GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005.

(Re-accredited with 'A' Grade by NAAC and Affiliated to Bharathidasan University, Tiruchirappalli)

PG AND RESEARCH DEPARTMENT OF CHEMISTRY

M.SC., CHEMISTRY COURSE STRUCTURE UNDER CBCS SYSTEM

(For the candidates admitted from the year 2021-2022 onwards)

About the Department of Chemistry

The Post Graduate (PG) Department of Chemistry was started in the year 2011 with sanctioned strength of 25. The students and faculty in our department create experimental and theory knowledge to develop students community. The department is located in close proximity to other department and industries. We are dedicated to developing the future generation of students and scholars in chemical sciences developing a learning environment.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS)

VISION

It is our vision to persuade every mind in this temple of learning to tirelessly seek the truth to face the challenges of the times and honestly participate in the establishment of universal peace, progress and love.

MISSION

It is our mission to create in everyone an honest searching mind to be ready for value-based creative citizenship for regional, national and global peace and progress.

DEPARTMENT OF CHEMISTRY

VISION

- The Chemistry Department prepares students for bright future by chemistry Knowledge through teaching and guiding services.

MISSION

- The Chemistry Department provides rigorous preparation of students in Chemistry.
- We are dedicated to standards for content chemistry knowledge.
- The Faculty in the Chemistry Department are committed to science as a Human endeavor.

What is Credit system?

Weightage to a course is given in relation to the hours assigned for the course. The following Table shows the correlation between credits and hours. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work. For **PG** courses, a student must earn a minimum of **90 (+4)** credits as mentioned in the table below. The total number of minimum courses offered by a department is given in the course pattern.

POST GRADUATE COURSE PATTERN (2021 ONWARDS)

PART	SEMESTER	SPECIFICATION	NO. OF COURSES	HOURS	CREDITS	TOTAL CREDITS
III	I - IV	Core courses Theory	**8**	**48**	**41**	**84**
	I - IV	Core courses Practical	**6**	**36**	**18**	
	I- IV	Elective Course	**5**	**30**	**25**	
	II	Extra credit course Internship programme (It should be completed in the semester Holidays)	**1**	**-**	**(2)**	**(4)**
	III	Extra Credit Course Massive Open Online Course (MOOC)	**1**	**-**	**(2)**	
	IV	Project Work	**1**	**6**	**6**	**6**
TOTAL				**120**	**90 + (4)**	**90 + (4)**

Course Pattern

The Postgraduate degree course consists of five vital components. They are as follows:

Part - III: Core Course (Theory), Core Practical, Core Electives, Project Work, Extra credit course.

Part - IV: Internship Programme, MOOC's.

Core Courses

A core course is the course offered by the parent department related to the major subjects, components like theories, practical's, Project work, field visits and etc.

Core Elective

The core elective course is also offered by the parent department. The objective is to provide choice and flexibility within the department. There are THREE core electives. They are offered in different semesters according to the choice of the college.

Extra Credit Courses

In order to facilitate the students gaining extra credits, the extra credit courses are given. There are two extra credit courses - Massive Open Online Courses (MOOC) and Skill-based Course - offered in the III and V

Semesters respectively. According to the guidelines of UGC, the students are encouraged to avail this option of enriching by enrolling themselves in the MOOC provided by various portals such as SWAYAM, NPTEL, etc. Skill based course is offered by the department apart from their regular class hours.

Subject Code Fixation

The following code system (11 characters) is adopted for Under Graduate courses:

Year of Revision	PG Code of the Dept	Semester	Specification of Part	Running number in the part
↓	↓	↓	↓	↓
2021	**P21**	***x***	***x***	***xx***
2021	**PCH**	**1**	**x**	**1**

For example:

I M.Sc., CHEMISTRY - INORGANIC CHEMISTRY - I

The code of the paper is **P21 CH 1C1.**

Thus, the subject code is fixed for other subjects.

EXAMINATION

Continuous Internal Assessment (CIA):

PG - Distribution of CIA Marks	
Passing Minimum: 50 Marks	
Theory CIA Maximum = 25	**Theory CIA Minimum = 10**
Practical CIA Maximum = 40	**Practical CIA Minimum = 16**

End - Semester Tests

Centralized - Conducted by the office of Controller of Examinations.

Semester Examination

Testing with Objective and Descriptive questions.

Section - A: 10 Questions x 2 Marks = 20 Marks (No Choice - Two questions from each unit)

Section - B: 5 Questions x 5 Marks = 25 Marks (Either… or Type - One pair from each unit)

Section - C: 3 Questions x 10 Marks = 30 Marks (3 Out of 5 - One question from each unit)

Duration of Examination:

3- Hours examination for courses.

Grading System

1. Grading

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added. The marks thus obtained, will then be graded as per the scheme provided in Table 1.

