical methods**	Hours	15
	Principles and instrumentation thermo gravimetric analysis (TGA) and differential gravimetric analysis (DTA) - characteristics and curves - factors affecting TGA and DTA curves- calcium oxalate monohydrate and silver nitrate.		
	Total Hours		**75**

Text Books	
1	Gopalan. R, Elements of analytical chemistry, Sultan Chand, 2009.
2	Kaur, Instrumental methods of chemical analysis.
References	
1	Khopkar S.M, Analytical Chemistry, New Age International, 2006.
2	Skog.A and West .M, Fundamentals of analytical chemistry, Saunders College Publications, 2004.
3	Sharma B.K, Instrumental methods of chemical analysis God Publications, 2007.
4	Usharani. S, Analytical Chemistry, Macmillan, 2008.

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2022-2024**
Department	**Chemistry**		Semester				**2**
Course Code	Course Name	Hours per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
22P2CH04	CORE PAPER IV: Organic Reaction Mechanism	5			05	25	75	100
Course Objectives	1. To enrich the student's knowledge in the field of reactions and reagents involved in organic chemistry. 2. To impart knowledge in understanding the reaction conditions and mechanisms to arrive required product.							

COs	**COURSE OUTCOMES**
CO 1	Students will learn the addition reactions taking place in the organic molecules.
CO 2	Students acquire deep knowledge on elimination reactions.
CO 3	Students can understand the path of different molecular rearrangements.
CO 4	Students will learn about the mechanism and applications of various naming reactions used in organic synthesis.
CO 5	Students will evaluate the role of reagents in organic synthesis.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**

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

CO / PSO Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Addition reactions**	Hours	15
	Addition across C-C multiple bonds – Electrophillic, Nucleophillic, Free radicals, orientation and reactivity – Addition of halogen and nitrosyl chloride to olefin. Hydration of olefins and acetylenes. Epoxidation, Hydroboroation, Hydroxylation, Michael addition and Brich reduction. Diels Alder reaction, 1,3-dipolar additions. Carbenes, Nitrenes and their addition to double bond. Simmon-Smith reaction, Mannich, Stobbe, Darzen, Wittig, Wittig-Horner, Grignard, and Benzoin condensation.		
Unit - II	**Elimination reactions**	Hours	15
	Elimination reactions – Mechanism of E1, E2 and E1CB – stereochemistry of elimination, Hofmann and Saytzeff rules – competition between Elimination and substitution – Pyrolytic – Cis elimination, Chugaev reaction – Typical reactions such as Dehydration, dehydrohalogenation, Hofmann degradation, Cope elimination – Bredt's rule.		
Unit - III	**Molecular rearrangements**	Hours	15
	A detailed study of the mechanism of the following rearrangements. Wagner – Meerwin, Demyanov, Dienone–Phenol, Favorski, Baeyer – Villiger, Wolff, Stevens, Von – Richter, Beckmann, Hoffmann, Curtius, Lossen, Benzil-Benzilic acid rearrangement, Kornblum Benzidine, Fries rearrangement, Ireland.		
	Organic naming reactions and applications	Hours	15

Unit - IV	A detailed study of the following naming reactions - Biginelli reaction, Hoeben – Hoesch reaction, Vilsmeyer formylation, Bucherer reaction, Pauson – Khand reaction, Heck reaction, Suzzuki, Stille, Sonogashira, Negishi, Cadiot–Chodkiewicz coupling reactions. Huigens synthesis. Baylis-Hillman, Luche, Yamaguchi reaction.		
Unit - V	**Reagents for Organic synthesis**	Hours	15
	Aluminium chloride,Alumniumisopropoxide, N-Bromosuccinimide, OsO_4, DCC, NChlorosuccinimide, Diazomethane, Fenton's reagent, Hydrogen peroxide, Lead tetraacetate, Lithium aluminium hydride, Perbenzoic acid, Periodic acid, Seleniun dioxide, Sodium borohydride, DDQ, Wilkinson catalyst, Gilman's Reagents, 1, 3 Dithiane, Trimethylsilyl halide.		
Total Hours			**75**

Text Books	
1	Jerry March, Advanced organic chemistry - Reactions Mechanism and tructure, McGraw Hill Kogakusha Ltd., 1977.
2	S.H. Mukhergee and S.P. Singh, Reaction Mechanisms in Organic Chemistry, McMillan 1976.
3	Raj K.Bansal, Organic Chemistry Reaction mechanisms, Hill Publishing Company Ltd 2006
4	I.L. Finar, Organic chemistry, Vol. II. Pearson Education P Ltd 2011
References	
1	S. N. Sanyal, Reactions, Rearrangements and Reagents, Bharati Bhavan Publishers & Distributor 2011
2	V.K. Ahluwalia, Rakesh Kumar Parashar and R. K. Parashar, Organic Reaction Mechanisms Narosa Publishing House 2002
E-References	
1	https //www.name-reaction.com/list
2	https //www.synarchive.com/named-reactions

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**			Regulations		**2022-2024**
Department	**Chemistry**		Semester					**2**
Course Code	Course Name		Hours per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P2CH05	CORE PAPER V: Chemical Bonding and Coordination Chemistry		5			05	25	75	100
Course Objectives	. To impart knowledge on types of bonding in simple and complex molecules. . To understand the concept of HOMO and LUMO, and their influence in bond formation.							

COs	**COURSE OUTCOMES**
CO 1	Students will acquire sound knowledge on bonding in inorganic molecules.
CO 2	Students will learn the theories, mechanism of complex formation and the electronic spectra of coordination complexes.
CO 3	Students will acquire knowledge about term symbols and its applications.
CO 4	Students will analyze the bioinorganic molecules in coordination chemistry.
CO 5	Students will evaluate the various coordination theories.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Chemical Bonding I**	Hours	15
	Ionic bond - Lattice energy and its determination -Born-Lande equation - Application of Born-Haber type calculations - Size effects - Ionic radii - Factors affecting ionic radii - Lewis structure - VB theory. Molecular orbital theory - Symmetry and overlap - Molecular orbitals of diatomic and triatomic molecules - Walsh diagram of' H2 - Ionization of diatomic molecules		
Unit - II	**Covalent Bonding and Molecular Structure**	Hours	15
	Covalent bonding Formal charges-Limitations of octet rule- Hybridization and geometry-VSEPR model of methane, ammonia, water, silicon tetrafluoride, AX_2 and AX_4 type, and some xenon compounds, Bent's rule - Failures of VBT-MO theory LCAO method-Molecular orbitals in homo nuclear diatomic molecules of oxygen, beryllium, nitrogen and carbon, hetero nuclear diatomic molecules such as HCl, NO and CO-HOMO and LUMO concepts in bonding.		
	Coordinationchemistry	Hours	15

Unit - III	Crystal field theory (CFT) – Crystal field splitting in octahedral, tetrahedral and square planar complexes - Crystal field stabilization energy and its applications - Weak and strong fields - Pairing energy - Factors affecting the magnitude of crystal field splitting. Jahn-Teller theorem – Limitations of CFT - Molecular orbital (MO) theory for octahedral, tetrahedral and square planar complexes – Types of pi-bonds-pi-bonding and MO theory – Evidences for pi-bonding		
Unit - IV	Reaction Mechanism in Coordination complex	Hours	15
	Stability of complexes, Thermodynamic and kinetic stability-stability constants Substitution reactions-General mechanism-Schemes of octahedral, tetrahedral and square planar complexes-Trans effect-Theories of trans effect-pi-bonding theory and polarisation theory - Applications of trans effect-Catalysis by transition metal complexes, Hydrogenation of alkene-Wilkinson's catalyst, Hydroformylation - Oxo process, Wacker process and Zieglar-Natta catalysis.		
Unit - V	**Electronic Spectra and Organometallics**	Hours	15
	Spectroscopic term symbols for dn ions-derivation of term symbols and ground state term symbols-Energy level diagrams. Electronic spectra of complexes-Orgel diagram - interpretation of electronic spectra of d1 to d9-Tanabe-Sugano diagrams-charge transfer spectra-Carbonyls Binuclear and tri nuclear carbonyls of iron - preparation, properties, uses - Nature of M-CO bond in carbonyls - Nitrosyls-Nature of M-NO bonding - Metallocenes Ferrocene, Cobaltocene-Preparation, Properties and structure.		
	Total Hours		**75**

Text Books	
1	J. E. Huheey, E. A. Keiter and R. L. Keiter., Inorganic Chemistry, 4th Edn, Pearson education 2006
2	R. D. Madan., Modern Inorganic Chemistry, Chand Publishers 2004
References	
1	C. N. Banwell., Fundamentals of Molecular Spectroscopy, Mc Graw Hill, Newyork 2001
2	R. Chang., Basic principles of Spectroscopy, McGraw Hill Ltd., New York, 1971
E-References	
1	http //chemed.chem.purdue.edu/genchem/topicreview/bp/ch8/vsepr.html
2	http//www.chem.iitb.ac.in/people/Faculty/prof/pdfs/L5.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2020-2022**
Department	**Chemistry**		Semester				**2**
Course Code	Course Name	Periods per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
22P2CH06	CORE PAPER VI: Quantum Chemistry and Thermodynamics	5			05	25	75	100
Course Objectives	1. To impart knowledge in the field of Quantum chemistry with applications. 2. To enable the students to acquire knowledge on statistical thermodynamics. 3. To understand the difference between classical and statistical thermodynamics							