From the second semester onwards the total performance within a semester and the continuous performance starting from the first semester are indicated by **Semester Grade Point Average (GPA)** and **Cumulative Grade Point Average (CGPA),** respectively. These two are calculated by the followingformulae

$$\text{GPA} = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i} \qquad \text{WAM (Weighted) Average Marks} = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$$

Where, 'C_i' is the Credit earned for the Course - i,

'G_i' is the Grade Point obtained by the student for the Course 'i'.

'M' is the marks obtained for the course 'i', and

'n' is the number of Courses **Passed** in that semester.

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

2. Classification of Final Results

i) For each of the three parts, there shall be separate classification on the basis of the CGPA, as indicated in the following Table - 2.

ii) For the purpose of Classification of Final Results, the Candidates who earn CGPA 9.00 and above shall be declared to have qualified for the Degree as 'Outstanding'. Similarly, the candidates who earn the CGPA between 8.00 - 8.99, 7.00 - 7.99, 6.00 - 6.99 and 5.00 - 5.99 shall be declared to have qualified for their Degree in the respective programmes as 'Excellent', 'Very Good', 'Good' and 'Above Average' respectively.

iii) Absence from an examination shall not be taken as an attempt.

Table - I - Grading of the Courses

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above but below 90	9	A+
70 and above but below 80	8	A
60 and above but below 70	7	B+
50 and above but below 60	6	B
40 and above but below 50	5	C
Below 40	0	RA

Table - 2 - Final Result

CGPA	Classification of Final Results	Corresponding Grade
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	RA	Re - Appearance

Credit based weighted Mark System is adopted for individual semesters and cumulative semesters in the column 'Marks Secured' (for 100).

Declaration of Result:

Mr./Ms. _____ has successfully completed the Post Graduate in _____ programme. The candidate's Cumulative Grade Point Average (CGPA) in Part - III is _____ and the class secured is _____ by completing the minimum of **90** credits. The candidate has acquired _____ (if any) extra credits offered by the parent department courses.

Programme Outcomes

1. Chemistry proficiency in all four disciplines of chemistry, analytical, organic, inorganic and physical.
2. Students acquire the opportunities related to chemistry in government services through public service commission particularly in the field of food safety and health inspector.
3. Students achieve the skills required to succeed in industries, like rubber, petrochemical, food processing, fertilizers and paper.
4. Students understand the importance of periodic table including their physical and chemical nature and role in the daily life.
5. Students are able to use modern library searching and methods to obtain information about a topic, chemical, chemical technique or an issue relating to chemistry.

Programme Specific Outcomes

1. After the completion of the programme the student will get global level research opportunities to pursue Ph. D program targeted approach of CSIR - NET examinations.
2. To understand and apply principles of organic chemistry for understanding the scientific phenomenon in reaction mechanisms.
3. The importance of various elements present in the periodic table, coordination chemistry and structure of molecules, properties of compounds, structural determination of complexes using theories and instruments.
4. To understand the metal complexes in biological system.
5. To understand the physical aspects of atomic structure, molecular thermodynamics, quantum mechanics, reaction kinetics and group theory.
6. The students are capable of carry out experiments in organic estimation derivatives, semi-micro analysis, Potentiometry, Conductometry, UV - Visible experiments.

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M.Sc., CHEMISTRY COURSE STRUCTURE UNDER CBCS SYSTEM

(For the candidates admitted from the year 2021-2022 onwards)

SEMESTER	COURSE	COURSE TITLE	COURSE CODE	INSTR HOURS. WEEK	CREDIT	EXAM HOURS	MARKS		TOTAL
							INT	ESE	
I	Core Course - I	Inorganic Chemistry - I	**P21CH1C1**	**6**	**5**	**3**	**25**	**75**	100
	Core Course - II	Organic Chemistry - I	**P21CH1C2**	**6**	**5**	**3**	**25**	**75**	100
	Core Course - III	Inorganic Chemistry Practical - I	**P21CH1C3P**	**6**	**3**	**6**	**40**	**60**	100
	Core Course - IV	Organic Chemistry Practical - I	**P21CH1C4P**	**6**	**3**	**6**	**40**	**60**	100
	Elective Course - I	Pharmaceutical Chemistry	**P21CH1E1**	**6**	**5**	**3**	**25**	**75**	100
				30	**21**				**500**
II	Core Course - V	Inorganic Chemistry - II	**P21CH2C5**	**6**	**5**	**3**	**25**	**75**	100
	Core Course - VI	Physical Chemistry - I	**P21CH2C6**	**6**	**5**	**3**	**25**	**75**	100
	Core Course - VII	Inorganic Chemistry Practical - II	**P21CH2C7P**	**6**	**3**	**6**	**40**	**60**	100
	Core Course -VIII	Organic Chemistry Practical - II	**P21CH2C8P**	**6**	**3**	**6**	**40**	**60**	100
	Elective Course - II	Solid State Chemistry and Nano Science	**P21CH2E2**	**6**	**5**	**3**	**25**	**75**	100
	Extra credit course	Internship programme (It should be completed in the semester Holidays)			**(2)**				
				30	**21**				**500**
III	Core Course - IX	Organic Chemistry - II	**P21CH3C9**	**6**	**5**	**3**	**25**	**75**	100
	Core Course - X	Physical Methods in Chemistry - I	**P21CH3C10**	**6**	**5**	**3**	**25**	**75**	100
	Core Course - XI	Physical Chemistry - II	**P21CH3C11**	**6**	**6**	**3**	**25**	**75**	100
	Core Course - XII	Physical Chemistry Practical - I	**P21CH3C12P**	**6**	**3**	**6**	**40**	**60**	100
	Elective Course - III	Polymer Chemistry	**P21CH3E3**	**6**	**5**	**3**	**25**	**75**	100
	Extra credit course	Massive Open Online Course (MOOC)			**(2)**				
				30	**24**				**500**
IV	Core Course - XIII	Physical Chemistry Practical - II	**P21CH4C13P**	**6**	**3**	**6**	**40**	**60**	100
	Core Course - XIV	Physical Methods in Chemistry - II	**P21CH4C14**	**6**	**5**	**3**	**25**	**75**	100
	Elective Course - IV	Analytical chemistry	**P21CH4E4**	**6**	**5**	**3**	**25**	**75**	100
	Elective Course - V	Green chemistry	**P21CH4E5**	**6**	**5**	**3**	**25**	**75**	100
	Project Work	Project Work	**P21CH4PW**	**6**	**6**	**3**	**	**	100
				30	**24**				**500**
TOTAL				**120**	**90 + (4)**				**2000**

* Viva Voce Exam 20 Marks; ** Dissertation - 80 Marks.

Internship Programme should be completed during the second semester holidays.

CHAIRMAN

BOARD OF STUDIES IN CHEMISTRY **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 5	COURSE CODE: P21CH1C1

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - I SEMESTER - CORE COURSE - I

(For the candidates admitted from the year 2021-2022 onwards)

INORGANIC CHEMISTRY - I

Course Educational Objectives:

1. To study of the bonding models and structure of solids.
2. To study the solid state chemistry and close packing of spheres.
3. To understand the basic acid base concept.

UNIT - I	**Bonding Models I** Ionic bond - Lattice energy and 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 H_2 - Ionization of diatomic molecules.
UNIT - II	**Bonding Models II** Hybridization - Molecular orbital equivalent of hybridization-Delocalization - Resonance - Molecular orbital equivalent of resonance. Fajan's rule - Results of polarization - Covalent bonding in ionic solid - Charge distribution in molecules - Dipole moment - Determination and applications.
UNIT - III	**Solid State Chemistry I** Cells and description of crystal structure - Close packing of spheres - Packing fraction, Packing efficiency - Hexagonal close packed (HCP) and cubic close packed structures (CCP) - Relative density of packing in simple cubic, CCP, HCP and BCC - Tetrahedral and octahedral holes - Limiting radius-ratio rule. Radius ratio for trigonal, tetrahedral, octahedral and cubic sites - Radius ratio and shape of ionic crystals - Structures of cesium chloride, sodium chloride, zinc blende, fluorite, rutile and calcite.
UNIT - IV	**Solid State Chemistry II** Perovskite structure of spinels - Stoichiometric defects - Schottky and Frenkel defects - Non- stoichiometric defects - Metal excess and metal deficiency defects - Extended defects - Line and plane defects. Band theory - Semiconductors - Intrinsic and extrinsic type - Fermi level- Flow of current in semiconductors - Band structure - p and n type semiconductors - p-n junction - Superconductivity -Photovoltaic effect. Solid state reactions - Classification - Thermal decomposition reactions - Reaction between two solids - Improving reactivity of solids.
UNIT - V	**Acid - Base Concept** Solvent system concept - Lewis concept - Classification of Lewis acids - Lewis acid - base reactions - Solvolysis and formation of coordination compounds. Inductive effects - Strength of oxyacids - Pauling's rule - Acidity of cations in aqueous solution - Hard and Soft Acids and Bases (HSAB) - Pearson's principle - Applications of HSAB theory.

Reference Books:

1. Inorganic Chemistry, J.E.Huheey, E.A.Keither and R.L.Keiter, Harper Collins College Publisher, New York, 4th edn., 1993.
2. Inorganic Chemistry, D.F.Shriver, P.W.Atkins and CH.Langford, ELBS, Oxford University Press, 2000.
3. Modern Inorganic' Chemistry, W.E.Jolly, McGraw Hill International edn., New York, 1994.
4. Theoretical Principles of Inorganic Chemistry, GS.Manku, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1994.
5. Concepts and Models of Inorganic Chemistry, B.Douglas, D.H.Me Daniel and J.J.Alexander, John Wiley and Sons, New Delhi, 2001.
6. Solid State Chemistry, D.K.Chakrabarthy, New Age International Publishers, New Delhi, 2005.