COs	**COURSE OUTCOME**
CO 1	Students will be able to identify wave functions using operators and recognize functions and values.
CO 2	Students will learn to perturbation and variation.
CO 3	Students can learn the concept of chemical potential, fugacity of gases, Activity and activity coefficient
CO 4	Students will learn the Objectives and various functions of Statistical thermodynamics
CO 5	Students acquire deep knowledge about the concept of non-equilibrium and applications
Pre-requisites	

KNOWLEDGE LEVELS (KLs)

1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing

CO / PO / PSO/ KL Mapping
(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping								
(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Quantum Chemistry-I**	Periods	15
	Quantum theory: Inadequacy of classical mechanics, Black body Radiation – Experimental results of Black body radiation – Photoelectric effect – De – Broglie equation – Heisenberg uncertainty principle – Compton effect. Born's interpretation of wave function. Operators and commutation relations, Eigen functions and Eigen values. Quantum mechanical postulates – Schrodinger equation and its solution to the problem of a particle in one- and three-dimensional boxes, the harmonic oscillator, the rigid rotator and Hydrogen atom (Arriving solution for energy and wave function). The origin of quantum numbers and their physical significance – Probability distribution of electrons. Approximation methods – Perturbation and Variation methods – application of Variation method to Hydrogen and Helium atom.		
Unit - II	**Quantum Chemistry-II**	Periods	15
	Theory of chemical bonding – Born – Oppenheimer approximation – LCAO – MO approximation for hydrogen molecule ion and Hydrogen – Valence Bond theory of Hydrogen molecule. Concept of Hybridization – sp, sp^2 and s^{p3} hybridization – Huckel Molecular orbital (HMO) theory for conjugated π- system – applications to simple		

	systems (Ethylene and butadiene) – Physical Significance of HMO coefficients. Self consistent field approximation – Hartree and Hartree – Fock Self Consistant field theory – Slater type orbitals – Slater rules.		
Unit - III	**Thermodynamics - I**	Periods	15
	Thermodynamics of non-ideal systems - Concept of chemical potential - Gibbs-Duhem equation - Variation of chemical potential with temperature and pressure - Concept of fugacity of gases - Determination by graphical method and from equation of state - Variation of fugacity with temperature and pressure - Fugacity coefficient - Activity and activity coefficient - Variation of activity of a gas with pressure and temperature.Determination of solvent activity by vapour pressure method and Cryoscopic method.		
Unit - IV	**Statistical Thermodynamics**	Periods	15
	Objectives of Statistical thermodynamics, concept of thermodynamical and mathematical probabilities, Distribution of distinguishable and non distinguishable particles. Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics Law – comparisons. Partition Function – Translational, Vibrational, Rotational and Electronic partition Functions. Thermodynamic Functions in terms of partition Function, Statistical expression for equilibrium constant C. Calculation of Equilibrium Constant from Partition function (isotopic exchange equilibria and dissociation of diatomic molecules) Heat capacities of monoatomic crystals - Einstein s and Debye s theories of heat capacities.		
Unit - V	**Irreversible Thermodynamics**	Periods	15
	Reversible and Irreversible process – Types of irreversibility of process. Postulates of Non-Equilibrium thermodynamics. Entropy production - heat flow and matter flow.Progogine's principle of minimum entropy production. Forces, fluxes and Flows - Entropy production of forces and fluxes. Linear laws - Phenomenological law - Onsager reciprocal relation - proof by Microscopic reversibility - Electro kinetic phenomenon – Diffusion. Non-Equilibrium stationary states and Applications – Peltier effect.		
	Total Periods		**75**

Text Books	
1	Arun Bahl, B. S.Bahl, G. D.Tuli., Essentials of Physical Chemistry, Multicolour Revised Edn, S. Chand and Company Ltd, (2008).
2	L. K. Nash., Chemical Thermodynamics, 2nd Edn, Addision Wesley Publishing (1976)
3	P.W. Atkins., Physical Chemistry, 6th Edn, Oxford University Press, (1998)
4	Gurudeep Raj, Advanced Physical Chemistry, Goel Publishing House, (2014).
References	
1	R. K. Prasad., Quantum Chemistry, Viva Books Private Ltd (2013).
2	D. McQuarrie., Quantum Chemistry, Viva Books Private Limited (2013).
3	A. K. Chandra., Introductory Quantum Chemistry, Tata McGraw Hill (1994).
4	W. J. Moore., Physical Chemistry, Longmann's (1975).
5	M.C. Gupta., Statistical Thermodynamics, Wiley Eastern Limited (1990)
6	I. N. Levine, Quantum Chemistry, 4th Edn., Prentice Hall India, (1994).
7	B. K. Sen., Quantum Chemistry Including Spectroscopy, Kalyani publishers (2004).
8	S. Glasstone., Thermodynamics for Chemists - East-west Press Pvt.Ltd, (2002).
9	
E-References	
1	www.chemistryexplained.com
2	http://unicorn.mcmaster.ca/teaching/4PB3/SymmetryLectureNotes2009-Vallance-Oxford-level2.pdf
3	http://cbc.arizona.edu/~salzmanr/480a/480ants/kinintro/kinintro.html

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			**2**		
Course Code	Course Name	Hours per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P2CHP03	Practical Inorganic Estimation and Complex Preparations-Practical			5	04	40	60	100
Course Objectives	1. To acquire training in micro scale experimental techniques. To acquire knowledge on the properties of ions and their compounds. 2. To educate the students about the complex formation reaction, influence of pH, stability of complexes and application							

COs	**COURSE OUTCOMES**
CO 1	Students will learn how to conduct a process systematically and precisely
CO 2	The qualitative analysis gives a type of mental training and develops a power of reasoning not equal to any other course in chemistry
CO 3	The students will learn the nature, significance, and influence of errors and how they may best be avoided or minimized during the qualitative and quantitative examination of a chemical compound
CO 4	Students will able to design and synthesize new complexes
CO 5	Students will able to carry out their research in future
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Organic Estimations and Spectral Interpretations**	Hours	35
	Iron and Magnesium, Iron and Nickel, Copper and Nickel, Copper and Zinc		
Unit - II	**Preparations**	Hours	40
	Tris(thiourea)copper(I) chloride Bis(acetylacetanato) copper(II) Hexammine cobalt(III) chloride Sodium hexa nitro cobaltate(III) Potasiumtrioxalato aluminate (III) trihydrate Chloropentammine cobalt(III) chloride Hexammine nickel(II) chloride		
	Total Hours		**75**

References

1	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas, Vogel " Textbook ofQuantitative Chemical Analysis", 6th Edition, Pearson Education (2001)
2	V. Venkateswaran, R. Veeraswamy and A.R.Kulandaivelu, Basic Principles ofPractical Chemistry, New Delhi, S.Chand& Co, (1995)

E-References	
1	http://lib.hku.hk/Press/9622092128.pdf
2	http://www.kvsunjuwan.com
3	http://science-blogs.ucoz.com/resources/notes/msc/pract1/CationGuide.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.				
Programme	**M.Sc**	Programme Code	**PCH**	Regulations	**2022-2024**
Department	**Chemistry**		Semester		2

Course Code	Course Name	Hours per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P2CHP04	Practical Organic Preparations and Estimation-Practical			5	04	40	60	100
Course Objectives	1. The objective of this lab is to provide hands-on opportunities to apply the knowledge of chemical reaction in functional group analysis. 2. It also gives hands-on training to synthesize organic compounds via a variety of organic reactions. 3. To promote the students towards research activity and job opportunities.							

COs	**COURSE OUTCOMES**
CO 1	Students can able to investigate and report an unknown compound systematically.
CO 2	Students will be known to synthesize, recrystallize and finding melting point of an organic compound. It will help them to carry out their research in future.
CO 3	Students can apply knowledge on identifying various functional groups.
CO 4	Students will analyze the various separation methods.
CO 5	Students can evaluate different binary organic mixtures.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Organic Estimations and Spectral Interpretations**	Hours	35
	Estimation of phenol, Estimation of aniline, Estimation of methyl ketone, Estimation of glucose. Interpretation of IR and UV visible spectra of organic compounds (six in each case)		
Unit - II	**Two stage preparations**	Hours	40
	sym-Tribromobenzene from aniline (Bromination + Hydrolysis) p-nitroaniline from acetanilide (Nitration + Hydrolysis) Benzanilide from benzophenone (Beckmann rearrangement) m-nitroaniline from nitrobenzene (Nitration + Reduction) p-bromo acetanlide from aniline (Acetylation + Bromination)		
	Total Hours		**75**

Text books

1	Antony J. Hannaford, Austin R. Tatchell, Brian S. Furniss, Peter W.G. Smith , Vogel's Text Book of practical organic chemistry, Pearson Education (2006).