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Course outcomes

CO1	Explain about the ionic bond, VB theory and MOT.
CO2	Examine the hybridization of molecular orbital's and to determine the dipole moment.
CO3	Identify the packing efficiency of crystal structure and calculate the radius ratio.
CO4	Outline the study of stoichiometric and non - stoichiometric defects and the types of semiconductors.
CO5	Evaluate the concept of acid base theory and to study the strength of oxyacids.

Nature of Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Outcome (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcome (PSOs)**						**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	
CO1	**5**	**5**	**4**	**4**	**4**	**3**	**3**	**4**	**4**	**3**	**4**	**3.91**
CO2	**4**	**4**	**4**	**4**	**4**	**4**	**3**	**3**	**4**	**3**	**4**	**3.72**
CO3	**5**	**5**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**5**	**3.91**
CO4	**4**	**4**	**4**	**5**	**4**	**5**	**3**	**3**	**3**	**3**	**3**	**3.72**
CO5	**5**	**3**	**4**	**4**	**5**	**3**	**4**	**4**	**3**	**4**	**4**	**3.91**
Mean overall score												**3.83**

Result: The Score for this course is 3.83 (High Relationship)

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. R.SRINIVASAN

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 5	COURSE CODE: P21CH1C2

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - I SEMESTER - CORE COURSE - II

(For the candidates admitted from the year 2021-2022 onwards)

ORGANIC CHEMISTRY - I

Course Educational Objectives:

1. To study the reaction mechanisms and reaction intermediates.
2. To study the electronic effects, aromaticity and stereochemistry.
3. To understand the substitution and elimination reactions.

UNIT - I	**Methods of Determination of Reaction Mechanisms** **Thermodynamic and Kinetic Requirements of Reactions:** Hammond postulates - Thermodynamic and kinetic control - methods of determination of reaction mechanisms - product analysis - determination of the presence of intermediate, isolation, detection, trapping - cross over experiments - isotopic labeling - isotopic effect - stereo chemical evidence - kinetic evidence. Quantitative treatment of the structural effects on reactivity - Substituent's effect - Origins of Hammett equation - Principles of Hammett correlation - Effect of structure on reaction mechanisms Hammett parameters; σ and ρ, modified forms of Hammett equation - Taft Equation.
UNIT - II	**Reactive Intermediates:** Structure, stability, generation and reactivity of carbocations - Bridged (non-classical) carbocations. Structure, stability, generation and reactivity of carbanions - Acidity of hydrocarbons. Structure, reactivity and generation of carbenes - Reactions of carbenes: Cycloaddition including Simmons-Smith reaction - Insertion to C-H and X-H bonds - Rearrangements - Reactions with nuclophiles. Structure, reactivity and generation of nitrenes - Reactions of Nitrenes: Cycloaddition, Insertion and Rearrangements. Structure, reactivity and generation of Benzynes - Reactions of Benzynes: Nucleophilic addition, Cycloaddition. Generation and characterization of Radicals - Radical ions - Reactions of Radicals: Addition of HX, Halomethanes, Reactions involving Bu_3SnH, Substitution of Halides, McMurry and Eglinton Reactions.
UNIT - III	**Electronic Effects & Aromaticity** **Electron Displacement Effects** - Inductive and field effect - Delocalised bonds - Rules of resonance - steric inhibition of resonance, steric enhancement of resonance, Hyperconjucation - Hydrogen bonding - Intra and inter molecular hydrogen bonding - effect of hydrogen bonding and hyperconjugation on physical and chemical properties. Fundamental aspects only. **Aromaticity:** Compounds with aromatic sextets: Five-, six-, seven- and eight - membered rings and other systems - Huckel's theory of aromaticity - Electron occupancy in MO's - NMR concept of aromaticity and antiaromaticity - Systems with $(4n + 2)\pi$ electrons and $4n\pi$

	electrons - Aromatic systems with 2,6,10 π-electrons, alternant and non - alternant hydrocarbons, systems of more than 10 π-electrons annulenes - aromaticity of azulenes, Sydnones - concept of homoaromaticity. Mobius aromaticity - Aromaticity in sydnones and fullerenes - Concept of homoaromaticity - Heteroaromatic molecules.
UNIT - IV	**Stereochemistry** R/S system on nomenclature of central and axially chiral molecules - atropisomerism, isomerism of biphenyls, allenes, spiranes compounds - Geometrical isomerism - E/Z nomenclature - determination of configuration of geometrical isomers - Conformational analysis of n-butane, cyclobutane and decalins. Asymmetric synthesis - substrate controlled methods and auxillary controlled methods - chiral catalyst - Cram's rule - Prelog's rule. Topical relationship in organic molecules - Homotropic, enantiotropy, diastereotopic groups and faces, Pro R and S descriptors and Re and Si for legend - Stereo specific and stereo selective reactions (elementary examples).
UNIT - V	**Reaction Mechanism** **Reaction Mechanism:** Nucleophilic substitution at saturated carbon atom - SN1 and SN2 reactions - mechanism and evidences - effect of structure - neighboring group participation - Non classical carbocations. SN Ar mechanism. **Elimination Reactions:** E1, E2 and E1CB - evidences - effect of structure, solvent and base - Hoffmann and Saytzeff rules - stereochemistry of E1 reaction - Pyrolytic elimination - cis elimination - elimination vs substitution.

Reference Books:

1. Advanced Organic Chemistry, J.March, Wiley Eastern, New Delhi, II edn., 1986.
2. A Guide Book to Mechanism in Organic Chemistry, P.Sykes, Orient Longman, 6th edn., 1988.
3. Applications of Absorption Spectroscopy of Organic Compounds, J.R.Dyer, Prentice-Hall, New Delhi, 1987.
4. Organic Chemistry, I.L.Finar, Vol.2 ELBS, 5th edn., 1974.
5. Molecular Reactions and Photochemistry, C.H.De Puy and O.L. Chapman, Prentice - Hall, New Delhi, 1987.

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

Course outcomes

CO1	Learns the methods of determination of reaction mechanism and reactive intermediates.
CO2	Examine the different reactive intermediates.
CO3	Understands the electronic effects and aromaticity.
CO4	Explain about the basic concepts of stereochemistry.
CO5	Discuss Nucleophilic substitution reaction and elimination reaction.

Nature of Course			
Knowledge and skill		Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Outcome (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcome (PSOs)**						**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	
CO1	**4**	**4**	**4**	**4**	**3**	**3**	**4**	**4**	**4**	**3**	**3**	**3.64**
CO2	**4**	**4**	**4**	**4**	**4**	**4**	**3**	**3**	**4**	**3**	**4**	**3.73**
CO3	**5**	**4**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**5**	**3.82**
CO4	**4**	**4**	**4**	**5**	**4**	**5**	**3**	**3**	**3**	**3**	**3**	**3.72**
CO5	**5**	**3**	**4**	**4**	**5**	**3**	**4**	**4**	**3**	**4**	**4**	**3.91**
Mean overall score												**3.76**

Result: The Score for this course is 3.76 (High Relationship)

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. K.BALASUBRAMANI

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 3	COURSE CODE: P21CH1C3P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - I SEMESTER - CORE COURSE - III

(For the candidates admitted from the year 2021-2022 onwards)

INORGANIC CHEMISTRY PRACTICAL - I

Course Educational Objectives:

1. To learn the semi micro qualitative analysis.
2. To learn the photocolorimetric estimation.

I. Semi - micro Qualitative Analysis

Semi - micro qualitative analysis of a mixture containing two common and two rare cations.

II. Photo colorimetric Estimation

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

Reference Book:

1. V. V. Ramanujam, Semi micro Qualitative analysis.

Course outcomes

CO1	Analysis of a mixture containing two common and two rare captions by semi - micro qualitative Analysis.
CO2	Estimate Cu, Fe, Ni, Cr and Mn using photoelectric colorimeter.

COURSE DESIGNER:

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 3	COURSE CODE: P21CH1C4P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - I SEMESTER - CORE COURSE - IV

(For the candidates admitted from the year 2021-2022 onwards)

ORGANIC CHEMISTRY PRACTICAL - I

Course Educational Objectives:

1. To separate and analyze systematically a given organic compound.
2. To know the preparation and isolation of organic compound.

Qualitative Analysis of an organic mixture containing two components.

Pilot separation, bulk separation, analysis, derivatization.

Preparation of Organic compounds. (Single stage)

(a) methyl - m - nitrobenzoate from methylbenzoate (nitration)

(b) glucose pentaacetate from glucose (acetylation)

(c) resorcetophenone from resorcinol (acetylation)

(d) benzophenone oxime from benzophenone (addition)

(e) o - chlorobenzoic acid from anthranilli+c acid (Sandmayer reaction)

(f) ρ-benzoquinone from hydroquinone (oxidation)

(g) Phenyl-azo-2-napthol from aniline (diazotization)

Reference Books:

Qualitative Organic analysis.
Gnanaprakasam and Ramamoorthe.

Course outcomes

CO1	Analysis of Organic Compounds.
CO2	Single stage preparation.

COURSE DESIGNER:

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NUMBER OF CREDIT: 5	COURSE CODE: P21CH1E1

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - I SEMESTER - ELECTIVE COURSE - I

(For the candidates admitted from the year 2021-2022 onwards)

PHARMACEUTICAL CHEMISTRY

Course Educational Objectives:

1. To study the basic principles and approaches of drug action.
2. To understand the basic concepts of antibiotics, analgesics and antimalarials.
3. To understand the basic concepts of antipyretics and cardiovascular drugs.