References

1	V. Venkateshwaran, R. Veerasamy, A. R. Kulandaivelu, Basic principles of practical chemistry, Sultan Chand &Sons,New Delhi, 2016

E-References

1	http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html
2	http://vlab.amrita.edu/?sub=2&brch=191&sim=345&cnt=1
3	http://amrita.olabs.edu.in/?sub=73&brch=8&sim=116&cnt=1

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2022-2024**
Department	**Chemistry**		Semester				2
Course Code	Course Name		Hours per Week		Credit	Maximum Marks	
			L	T P	C	CA	ESE Total
22P2CHE03	Elective: III Supramolecular chemistry		4		03	25	75 100
Course Objectives	This course has been designed for students to learn and understand 1. The fundamentals of supramolecules. 2. The co-receptor molecules and multiple recognitions. 3. The supramolecular reactivity and their catalytic activity.						
COs	**COURSE OUTCOMES**						
CO 1	Interpret the information about various concepts involved in supramolecular Chemistry.						
CO 2	Compare the different model for the metallo organic frameworks.						
CO 3	Explain the various co-receptor molecules and multiple recognitions in metalloreceptors.						
CO 4	Examine the Supramolecular reactivity and their catalytic activity.						
CO 5	Analyze the role of supramolecular chemistry in the development of nanoscience And technology.						
Pre-requisites							

KNOWLEDGE LEVELS (KLs)

1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing

CO / PO / PSO/ KL Mapping
(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Concepts of Supramolecular Chemistry**	Hours	15
	Concepts and languages of supramolecular chemistry – various types of non- covalent interactions – hydrogen bonds, C-H...X interactions, halogen bonds – π-π interactions, non–bonded interactions – various types of molecular recognition. Crystal engineering of organic solids – hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs – concepts of different types of synthons based on non-covalent interactions – principles of crystal engineering and non-covalent synthesis – polymorphism and pseudopolymorphism – supramolecular isomorphism / polymorphism – crystal engineering of pharmaceutical phases.		
Unit - II	**Metallo Organic Frameworks**	Hours	15
	M.O.F (Metallo Organic Frameworks) – organometallic systems – combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. – design of nanoporous solids – interligand hydrogen bonds in metal complexes – implications for drug design – crystal engineering of NLO materials, OLED.		
Unit - III	**Co-receptor Molecules and Multiple Recognition**	Hours	15
	Dinuclear and polynulclear metal ion cryptates – linear recognition of molecular length by ditopic co-receptors – heterotopic co-receptors – cyclophane receptors, amphiphilic receptors and large molecular cages – multiple recognition in metalloreceptors – supramolecular dynamics		
	Supramolecular Reactivity and Catalysis	Hours	15

Unit - IV	Catalysis by reactive macrocyclic cation receptor molecules – catalysis by reactive anion receptor molecules – catalysis with cyclophane type receptors – supramolecular metallocatalysis – cocatalysis – catalysis of synthetic reactions – biomolecular and abiotic catalysis. upramolecular chemistry in solution – cyclodextrin, micelles, dendrimers, gelators – classification and typical reactions – applications		
Unit - V	**Supramolecular Devices**	Hours	15
	Supramolecular devices and sensors – various types of supramolecular devices – an overview – supramolecular photochemistry – molecular and supramolecular photonic devices – light conversion and energy transfer devices – molecular and supramolecular electronic devices – electronic conducting devices – molecular wires, modified and switchable molecular wires – molecular and supramolecular ionic devices – tubular mesophases, molecular protonics – switching devices – electro-photo switch – ion and molecule sensors – role of supramolecular chemistry in the development of nanoscience and technology		
	Total Hours		**75**

Text Books	
1	G. R. Desiraju and T. Steiner. 2001. The Weak Hydrogen Bond in Structural Chemistry and Biology. International Union of Crystallography.
2	J. M. Lehn. 1995. Supramolecular Chemistry. Wiley VCH.
References	
1	J. M. Lehn. 1999. Transition Metals in Supramolecular Chemistry. John Wiley and Sons.
2	G. R. Desiraju. 1989. Crystal Engineering: The Design of Organic Solids. Elsevier.
3	G. A Jeffrey. 1997. Introduction to Hydrogen Bonding. Oxford University
	Press UK.
4	Jonathan W. Steed and Jerry L. Atwood. 2009. Supramolecular Chemistry. 2nd edition. Wiley-Blackwell.
E-References	
1	http://www.pubs.acs.org/journals/cgdefu/index.html

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**	
Department	**Chemistry**		Semester			**2**	
Course Code	Course Name	Hours per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
22P2CHE04	Elective: III Organic Spectroscopy	4			03	25	75	100
Course Objectives	To enable the students to identify the organic compounds. Acquire the fundamentals and principles of spectroscopic techniques. Enhance the knowledge in mass, NMR, IR spectroscopy.							

COs	**COURSE OUTCOMES**
CO 1	Students will understand the basic principles of UV visible spectroscopy.
CO 2	Students will learn about the basic concepts of IR spectroscopy.
CO 3	Students will apply their knowledge on interpretation of mass spectrum.
CO 4	Students will analyze the chemical shift in molecules using NMR.
CO 5	Students will evaluate the types of spectra.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)

1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing

CO / PO / PSO/ KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs/PSOs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1

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

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**UV Visible Spectroscopy**	Hours	15
	Frank-Condon principle, Types of electronic transitions, Chromophores &Auxochromes, absorption and intensity shifts, Types of absorption bands, Effect of temperature and solvent on the fineness of absorption band, conjugated dienes, Woodward - Fieser rules.		
Unit - II	**IR Spectroscopy**	Hours	15
	Vibrational frequencies & factors affecting them, number of fundamental vibrations, selection rules, identification of functional groups, Finger Print Region, Applications of IR spectroscopy		
Unit - III	**Mass Spectrometry**	Hours	15
	Principle - EI, CI & FAB - Base peak, isotopic peaks, metastable peak, parent peak, Fragmentation - Nitrogen, even electron rule and pattern, McLafferty rearrangement, Retro – Diel's Alder reaction fragmentation pattern of hydrocarbons, alcohols, aldehydes and ketones, phenols, ethers		
Unit - IV	**NMR Spectroscopy**	Hours	15
	Basic principles of NMR experiments - Shielding and deshielding effects- Chemical Shift. Factors influencing chemical shift, splitting of signals, Spin-Spin coupling& Coupling constant - Factors influencing Proton Chemical Shift & Proton - Proton Coupling constant, AX & AB spin system - Spin decoupling - Nuclear Overhaust effect - Chemical exchange. ^{13}C NMR chemical shift & factor affecting ^{13}C Chemical shift.		
Unit - V	**Identification of organic compounds**	Hours	15
	Identification of organic molecules alcohols, aldehydes, ketones, ethers, hydrocarbons esters using UV, IR, NMR and Mass spectroscopic techniques.		
	Total Hours		**75**

Text Books	
1	Finar. I.L, Organic Chemistry, Vol-I&II, Fifth Edition, ELBS Publication, 2006.
2	Sharma. Y.R, Elementary Organic Spectroscopy, Fifth Edition, S. Chand Publication, 2013.
3	Jag mohan, Organic Spectroscopy: Principles and Applications, Second Edition, Alpha Science International Ltd., Harrow, U.K.
References	
1	Dyer.J, Applications of Organic Spectroscopy, Prentice & Hall of India Pvt Ltd., NewDelhi, 1980.
2	Mukerjee.S.M&Singh.S.P, Organic Reaction Mechanism, McMillan India Ltd.,Chennai, 1990.
3	Kemp. W, Organic Spectroscopy, Mcmillan Ltd., 2001.

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			**3**		
Course Code	Course Name	Hours per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P3CH07	Core - VII Natural products, Pericyclic reactions, and Retro synthesis	5			05	25	75	100
Course Objectives	1. To enable students to learn about the chemistry of natural products. 2. To learn the concepts of pericyclic reactions. 3. To learn the relation between the structure and physiological properties of chemicals. 4. To learn the basic principles and various methods.							

COs	**COURSE OUTCOME**
CO 1	Students can learn about the chemical properties and structure of organic compounds like terpenoids, alkaloids, steroids and flavones, etc derived from plant materials.
CO 2	Students can understand isolation, characterization and laboratory synthesis of natural products.
CO 3	Students can know the concept of HOMO and LUMO, and their influence in bond formation.
CO 4	Students study the nature of double-bonded compounds and the possible isomer arrived upon their rearrangement.
CO 5	The knowledge of students will be enriched with green chemistry and various types of eco-friendly reactions could be conducted on their own.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5

CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Content of the Syllabus			
Unit - I	**Terpenoids and Steroids**	**Hours**	**15**
	Terpenes: classification,, structural elucidation and synthesis of α-pinene, camphor, zingiberene. Steroids: classification, structural elucidation of cholesterol (synthesis not required), stigmasterol (synthesis not required), structure and synthetic aspects of estrone and progesterone.		
Unit - II	**Alkaloids and Flavonoids**	**Hours**	**15**
	Alkaloids: classification, structural elucidation and synthesis of papaverine, quinine, morphine and reserpine.Flavones: introduction and Baker-Venkatraman synthesis - Flavanol: synthesis of quercetin – Isoflavones: synthesis of daidzein.		
Unit - III	**Anthocyanins and Vitamins**	**Hours**	**15**
	Introduction to anthocyanins – synthesis of anthocyanins. structure and biological applications - uric acid, purine derivatives and xanthine bases Vitamins: fatand watersoluble vitamins, structural elucidation of vitamin B6, vitamin B12, and vitamin K		
Unit - IV	**Pericyclic Reactions and Photochemistry**	**Hours**	**15**
	Electrocyclic reactions (butadiene-cyclobutene system), cyclo-addition reactions ((4 +2) and (2+2)) systems, sigmatropic and cheletropic reactions, use of frontier		

	molecular orbital and correlation diagrams, 1,3 and 1,5 - hydrogen shifts. Sigmatropic rearrangements: Claisen, Cope and oxy-Cope rearrangements. Photochemistry: cis-trans isomerization, buterno-buchi reaction, Norrish type I and type II reactions, di-pi methane rearrangement-photoreduction of ketones, barton's reaction		
Unit - V	**Strategies for Organic Synthesis**	**Hours**	**15**
	Retrosynthetic analysis: synthons and synthetic equivalents, functional group interconversion - disconnection approach – one group C-X, two group C-X and one group C-C disconnections - chemoselectivity, umpolungand amine synthesis-protection and deprotection : alcohols, carbonyls, carboxylic acids and amino functional groups - reterosynthetic analysis: alternate synthetic routes, synthesis of organic mono and bifunctional compounds via disconnection approach – stereochemical control of products: selective aldol and Michael reactions		
Total Hours			**75**