UNIT - I	**Drug action and sulpha drugs** Physiochemical properties in relation to biological action - influence of route of administration. Biotransformation - absorption from stomach - absorption from intestines - sites of loss - metabolism and excretion, harmful drugs and their side effects. Sulpha drugs - sulphathiazole, sulphamerazine, sulphaguanidine and other sulpha drugs, - synthesis, mechanism of action - uses.
UNIT - II	**Antibiotics** Antibiotics -A study of Chloramphenicol, Penicillin - semisynthetic Penicillin - gross structural features Streptomycin - Cephalasporin and Tetracycline. Poly~ne antifungal antibiotics - nystatin, fusicidic acid - griesofulvin. (gross structural features not needed).
UNIT - III	**Analgesics and antipyretics** Study of morphine - structure activity relationship (SAR) - morphine analogues - Codeine - synthetic analgesics - pethidines and methadones - narcotic antagonist. Antipyretic analgesics - salicylic acid, pyrazole and para amino phenol derivatives. sedatives:- -Barbiturates, Benzodiazepines.
UNIT - IV	**Cardio Vascular and anti - tubercular drugs** Cardio Vascular Drugs - classification, cardiac glycosides, antihypertensive and hypotensive agents - mode of action - ntiarythamic agents. Anti - tubercular drugs - sulphonamides - sulphones, p - amino salicylic acid - INH - ethambutal, Rifampicin.
UNIT - V	**Antihistamines and antimalarials** Antihistamines - introduction - mode of action of anthistamines - SAR - ethylene diamine, ethyl amine, propyl amine and - cyclizine derivatives - synthesis. Antimalarials - classification - quinine, 4-amino and 8-amino quinolines and pyrimidines.

Reference Books:

1. Medicinal Chemistry -A Burger - Wiley inter Science - N.Y.V ol. I and II, 1990.
2. TB of organic, Medicinal and Pharmaceutical Chemistry, O.Wilson, O.Giswold and F.George J.G., Lippincott Company, Philadelphia, 9th edn., 1991.
3. Bentley and Drivers' TB of Pharmaceutical Chemistry.

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Course outcomes

CO1	Analyze the physiochemical properties in sulpha drugs.
CO2	Learns the importance of antibiotics.
CO3	Learn the applications of analgesics and antipyretics.
CO4	Gains the knowledge of cardiovascular and anti-tubercular drugs.
CO5	Relates the antihistamines and anti - malarias.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	4	4	4	3	3	3	4	3	4	3	3	3.45
CO2	4	4	4	3	4	4	3	3	4	3	4	3.64
CO3	5	4	4	3	4	4	3	3	3	3	4	3.64
CO4	4	4	4	4	4	5	3	3	3	3	3	3.64
CO5	4	3	4	4	4	3	4	4	3	3	4	3.64
Mean overall score												3.61

Result: The Score for this course is 3.61 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

COURSE DESIGNER: Dr. D.RAJADURAI

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 5	COURSE CODE: P21CH2C5

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - II SEMESTER - CORE COURSE - V

(For the candidates admitted from the year 2021-2022 onwards)

INORGANIC CHEMISTRY - II

Course Educational Objectives:

1. To study the structure, reaction mechanism and bonding in coordination chemistry.
2. To understand the M-C bonds and metal carbonyls.
3. To understand the basic concepts of organometallic chemistry.

UNIT - I	**Coordination Chemistry (Bonding)** 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-MO theory - Evidences for pi-bonding.
UNIT - II	**Coordination Chemistry (Structure)** Geometrical and optical isomerism in octahedral and square planar complexes - Stereochemistry of complexes - Symbiosis - Chelate effect - Macrocycles - Magnetic properties - Dia, para, ferro and antiferro magnetisms - Curie's law - Spin isomerism. Stability constants of complexes and their determination - Stability of unusual oxidation states.
UNIT - III	**Coordination Chemistry (Reaction Mechanism)** **Substitution reactions:** General mechanism - Schemes of octahedral, tetrahedral and square planar complexes - Dissociative (D) - Associative (A) - Interchange (I) and dissociation types - Linear free energy relationships Racemisation and isomerisation: Trans - effect - Theories of trans - effect, pi - bonding theory and polarization theory - Application of trans effect - cis effect. Redox reactions: Inner sphere mechanism - The role of bridging ligand - Outer sphere mechanism - The limiting rate law - Theoretical treatment of electron transfer - Simple applications to bio - inorganic chemistry.
UNIT - IV	**Coordination Chemistry (Electronic spectra of complexes)** Quantum numbers of multi - electron atoms - Russell-Sanders coupling - L-S coupling and micro states - Ground state terms for d^1 - d^{10} ions-Derivation of terms for p^2, p^3, d^1 and d^2 configurations. Splitting of free ion terms in octahedral field - correlation diagram - Orgel diagrams for d^1 to d^9 ions and Tanabe - Sugano diagrams for d^2 and d^3 ions.
UNIT - V	**Basic Concepts of Organometallic Chemistry** Valence electron count (16/18 electron rules); structure and bonding in mono and polynuclear metal carbonyls; substituted metal carbonyls and related compounds; synthesis and reactivity of metal carbonyls; vibrational spectra of metal carbonyls; dinitrogen and dioxygen as ligands in Organometallic compounds. Types of M - C bonds; synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes; metallocenes and bent metallocenes; isolobal analogy. Reactions or Organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and deinsertion; catalysis - Hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