Text Books	
1	V.K.Ahluwalia,M.Kidwai,New trends in green chemistry,Second Edition,2007
2	Arun Bahl and B.S.Bahl,Advaced organic chemistry,S.Chand and company,2009
3	T.W.Grahamsalomons, CarigB.Fryhle,Organic chemistry,9th edition,Wiley.2011.
4	Singh, Jagadamba and L.D.S .Yadav. *Advanced Organic Chemistry*.Meerut: Pragati Prakashan, 2010
References	
1	I.L. Finar organic Chemistry, Vol. II, 5th Edition ELBS 1975
2	O.P.Agarwal, Chemistry of Organic Natural products,Goel publication vol I & II
3	M.G. Arora, Organic Photochemistry and Pericyclic reaction,2008
4	C.H.Depuy ,O.SChampman Molecular reactions and Photo-chemistry, Prentice Hall, 1975
5	B.B. Grill, M. R. Willis, Pericyclic reactions, Champan& Hall 1974.
6	Jonathan, Clayden, Nick Greeves, Stuart Warren. Organic Chemistry. New York: Oxford University Press, 2012
E-References	
1	https://articles.mercola.com/sites/articles/archive/2017/08/28/terpenoids.aspx
2	https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/pericycl.htm
3	https://lpi.oregonstate.edu/mic/dietary-factors/phytochemicals/flavonoids
4	www.essentialchemicalindustry.org/processes/green-chemistry.html

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN **(AUTONOMOUS)** Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2022-2024**
Department	**Chemistry**		Semester				**3**
Course Code	Course Name	Hours per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
22P3CH08	CORE PAPER VIII: Organometallic, Solid state, Spectroscopy and Bio-inorganic Chemistry	5			05	25	75	100
Course Objectives	To gain knowledge about Boron compounds, cages, chains and clusters. To learn elaborately in the field of solid state and bio-inorganic chemistry. To understand the working and application of various analytical tools to deduce crystal structure of solids.							

COs	**COURSE OUTCOME**
CO 1	Students have the knowledge of application and properties of non-aqueous solvents and formation of liquid and gaseous molecules.
CO 2	Students can able understand the commercial application of Organometallic Chemistry & catalysis.
CO 3	Students are enable to understand the basic of crystal structure, application of the analytical tools like XRD, AAS and PES tools in elucidating three dimensional structure of the inorganic molecules.
CO 4	Students can know the importance of biologically important materials in our body.
CO 5	Students will have enriched knowledge on porphyrin and other bioinorganic molecules.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Boron compounds and Clusters Boron hydrides**	**Hours**	**15**
	Inorganic chains - rings - cages and clusters - catenation - heterocatenation - intercalation chemistry - one dimensional conductor - isopolyanions - heteropolyanions - borazines - phosphazenes - phosphazene polymers - ring compounds of sulphur and nitrogen - homocyclic inorganic systems - cages - boron cage compounds - metal clusters - dinuclear clusters - trinuclear clusters - tetranuclear clusters - hexanuclear clusters - structural prediction of organometallic clusters.		
Unit - II	**Organometallic Chemistry**	**Hours**	**15**
	Carbon donors - Alkyls and Aryls-preparation and properties; Carbonyls -18 electron rule, isolobal concept - application to structure of carbonyls (simple and polynuclear); Nitrosyls - bridging and terminal nitrosyls, bent and linear nitrosyls; dinitrogen complexes; Chain Carbon donors - Olefins, acetylene and allyl complexes - synthesis, structure and bonding; Cyclic Carbon donors - Metallocene - synthesis, structure and bonding (Ferrocene only).		
Unit - III	**Catalysis**	**Hours**	**15**

	Hydrogenation of olefins (Wilkinsons catalyst); hydroformylation of olefins using Cobalt or Rhodium catalysts (oxo process); Oxidation of olefins to aldehydes and ketones (Wacker process); polymerization (Zeigler-Natta catalyst); Cyclo oligomerization of acetylene using Nickel catalyst (Reppe's catalyst); polymer bound catalysts.		
Unit - IV	**Solid state Chemistry**	**Hours**	**15**
	Space lattice - unit cell- crystal systems- elements of symmetry- space groups-Miller indices- crystal analysis- XRD - rotating crystal method- powder method - packing of atoms and ions in solids- Electrical properties of solids – Band theory, semiconductors, super conductors, theory of super conductivity – defects in solids - solid state electrolytes; magnetic properties of solids – dia, para, ferro, antiferro and ferrimagnetism.		
Unit - V	**Bio-inorganic Chemistry**	**Hours**	**15**
	Porphyrin ring system - Metalloporphyrins - Haemoglobin and Myoglobin-structures and work functions - other oxygen carriers - Cytochromes: Structure and work functions in respiration - Chlorophyll, structure - photo synthetic sequence - Sulphur proteins - (Non Haemo iron protein) - Copper oxidizes - Blue copper proteins - Carboxyl peptidase A: Structure, function - Vitamin B12, In vivo and in vitro nitrogen fixation - Molecular mechanism of ion transport across the membrane - Na and K ion pumps-Chelate therapy-cis-platin.		
	Total Hours		**75**

Text Books	
1	U. Malik, G. D. Tuli and R. D. Madan., Selected topics in Inorganic Chemistry, 6th EdnS. Chand & company Ltd., (2005).
2	B. R. Puri, L. R. Sharma and K. C. Kalia., Principles of Inorganic Chemistry, S. Chand & Co (2004).
3	R. D. Madan., Modern Inorganic Chemistry, Chand Publishers (2004).
4	
5	
References	
1	J. E. Huheey, E. A. Keiter and R. L. Keiter., Inorganic Chemistry, 4th Edn, Pearson education (2006).
2	F. A. Cotton, G. Wilkinson., Advanced Inorganic Chemistry, 3rd Edn, John Wiley & Sons, Inc (1972).

3	G. Raj., Advanced Inorganic Chemistry Vol. I & Vol. II, 6th Edn, Goel publishing house (1999).
4	G. S. Manku., Theoretical Principles of Inorganic Chemistry, Tata McGraw –Hill Publishing Company Ltd., (Reprint 2001).
E-References	
1	global.oup.com/ushe/product/boron compounds-9780198502593
2	https://www.nature.com › subjects
3	https://www.chemie.uni-hamburg.de/ac/rehder/Lund_BioinorgChem_08.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			**3**		
Course Code	Course Name		Hours per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P3CHP05	Physical Chemistry Electrical Practical				6	04	40	60	100
Course Objectives	1. To apply the principles of Conductometry and Potentiometry to the given samples. 2. To develop laboratory skills 3. To the ability to work with instruments independently.							

COs	**COURSE OUTCOME**
CO 1	Students will understand the breadth and concepts of physical chemistry.
CO 2	Students will develop skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry.
CO 3	Students will plan, conduct, review and report the experiment.
CO 4	Students will analyze the possible errors in instrument based experiments.
CO 5	Students will evaluate the hydrolysis constant with time.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Electrical Experiments**	Hours	75
	Conductometry: 1. Estimation of mixture of acids (HCl, CH3COOH Vs NaOH). 2. i. Determination pKa – Ostwald's dilution law. ii. Determination of solubility product - Kohlrausch's law. 3. Estimation of mixture of halides (KCl, KI Vs AgNO3). 4. Determination of hydrolysis constant (for aniline hydrochloride) 5. i. Saponification of ethyl acetate (Kinetics study). ii. Comparison of the relative strength of acetic acid and chloroacetic acid. **Potentiometry:** 1. Estimation of mixture of acids (HCl, CH_3COOH Vs NaOH). 2. Determination of solubility product by a) Galvanic cell method. b) Concentration cell method. 3. Estimation of mixture of halides (KCl, KI Vs $AgNO_3$). 4. Determination of E^0 of Zn / Zn^{2+} and estimation of Zn^{2+} 5. Determination of hydrolysis constant (for aniline hydrochloride)		
	Total Hours		**75**
Text Books			
P.S. Sindhu, Practicals in Physical Chemistry, 1st Edition, Macmillan, India (2006).			

V. Venkateswaran, R. Veeraswamy and A. R. Kulandaivelu, Basic Principles of Practical Chemistry, New Delhi, S.Chand & Co, (1995).
References
B Viswanathan, P.S. Raghavan, Practical Physical Chemistry, Viva Books Private Limited, (2005).
E-References
http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Material Science
http://www.cffet.net/sia-e/2_Pot_titr.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2020-2022**
Department	**Chemistry**		Semester				3
Course Code	Course Name		Hours per Week		Credit	Maximum Marks	
			L	T P	C	CA	ESE Total
22P3CHE05	Elective-IV Physical methods in Chemistry		5		04	25	75 100
Course Objectives	1. To make the students to understand the principles of vibrational and rotational spectroscopy. 2. To acquire knowledge in the field of UV-Vis spectroscopy and its application to organic chemistry.						

COs	**COURSE OUTCOME**
CO 1	Students will learn about instrumental techniques in Microwave Spectroscopy that helps them incharacterizing new materials.
CO 2	Specialized and basic spectroscopic techniques are taught such as Infrared spectroscopy and Raman spectroscopy
CO 3	Students will learn about the theory of UV spectroscopy, Fluorescence Spectroscopy and its applications
CO 4	Students will analyze theory and applications of Nuclear Magnetic Resonancespectroscopy and EPR spectroscopy. These topics help thestudents in understanding the basic principle andapplications of different characterizing techniques
CO 5	The students gain more knowledge about the concepts of Mass, and Mossbauer techniques andhow to apply the learned concepts of these techniques forspectral interpretation. This helps to find out the structure ofsynthesized unknown organic compound.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2

CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Microwave spectra**	**Hours**	**15**
	Introduction: Electromagnetic radiation, Interaction of light with matter, mechanism of absorption & emission of radiation. Rotational, vibrational, and electronic transitions in molecules; regions and representation of spectra. Micro wave Spectroscopy: Diatomic molecules as rigid rotors: rotational energy levels, intensity of spectral lines, selection rules, effect of isotopic substitution. Diatomic molecules as non-rigid rotors. Rotational spectra of polyatomic molecules – Linear and Symmetric top molecule.		
Unit - II	**Vibrational Spectra**	**Hours**	**15**

	Vibrational Spectroscopy: Vibrating diatomic molecule: energy of diatomic molecules as simple harmonic and Anharmonic oscillator - energy levels, vibrational transitions, selection rules; Diatomic vibrating rotator: Born-Oppenheimer approximation, vibrationrotational spectra, selection rules; P, Q, R branches. Vibrations of polyatomic molecules: fundamental vibrations and its symmetry, normal modes of vibration, overtones and combination of bands. Raman Spectroscopy: Rayleigh scattering, Raman Scattering. Polarizability, Polarization of Raman lines, Rule of mutual, exclusion, Instrumentation and applications		
Unit - III	**UV and fluorescence Spectroscopy**	**Hours**	**15**
	UV-spectroscopy: Theory, Instrumentation, selection rules, Beer-Lamberts Law, Electronic transitions, Characteristic absorption (λ_{max} and ε_{max}) Conjugated double bond – dienes, carbonyl compounds and aryl groups. Factors influencing absorption. Fluorescence and phosphorescence, fluorescence quenching, concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance energy transfer between photoexcited donor and acceptor systems (FRET).		
Unit - IV	**NMR and ESR Spectroscopy**	**Hours**	**15**
	NMR Spectra: Theory, Instrumentation. Chemical shift - Factors affecting chemical shift, Shielding and deshielding mechanisms. Spin-spin coupling, Coupling constant – Geminal and Vicinal coupling constant, heteronuclear couplings, Nuclear Overhauser effect. Introduction to ^{13}C NMR, ^{19}F NMR, ^{31}P NMR and applications of ^{1}H NMR. ESR Spectroscopy – Theory, derivative curves, g values, Hyperfine splitting, Zerofield splitting, Kramersdegeneracy-Isotropic and anisotropic systems and Applications in metal complexes.		
Unit - V	**Mass Spectrometry and Mossbauer Spectroscopy**	**Hours**	**15**
	Mass Spectrometry :Instrumentation, Molecular Formulae Index (D.B.E), Molecular ion peak, base peak, metastable ions, Nitrogen rule, effect of isotopes, Rules for fragmentation, Mclafferty rearrangement, retro Diels- Alder fragmentation, Fragmentation of hydrocarbons, alcohols, Phenols, Halides, aldehydes, Ketones, amines, nitriles, carboxylic acids, esters, Problems based on analysis of mass spectra of various organic compounds Prediction of molecular formulae based on relative abundance. Mossbauer Spectroscopy: Line width - Isomer shift - Quadrupole interactions - Magnetic interactions, Structural elucidation of iron tin complexes.		
	Total Hours		**75**
Text Books			
1	Y. R. Sharma., Elementary Organic Spectroscopy, Chand Publications (2007)		

2	Gurudeep Raj, Advanced Physical Chemistry, Goel Publishing House, (2014)
3	R. Chang., Basic principles of Spectroscopy, McGraw-Hill Inc.,US (1971).
4	Jag Mohan., Organic Spectroscopy - Principles and Applications, CRC press (2004)
5	D.N. Sathyanarayana., Introduction to Magnetic resonance Spectroscopy, IK International Publishing House Pvt. Ltd., (2013)
6	Introduction to MoelcularSpectrsocopy : G.M. Barrow, McGraw Hill (1962)
References	
1	C. N. Banwell and E. M. McCash., Fundamentals of Molecular Spectroscopy, 4th Edn, Tata McGraw Hill, (2010).
2	B.R. Puri, L. R. Sharma, M. S. Pathania., Principles of Physical Chemistry, Vishal Publishing Co. (2016)
3	P. S. Kalsi., Spectroscopy of Organic Compounds, New Age International (2007)
4	NMR, NQR, EPR & Mossbauer Spectroscopy in Inorganic Chemistry : R.V. Parish, Ellis Harwood.
E-References	
1	nptel.ac.in/courses/103103033/module9/lecture1.pdf
2	http://folk.ntnu.no/fredrol/Nanomaterials%20and%20Nanochemistry.pdf
3	https://www.ceitec.eu/nanoparticles-for-biomedical-applications/f33079
4	https://chem.libretexts.org/

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN **(AUTONOMOUS)** Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			**4**		
Course Code	Course Name		Hours per Week		Credit	Maximum Marks		
			L	T P	C	CA	ESE	Total
22P3CHE06	ELECTIVE PAPER: Industrial Chemistry		5		04	25	75	100
Course Objectives	To impart knowledge on fermentation, pigments, oils and fats. To understand the industrial applications of chemistry. To give an idea for the student about drugs and explosives.							

COs	**COURSE OUTCOME**
CO 1	Students enable to understand various fermentation processes.
CO 2	Acquire knowledge about different drugs and pharmaceutical aids.
CO 3	Students know about the types of pigments and its use.
CO 4	Students will analyze the applications of enamels, adhesives and explosives.
CO 5	Students enable to understand importance of oils and fats for commercial applications.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**

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

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Fermentation**	**Hours**	**15**
	Introduction - Historical -Conditions favourable for fermentation. Characteristics for enzymes - short accounts of some fermentation processes – Manufacture of beer – sprits- wines and power alcohol. Ethyl alcohol from molasses- Preparation of wash and distillation. Alcohol from waste sulphite liquor- Distillery effluents for Agricultural production.		
Unit - II	**Drugs, diagnostic reagents and pharmaceutics aids**	**Hours**	**15**
	Drugs: Definition sources of drugs – some important drugs – aspirin – phenacetin – paracetamol – penicillin – chlormycetin – structure – properties – uses. **Organic diagnostic reagents** – definition – uses – sodium diatrizoate, phenol red Evans blue, indigo carmine, methylene blue, xylose, Histamine and sodium benzoate - properties – uses. **Organic pharmaceutics aids** – Definition – preservatives – antioxidants – flavouring agents – colouring agents – sweetening agents - Emulsifying agents and stabilising agents – examples for each class – uses (structure and preparation not necessary)		
Unit - III	**Pigments**	**Hours**	**15**
	Definition – composition, characteristics and uses of white pigments - white lead, Zinc oxide Lithopone and TiO_2 – Blue pigments – Ultra marine blue and iron blue – characteristics – uses. Red pigments – red lead –characteristics and uses. Green pigments – chrome green and Guigwet's green– characteristics and their uses- Black pigments-Natural black oxide, precipitated black iron oxide, carbon black- Yellow pigments- orchre, chrome black.		