Reference Books:

1. Inorganic Chemistry, IV edn, J.E.Huheey, E.A.Keither and R.L.Keiter, Harper Collins College Publisher, New York, 1993.
2. Inorganic Chemistry, G.L.Miessler and D.A.Tarr, Pearson, Prentice Publishers, Delhi, 2009.
3. Inorganic Chemistry, D.F.Shriver, P.W.Atkins and CH Langford, ELBS, Oxford University Press, 2000.
4. Concepts and Models of Inorganic Chemistry, B.Douglas, D.H.Mc Daniel and J.J.Alexander, John Wiley and Sons, New Delhi, 2001.
5. Basic Organometallic Chemistry: Concepts, syntheses and applications of Transistion metal, 2010, CRC Press and Universities Press.

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Course outcomes

CO1	Analyze the theory and limitations of Coordination compounds.
CO2	Learns the structure and properties of Coordination compounds.
CO3	Analysis the reaction mechanism and redox reactions.
CO4	Understands the electronic spectra of the Coordination complexes.
CO5	Gains the basic concepts Organometallic chemistry.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	5	4	4	4	4	4	4	3	4	3	3	3.82
CO2	4	4	4	3	4	3	3	3	3	3	4	3.45
CO3	5	4	4	3	4	4	3	3	3	3	4	3.64
CO4	4	3	4	3	4	5	4	3	3	3	3	3.55
CO5	4	3	4	4	4	3	4	4	3	3	4	3.63
Mean overall score												3.62

Result: The Score for this course is 3.62 (High Relationship)

Nature of Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

COURSE DESIGNER: Dr. R.SRINIVASAN

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 5	COURSE CODE: P21CH2C6

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005
M.Sc., CHEMISTRY - II SEMESTER - CORE COURSE - VI
(For the candidates admitted from the year 2021-2022 onwards)

PHYSICAL CHEMISTRY - I

Course Educational Objectives:

1. To study the different distributions, partition functions, thermodynamic parameters.
2. To study the theories of photochemistry and applications.
3. To understand the Electrochemistry principles and its applications.

UNIT - I	**Chemical Kinetics** Theories of reaction rate- Absolute reaction rate theory (ARRT) - Significance of reaction co - ordinate - Potential energy surfaces - Kinetic isotope effect - Molecular dynamics - Marcus theory of electron transfer processes. Principle of microscopic reversibility - steady-state approximation - Chain reactions: thermal and photochemical reactions between hydrogen and halogens - Explosions and hydrogen - oxygen reactions.
UNIT - II	**Molecular Thermodynamics** Calculation of thermodynamic probability of a system - Difference between thermodynamic proability and statistical probability - Ergodic hypothesis - derivation of Boltzman distribution equation - Physical significance of partition function - Translational, rotational, vibrational and electronic partition functions - Quantum statistics - Bose-Einstein and Fermi - Dirac distribution equations - Comparison of B.E and F.D statistics with Boltzman statistics - Concept of Negative Kelvin Temperature. Relationships between partition function and thermodynamic properties such as E, H, Cp, Cv, P. Derivation PV=RT, molecular interpretation of entropy - Derivation of S=klnW - Establishment of analogues nature of S= klnW to ds=dqrev/T. Calculation of S, A, G etc., from partition functions - Calculation of equilibrium constants for very simple reactions.
UNIT - III	**Phase Equilibrium** Gibbs-phase rule - Derivation - Application to three component system - Graphical representation - System of three liquids - Systems consisting of two salts and water - phase rule -reduced phase rule - one component and two component system. **Photochemistry:** Photophysical processes electronically excited molecules Jablonski diagram - Stern - Volmer equation and its applications - experimental techniques in photochemistry - chemical actinometers - lasers and their applications.
UNIT - IV	**Electrochemistry I** Formation of electrical double layer - electrocapillary curves - Lippmann equation-structure of electrified interfaces - Helmholtz - Perrin model - Gouy - Chapman model - electrode kinetics - derivation of the fundamental equation of electrode kinetics. Butler - Volmer equation - low field and high field approximations - Tafel equation-electro plating - electroless plating - corrosion.
UNIT - V	**Electrochemistry II** Ionic strength - Debye Huckel theory - Debye - Huckel limiting law - relaxation effect - electrophoretic effect - Debye - Huckel - Onsager (DHO) conductance equation - validity of DHO equation-deviations from the DHO equation. Lead - acid batteries - Cadimum - Nickel oxide and Li - ion batteries-charging and discharging reactions - Fuel cells - classification.