Unit - IV	**Adhesives, Enamels and Explosives**	**Hours**	**15**
	Adhesives: definition – classification of adhesives. Preparation and uses of animal glue – bone glue - protein adhesives - starch adhesives – Synthetic resin adhesives. Enamels: Introduction - Raw Materials – Manufacture and Applications **Explosives:** Introduction- Classification - Characteristics of Explosives. Preparation and uses of explosives- Nitro cellulose, TNT, Picric acid, Gun Powder and Dynamite.		
Unit - V	**Oils and Fats**	**Hours**	**15**
	Soaps-Properties, Manufacture of soap. Types- Transparent Soap, Toilet soap, Powder soap and Liquid soap –Ingredients. **Detergents**-Definition, Properties- Cleansing action - Soapless detergents - Uses of detergents as surfactants. Biodegradability of soaps and detergents. **Sugar**- Manufacture from sugar cane - Recovery of sugar from molasses - Testing and estimation of sugar. **Paper**- Manufacture of pulp – Mechanical, Chemical process - Sulphate pulp - Rag pulp. Manufacture of paper. **Cement** – Types - Raw materials. Manufacture- Wet process- constituent of Cement- Properties of cement.		
	Total Hours		**75**

Text Books	
1	B.N. Charabarthy – "Industrial Chemistry", 1st Ed., Oxford and IBh Publishing, New Delhi.
2	B.K. Sharma – "Industrial Chemistry", 1st Ed., (1983), Goel Publication, Meerut.
3	Arun Bahl and B.S. Bahl – "Text Book of Organic Chemistry", 11th and 18th Ed., S. Chand,
	New Delhi, 2006.
4	Ghosh, Jayashree – "Text Book of Pharmaceutical Chemistry", 3rd Ed., S.Chand& Co. Ltd., New Delhi, 1999.
References	
1	V.P. Gowariker and N.V. Viswanathan – "Polymer Science", 1st Ed., Wiley Easter Pvt. Ltd., New Delhi.
2	Lakshmi. S – "Pharmaceutical Chemistry", 3rd Ed., (1995), Sultan Chand & Sons, New Delhi.
3	Rajasekaran, VN. – "Pharmaceutical Chemistry", 1st Ed., (2003), Sun Publications – Chennai.
4	Krishnamoorthy, P. Vallinayagan& K. Jaya Subramanian – "Applied Chemistry", 2nd Ed., (1999, 2001), Tata MaGraw-HillPublishing Co. Ltd., New Delhi.

E-References	
1	http://www.naturebioscience.com/molasses-fermentation.php
2	https://digital-photography-school.com/mastering-color-series-color-blue-in-photography
3	https://www.ilo.org/legacy/english/protection/safework/ghs/ghsfinal/ghsc1528.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			**4**		
Course Code	Course Name		Hours per Week		Credit	Maximum Marks		
			L	T P	C	CA	ESE	Total
22P4CH09	Core – IX Electrochemistry and Photochemistry		5		05	25	75	100
Course Objectives	1. To impart the basic concepts electrochemistry. 2. To understand the application of electrochemistry and electrochemical cells. 3. To acquire knowledge about electrochemical reactions. 4. To enrich the students' knowledge with the basic principles							

COs	**COURSE OUTCOME**
CO 1	Students will understand the basic principles of electrochemistry and different types of electrochemical cells.
CO 2	Students will learn about the basic concepts of photochemistry and their importance in various fields.
CO 3	Students will apply their knowledge of photochemistry in the process taking place in biosystems.
CO 4	Students will analyze the various electrokinetic processes.
CO 5	Students will evaluate the theories of electrical double layer theories.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)								
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Electro chemistry - I**	Hours	15
	Introduction to electrochemical cells-Types-Chemical cells with and without transferences-Concentration cells- types- electrode concentration cells-electrolytic concentration cells - with and without transferences - liquid junction - salt bridge - derivation- Electrical double layer, theories of double layer -Electrokinetic phenomena: Electroosmosis – electrophoresis - Diffusion, Streaming and Sedimentation potentials Dispersion dielectric loss and reractive index – Lennard – jones potential. electro-capillary phenomena, electro-capillary curve.		
Unit - II	**Electro chemistry - II**	Hours	15
	Debye - Huckel theory of inter-ionic attraction, ionic atmosphere, time of relaxation, relaxation and - phoretic effects, Derivation of Debye-Huckel-Onsagar equation and its validity for dilute solutions at appreciably concentrated solutions. Debye-Falkenhagen and Wein effects. Mean ionic activity coefficients and their determination. Debye – Huckel Bronsted equations - Derivation of Debye-Huckel limiting law, Quantitative and qualitative verification, ion association and Bjerrum theory -Clausius –mosotti Equation –electrostatic of dielectric medium.		
	Applications of Electrochemistry	Hours	15

Unit - III	Polarography- Introduction-Origin of diffusion limiting current—Polarisable Dropping mercury electrode-Principles of polarography-Instrumentation techniques.-the Ilkovic equation-Polarographic waves-Half wave potential-polarographic maxima-.AC polarography-Rapid scan polarography—-pulse polarography – square wave polarography- Applications of polarography-Qualitative and quantitative analysis-organic polarographic analysis. Anodic stripping voltammetry-Principles – applications.Cyclic voltammetry – principles and applications. Electrochemical sensors and detectors-applications.		
Unit - IV	**Organic Photochemistry**	Hours	15
	Fundamental concepts - Photooxidation reaction (Formation of Peroxy compounds) – Photoreduction of ketones and enones, Norrish type I and II reactions-Photodimerisation of carbonyl compounds-Intramolecular hydrogen abstraction - Photochemistry of Alkenes, Dienes and Aromatic compounds - Photoisomerisation – Cis and Trans isomerization - Photoaddition reaction-Paterno-Buchirreaction-Barton reaction Photo– Fries rearrangement and photorearrangement of 2,5- Cyclohexadienones. Cycloaddition reaction of Enones with alkenes. The Hoffmann Loeffler Freytag reaction.		
Unit - V	**Applied Photochemistry**	Hours	15
	Photochemistry reaction in the atmosphere - oxygen and ozone - nitrogen oxide - chlorofluoro carbons - organic compounds - chemistry of vision – photography - Light absorbing compounds -photosensitisers-ultraviolet screening agents - optical bleach – photochronism - photoimaging - photochemistry of polymers - Photochemistry of Aromatic compounds- photochemistry of carbonyl compounds.- Photo polymerization: imaging, curing - photodegradation and photostabilization– Photoelimination-- photochemistry of excited redox reactions.		
	Total Hours		**75**

Text Books	
1	K. K. Rohatgi - Mukharjii, Wiley Eastern., Fundamentals of Photochemistry, New age international., P Ltd., New Delhi 2011
2	S. Glasstone, D. Van Nostrand., An introduction to Electrochemistry., Affiliated East west press Pvt., Ltd., New Delhi, 2004
3	Gurdeep Raj, Advanced Physical Chemistry, Go Publishing House.1999

4	Jagdambasingh, Jaya singh, Photochemisty& Pericyclic Reaction, New age international publishers 2012
References	
1	M.S Yadav Electrochemistry- Anmol Publication Pvt Ltd. New Delhi, 2011
2	J.G.Calverts&J.N.Pitts - An introduction to Photochemistry, New age international p Ltd., New Delhi. Wells.
E-References	
1	http//www.engr.uconn.edu/~jmfent/CHEG320_electrochemistry%20lectures.pdff33079
2	https //web.stanford.edu/group/burnslab/meetings/13_01_24_QOphotochemistry.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.					
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**
Department	**Chemistry**		Semester			**4**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P4CHE07	ELECTIVE IV: Environmental Chemistry	5			03	25	75	100
Course Objectives	To impart knowledge in the field of environment, pollution, water quality, water treatment, industrial, agricultural pollutants, water management and acquire knowledge on the structure of atmosphere.							

COs	**COURSE OUTCOME**
CO 1	Students will acquire sound knowledge of environmental chemistry
CO 2	Students learn the importance of water management
CO 3	Students will acquire knowledge about pollution from industries
CO 4	Students will acquire knowledge about pollution from agricultural wastes
CO 5	Students will evaluate the waste management
Pre-requisites	

KNOWLEDGE LEVELS (KLs)

1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing

CO / PO / PSO/ KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	1	1	2	2	3	1	1	2

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

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Fundamentals of Environmental Chemistry**	**Hours**	**15**
	Concept of environmental chemistry, Composition of atmosphere, vertical temperature and vertical structure of the atmosphere. Environmental pollution: Types and sources of Pollutants - air, water and soil pollution. Prevention and control of pollutions. . Biogeochemical cycles C, N, P, S and O. Biological control of chemical factors in the environment.		
Unit - II	**Water Chemistry**	**Hours**	**15**
	Characteristics of water, Quality of natural water, quality requirements of portable water, organic, humic and colloidal material in water, chemical composition of water bodies, Commercial water purification method- reverse osmosis method-disinfection of water-purification method of water for industrial purpose- lime-soda process, ion exchange process, Zeolite process. Water pollution and its environmental impact, eutrophication, Water quality parameters: pH, conductivity, TDS, DO, BOD and COD. Role of water in the environment- Hydrological cycle.		
Unit - III	**Atmospheric Pollutants**	**Hours**	**15**
	Atmospheric chemistry-Particles, ions and radicals in the atmosphere. Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants. Oxygen and ozone chemistry. Chemistry of air pollutants, Photochemical smog. Methods of monitoring and control of air pollution- SO_2, NOx, CO, SPM. Effects of pollutants on human beings, plants, animals and materials. Air quality Standards		

Unit - IV	**Soil and sediment geochemistry**	**Hours**	**15**
	Soil and sediment geochemistry-Inorganic and organic components of soil, Weathering of rocks, rock forming minerals, Soil properties, acid-base and ion-exchange reaction in soil, Macro and micronutrients in soil, Nitrogen pathways and NPK in soils, Interior of the earth minerals and rocks- earth processes- plate tectonics- sea floor spreading, mountain building, rock deformation		
Unit - V	**Waste Management and Recycling**	**Hours**	**15**
	Sources and classification of waste. Waste management - Land filling - Incineration - Disposal of medicinal waste - New technique to treat industrial and farm effluents - Reduce, reuse and recycle - Wealth from waste recycling - Recycling technique - Utilizing agricultural waste - Energy Recovery from Waste - Municipal waste into road making - Electricity from tannery waste - Vermicomposting - biogas – Plastic recycling techniques - Waste water and its treatment - primary treatment pre-treatment – sedimentation – Flotation, recycling of sewage - Removal of hazardous wastes from contaminated metals.		
	Total Hours		**75**

Text Books	
1	Sharma and Kaur, Environmental Chemistry, Krishna Publishers, New Delhi, 2000.
2	Dara, S.S., Environmental Pollution and Control, S.Chand& Co., New Delhi, First Edition, 1993.
3	S.E Manahan, Environmental Chemistry, Lewis Publishers, London, 2001.
References	
1	De, A.K., Environmental Chemistry, New Age International Publishers Private Ltd., New Delhi, Fifth Edition, 2008.
2	Sodhi, G.S., Fundamantal Concepts of Environmental Chemistry, Narosa Publishing House Pvt. Ltd., New Delhi, Third Edition, 2009.
3	Jadhav H.V Elements of Environmental Chemistry, Himalaya. (1992)
E-References	
1	www.purdueglobal.edu/degree-programs/legal-studies/bachelor-environmental-policy-management
2	www.onlinecolleges.net/degrees/environmental-science

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.						
Programme	**M.Sc**	Programme Code	**PCH**		Regulations		**2020-2022**
Department	**Chemistry**		Semester				**4**
Course Code	Course Name		Periods per Week		Credit	Maximum Marks	
			L	T P	C	CA	ESE Total
22P4CHE08	ELECTIVE IV: Green Chemistry		5		03	25	75 100
Course Objectives	1. To design and produce cost-competitive chemical products 2. To processes that attain the highest level of the pollution-prevention hierarchy by reducing pollution at its source						

COs	**COURSE OUTCOME**
CO 1	Students will acquire sound knowledge of Green chemistry
CO 2	Students learn new beneficialsustainable substances and processes
CO 3	Students will acquire knowledge about pollution from industries
CO 4	Students will acquire knowledge about pollution from agricultural wastes
CO 5	Students will evaluate the waste management
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3

CO / PO Mapping
(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	**Programme Specific Outcome (POs)**				
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of theSyllabus		
Unit - I	**Introductions**	**Hours**	**15**
	Green chemistry-relevance and goals, Anastas' twelve principles of green chemistry - Tools of green chemistry: alternative starting materials, reagents, catalysts, solvents and processes with suitable examples.		
Unit - II	**Solvent free reactions, Ionic liquids**	**Hours**	**15**
	Exploration of solvent free reactions – Microwave assisted organic synthesis – Functionalgroup transformations – Protection and deprotection reactions, Condensation reactions,reduction, oxidation and multi-component reactions. Ionic liquids and PTC Introduction – synthesis of ionic liquids – physical properties – applications in alkylation – hydroformylations – expoxidations – synthesis of ethers – Friedelcraft reactions – Diels-Alder reactions – Knoevengal condensations – Wittig reactions – Phase transfer catalyst - Synthesis – applications		
Unit - III	**Supported catalysts&Eco-friendly green Techniques**	**Hours**	**15**
	Biocatalysts – Modified biocatalysts – Transition metal catalysts – Supported metal catalysts. Eco-friendly synthesis and reactions of unsaturated nitroalkanes. Heterogenized reactions – Mineral solid catalysed reactions – Solid supported catalysts –Super critical fluids.A photochemical alternative to Friedel-crafts reactions - Dimethyl carbonate as a methylating agent – the design and applications of green oxidants – super critical carbon dioxide for synthetic chemistry.		
Unit - IV	**Alternative Treatment Technologies**	**Hours**	**15**

	Oxidation at ambient conditions for wastewater treatment – Photocatalytic reactions – Electrocatalytic reactions – Fentons chemistry – Hybrid processes.Chemical methods for dye removal – Oxidative processes – physical treatments –Biological treatments.		
Unit - V	**Exploration of Green Chemistry**	**Hours**	**15**
	Trace element speciation by hyphenated techniques – tools for analytical speciation. Green chemicals – Prospects and future in designing new drugs. Designing of next generation agrochemicals from nature.		
	Total Hours		**75**

Text Books	
1	Rashmi Sanghi and M.M.Srivastava (Eds.), Green Chemistry – Environment friendly alternatives, Narosa Publishing house, New Delhi, 2003.
2	P.T.Anastas and J.C.Warner, Green Chemistry: Theory and Practice, Oxford Science Publications, Oxford, 1998
3	P.Tundo and P.T.Anastas(Eds.) Green Chemistry: Challenging Perspectives, Oxford University Press, Oxford, 2000
References	
1	P.T.Anastas and T.C.Williamson(Eds.) Green Chemistry: Frontiers in Chemical Synthesis and processes, Oxford University Press, Oxford, 1985.
2	A.S.Matlach, Introduction to Green Chemistry, Marcel Decker Inc.. New York, 2001
3	Green Chemistry – Environmentally benign reactions – V. K. Ahluwalia. Ane Books India (Publisher). (2006).
4	Green Chemistry – Designing Chemistry for the Environment – edited by Paul T. Anastas& Tracy C. Williamson. Second Edition, (1998).
5	Green Chemistry – Frontiers in benign chemical synthesis and processes- edited by Paul T. Anastas& Tracy C. Williamson. Oxford University Press, (1998).
6	Green Chemistry – Environment friendly alternatives- edited by Rashmi Sanghi& M. M. Srivastava, Narora Publishing House, (2003).

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**		Regulations	**2022-2024**		
Department	**Chemistry**		Semester			**4**		
Course Code	Course Name		Hours per Week		Credit	Maximum Marks		
			L	T P	C	CA	ESE	Total
22P4CHP06	Physical Chemistry Non-Electrical Practical			6	04	40	60	100
Course Objectives	1. To apply the principles of phase rule, adsorption in the analysis of physical and chemical properties of the given compounds 2. To develop laboratory skills 3. To the ability to work with instruments independently.							

COs	**COURSE OUTCOME**
CO 1	Students will understand the breadth and concepts of physical chemistry.
CO 2	Construct and explain phase diagram for multi-component system
CO 3	Investigate the mechanism of kinetics of reaction.
CO 4	Students will analyze the possible errors in phase studies.
CO 5	Students will evaluate the adsorption mechanism with time.
Pre-requisites	

KNOWLEDGE LEVELS (KLs)			
1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Synthesizing			
CO / PO / PSO/ KL Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			
COs	**KLs**	**POs**	**KLs**
CO 1	4	PO 1	2
CO 2	1	PO 2	1
CO 3	3	PO 3	5
CO 4	3	PO 4	5
CO 5	2	PO 5	4
PSO 1	3	PO 6	6
PSO 2	2	PO 7	2
PSO 3	2	PO 8	3
CO / PO Mapping **(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)**			

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	2	2	3	1	1	2
CO2	2	3	1	1	1	1	2	1
CO3	2	1	1	1	2	1	2	3
CO4	1	1	3	3	2	2	1	1
CO5	1	1	2	2	1	3	1	1

CO / PSO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)					
COs	Programme Specific Outcome (POs)				
	CO1	CO2	CO3	CO4	CO5
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

	Content of the Syllabus		
Unit - I	**Non- Electrical Experiments**	Hours	75
	1. Phase diagram of a binary system -Simple Eutectic formation 2. Phase diagram of a two-component system forming compound (with congruent melting point). 3. Phase diagram of a three-component liquid system (with one partially miscible pair) (Toluene-Water- Acetic acid). 4. Heat of solution of benzoic acid in water. 5. Verification of Freundlich adsorption isotherm (Adsorption of oxalic acid on Charcoal). 6. Comparison of strengths of three acids from kinetic study (Iodination of acetone). 7. Determination of E_a and A (for the hydrolysis of ethyl acetate at different temperatures). 8. Estimation of KI by partition method. 9. Primary salt effect (on the kinetics of reaction between S2O82- and I-). 10. Determination of molecular weight by Rast's micro method.		
	Total Hours		**75**

Text Books and References	
1	P.S. Sindhu, Practicals in Physical Chemistry, 1st Edition, Macmillan, India (2006).

2	V. Venkateswaran, R. Veeraswamy and A. R. Kulandaivelu, Basic Principles of Practical Chemistry, New Delhi, S.Chand & Co, (1995).
3	B Viswanathan, P.S. Raghavan, Practical Physical Chemistry, Viva Books Private Limited, (2005).
E-References	
1	https://books.google.co.in/books/about/Practicals_in_Physical_Chemistry.
2	http://www.cffet.net/sia-e/2_Pot_titr.pdf

Signature of BOS Chairman

	VIVEKANANDHACOLLEGEOFARTSANDSCIENCESFORWOMEN (AUTONOMOUS) Elayampalayam,Tiruchengode-637205.							
Programme	**M.Sc**	Programme Code	**PCH**			Regulations		**2022-2024**
Department	**Chemistry**		Semester					**3**
CourseCode	CourseName		Periods per Week			Credit	MaximumMarks	
			L	T	P	C	CA	ESE	Total
20P3CHED01	ELECTIVEPAPER: Applied Polymer Chemistry		5			04	25	75	100
Course Objectives	Toimpart theknowledge inthefieldof polymer chemistry. Toimpart knowledge inthe preparation of syndiotactic, atactic and isotactic polymers using Zeiler-Natta catalyst.To impart understanding in the field of processing of polymers. To explore the applications of various synthetic polymers.							

COs	**COURSEOUTCOME**
CO1	Studentsenabletounderstandvariousmethodsofpolymer preparation.
CO2	Acquireknowledgeabouttypesofpolymersandprocessingtechniques.
CO3	StudentsknowMolecularweightdeterminationofpolymers.
CO4	Studentswillanalyzethevariousprocessingofpolymers
CO5	Studentsenabletounderstandimportanceofpolymersusedforcommercialapplications.
Pre-requisites	

KNOWLEDGELEVELS			
1.Remembering,2.Understanding,3.Applying,4.Analyzing,5.Evaluating,6.Synthesizing			
CO/PO/KLMapping (3/2/1indicatesthestrengthofcorrelation,3-strong,2-medium,1-weak)			
Cos	KLs	POs	KLs
CO1	2	PO1	2
		PO2	1
CO2	1	PO3	5
		PO4	5
CO3	5	PO5	4
		PO6	6
CO4	3	PO7	2
		PO8	4
CO5	2	PO9	1
		PO10	3
PSOs	KLs	PO11	3
		PO12	2

PSO1	3	PO13	1
PSO2	4	PO14	6
PSO3	1	PO15	3

CO/POMapping
(3/2/1indicatesthestrengthofcorrelation,3-strong,2-medium,1-weak)

COs	ProgrammeOutcome(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO12	PO13	PO14	PO15
CO1	3	2	1	1	1	1	1	1	2	2	3	2	1	2
CO2	2	3	1	1	1	1	2	1	3	1	2	3	1	1
CO3	1	1	3	3	2	2	1	2	1	1	1	1	2	1
CO4	2	1	1	1	2	1	2	2	1	3	2	1	1	3
CO5	3	2	1	1	1	1	1	1	2	2	3	2	1	2

CO/PSO Mapping
(3/2/1indicatesthestrengthofcorrelation,3-strong,2-medium,1-weak)

Cos	Programme SpecificOutcome (POs)				
	CO1	CO2	CO3	CO4	CO5
PSO1	2	1	1	3	2
PSO2	1	1	2	2	1
PSO3	2	3	1	1	2

Course Assessment Methods

Direct

1. Continuous AssessmentTestI,II&Model
2. Assignment
3. EndSemester Examinations

Indirect

1. Course End Delivery

Content of the Syllabus

Unit-I	**BasicConcepts**	**Hours**	15
	Monomers, Polymers-natural, Semi-synthetic, synthetic degree of polymerization, Linear, branched and network Polymers. Addition polymerization: Condensation Polymerization; Thermoplastic and		

	thermosetting polymers - Elastomers, fibers and resins. Techniques of polymerization - bulk solution, emulsion and suspension.		
Unit-II	**KINETICS AND MECHANISM**	**Hours**	15
	Kinetics and mechanism of polymerization - free radical, cationic, anionic and coordination polymerization (Ziegler-Natta Catalyst). Copolymerization - kinetics (Detailed Study). General characterization-kinetic chain length-degree of polymerization, chain transfer - initiators - inhibitors - retarders.		
Unit-III	**MolecularWeight and Properties**	**Hours**	15
	Importance of molecular weight – Average molecular weight -Number average, weight average and viscosity average molecular weights. Measurement of molecular weights- Viscosity, light scattering, osmotic and ultracentrifugation methods.		
Unit-IV	**Structure Properties and Analysis**	**Hours**	15
	Structure - property relationship - mechanical properties, thermal properties - glass transition temperature - factors affecting glass transition temperature - crystallinity and melting point - related to structure Crystalline nature - X-Ray diffraction - Differential Scanning Calorimetry (DSC) - Thermo Gravimetric Analysis.		
Unit-V	**ADVANCES IN POLYMERS**	**Hours**	15
	Biopolymers - biodegradable polymers - biomedical polymers - poly electrolytes - conducting polymers - high temperature and fire retardant polymers - polymer blend - polymer composites - polymer nanocomposites - IPN inter penetrating network polymers - electroluminescent polymers.		
Total Hours			**75**

TextBooks	
1	V.R.Gowariker,N.V.ViswanathanandJ.Sreedhar,PolymerScience,NewAgeInt.,(1986).
References	
1	F.W.Billmeyer,TextBookofPolymerScience,3rdEdition,J.Wiley,(2003).
2	H.R.AlcockandF.W.Lamber,ContemporaryPolymerChemistry,PrenticeHall,(1981).

3	P.J.Flory,PrinciplesofPolymerChemistry,CornellUniversitypress,NewYork,(1953).
4	G.Odian,PrinciplesofPolymerization,2ndEdition,John Wiley&Sons,NewYork,(1981).
5	Roy W. TessGary W. Poehlein , Applied Polymer Science, American Chemical Society, Volume 285, 2021.
E-References	
1	http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch8/vsepr.htm
2	https://chem.libretexts.org
3	http://www.chem.iitb.ac.in/people/Faculty/prof/pdfs/L5.pdf

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.				
Programme	**M.Sc**	Programme Code	**PCH**	Regulations	**2022-2024**
Department	**Chemistry**		Semester		**3**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P3CHED02	EDC: DAIRY CHEMISTRY	4			03	25	75	100
Course Objectives	To impart the basic knowledge on all aspects of milk lipids and to project the importance of milk lipids in the quality of milk products as well as in human health. To impart knowledge on different aspects of milk proteins. To project the physico-chemical changes and effects of various milk constituents of the milk products							

COs	**COURSE OUTCOME**
CO 1	Students will be known to the composition of lipids in milk.
CO 2	Students can able to understand the chemical properties and secondary products of milk.
CO 3	Students can able to understand the isolation of proteins in milk.
CO 4	Knowledge of students will be enriched with knowing the physico-chemical properties of milk proteins.
CO 5	Students will systematically learn about the chemistry of milk products.
Pre-requisites	

KNOWLEDGE LEVELS

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

Cos	KLs	POs	KLs
CO 1	4	PO 1	2
		PO 2	1
CO 2	1	PO 3	5
		PO 4	5
CO 3	3	PO 5	4
		PO 6	6
CO 4	5	PO 7	2
		PO 8	4

CO 5	6	PO 9	1
		PO 10	3
PSOs	KLs	PO 11	3
		PO 12	2
PSO 1	3	PO 13	1
PSO 2	4	PO 14	2
PSO 3	1	PO 15	1

CO / PO Mapping
(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	1	1	2	2	3	1	1	3	1	2	2	1	1	1	2
CO2	2	3	1	1	1	1	2	1	3	1	1	2	3	1	1
CO3	2	1	1	1	2	1	2	2	1	3	3	2	1	1	3
CO4	1	1	3	3	2	2	1	2	1	1	1	1	1	2	1
CO5	1	1	2	2	1	3	1	1	1	1	1	1	1	3	1

CO / PSO Mapping
(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

Cos	**Programme Specific Outcome(POs)**				
	CO1	CO2	CO3	CO4	CO5
PSO1	1	3	2	2	1
PSO2	2	2	1	3	2
PSO3	2	1	2	1	1

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II & Model
2. Assignment
3. End Semester Examinations

Indirect

1. Course End Delivery

Content of the Syllabus

Unit - I	**Composition of Milk**	Periods	15
	Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk -colour, odour, acidity, specific gravity, viscosity and conductivity – Factors affecting the composition of milk - adulterants, preservatives with neutralizer examples and their detection- estimation of fat,		

	acidity and total solids in milk.		
Unit - II	**Processing of Milk**	Periods	15
	Microbiology of milk - destruction of micro - organisms in milk, physico –chemical changes taking place in milk due to processing - boiling,pasteurization – types of pasteurization - Bottle, Batch and HTST (HighTemperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.		
Unit - III	**Major Milk products**	Periods	15
	Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition - composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee – major constituents - common adulterants added to ghee and their detection – rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.		
Unit - IV	**Special Milk**	Periods	15
	Standardised milk - definition - merits - reconstituted milk - definition – flow diagram of manufacture - Homogenised milk - flavoured milk – vitaminised milk - toned milk - Incitation milk - Vegetable toned milk - humanized milk -condensed milk - definition, composition and nutritive value.		
Unit - V	**Fermented and other Milk Products**	Periods	15
	Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream,butter milk - Bulgarious milk - acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice–cream, stabilizers - emulsifiers and theirrole-milk powder-definition need for making milk powder dryingprocess-types of drying.		
Total Periods			75

Text Books	
1	Mathur MP, Datta Roy D & Dinakar P. 2008. Text Book of Dairy Chemistry. ICAR.
2	Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021
3	K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006.
4	K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974.
References	
1	Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.
2	P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016
E-References	

1	https://dairyprocessinghandbook.tetrapak.com/chapter/chemistry-milk

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) Elayampalayam, Tiruchengode-637 205.							
Programme	**M.Sc**	Programme Code	**PCH**			Regulations		**2022-2024**
Department	**Chemistry**		Semester					**4**
Course Code	Course Name		Hours per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P4CHPR01	PROJECT			5		05	40	60	100
Course Objectives	. To inculcate the habit of literature survey among the students. . To offer skill based knowledge to the students. . To facilitate the students towards basic research and development.							