Reference Books:

1. Physical Chemistry, P.Atkins and J.D.Paula, 8th edn, Oxford University Press, 2006.
2. Physical Chemistry, Gordon M.Barrow, 6th edn, McGraw - Hill, International, 1996.
3. Thermodynamics for Chemists, S.Glasstone, East - West Press, 1994.
4. Non - equilibrium Thermodynamics - Principles and Applications, C.Kalidas and M.V.Sanganaranya, McMillan, India, 2002.
5. Electrochemistry, S.Glasstone, Affiliated East West Press, 1997.
6. Modern Electrochemistry, J.O.M.Bockris and A.K.N.Reddy, Chapter 7, Plenum Press, New York, 1970.
7. Hand book of batteries and fuel cells, D.Linden, McGraw Hill, 1984.

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Course outcomes

CO1	Understanding of ARRT and Marcus theory.
CO2	Examine the theory of partition function.
CO3	Industrial applications of phase equilibria.
CO4	Developed skills in electrochemical series and electrochemical model.
CO5	Theory behind batteries.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	5	4	4	4	4	4	4	3	4	3	3	3.82
CO2	5	4	4	4	4	4	3	4	3	3	4	3.81
CO3	5	4	4	4	4	4	4	3	3	3	4	3.81
CO4	4	3	4	3	4	5	4	3	3	3	3	3.55
CO5	4	3	4	4	4	3	4	4	3	3	4	3.63
Mean overall score												3.72

Result: The Score for this course is 3.72 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	
Skill oriented	✓	Entrepreneurship oriented	

Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

COURSE DESIGNER: Dr. P.MUTHUKUMAR

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 3	COURSE CODE: P21CH2C7P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - II SEMESTER - CORE COURSE - VII

(For the candidates admitted from the year 2021-2022 onwards)

INORGANIC CHEMISTRY PRACTICAL - II

Course Educational Objectives:

1. To estimate the mixture of solutions using volumetrically and gravimetrically.
2. To know the preparation and isolation of organic compounds.

Titrimetry and Gravimetry

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

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

Preparation of the following compounds

a. Tetraammine copper (II) sulphate.
b. Potassium trioxalato chromate (III).
c. Potassium trioxalato aluminate (III).
d. Tristhiourea copper (I) chloride.
e. Tristhiourea copper (I) sulphate.
f. Dibenzyltin dichloride.

Reference Books:

1. A.I.Vogel, Practical Inorganic Analysis.

Course outcomes

CO1	Estimates the mixture of solutions using Titrimetry and Gravimetry.
CO2	Understands the method of Complex preparation for Inorganic compounds.

COURSE DESIGNER:

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 3	COURSE CODE: P21CH2C8P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - II SEMESTER - CORE COURSE - VIII

(For the candidates admitted from the year 2021-2022 onwards)

ORGANIC CHEMISTRY PRACTICAL - II

Course Educational Objectives:

1. To learn the estimations of an organic compounds.
2. Plan a two steps organic synthesis.

Quantitative analysis of organic compounds

Estimation of phenol, aniline, ketone, glucose, nitrobenzene, saponification value of an oil and Iodine value of an oil.

Preparation of organic compounds (Double stage)

a. p - bromo acetanilide from aniline (acetylation and bromination).

b. acetyl salicylic acid from methyl salicylate (hydrolysis and acetylation).

c. 1, 3, 5 - tribromobenzene from aniline (bromination, diazotization and hydroxylation).

d. p - nitro aniline from acetanilide (nitration and hydrolysis).

e. benzillic acid from benzoin (rearrangement).

f. p - amino benzoic acid from p - nitro toluene (oxidation and reduction).

g. benzanilide from benzophenone (rearrangement).

h. p - bromoaniline from acetanilide (bromination and hydrolysis).

i. m - nitroaniline from nitrobenzene (nitration and reduction).

j. 1, 2, 4 - triacetoxy benzene from hydroquinone (oxidation and acylation).

Reference Books:

1. A. I. Vogel, Practical Organic Analysis.
2. Gnanaprakasam & Ramamurthy, Organic analysis and preparation.

Course outcomes

CO1	1. Learns the principle of Organic Estimations.
CO2	2. Understands the method of double stage organic preparation.

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NUMBER OF CREDIT: 5	COURSE CODE: P21CH2E2

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - II SEMESTER - ELECTIVE COURSE - II

(For the candidates admitted from the year 2021-2022 onwards)

SOLID STATE CHEMISTRY AND NANO SCIENCE

Course Educational Objectives:

1. To study the concept of supramolecular chemistry and crystal engineering.
2. To understand the preparative methods in solid state chemistry.
3. To study the basic concepts of nano materials and its applications.

UNIT - I	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. 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. Polymorphism and Pseudopolymorphism. Supramolecular isomorphism / polymorphism.
UNIT - II	M.O.F (Metallo Organic Frame works), Organometallic systems. Combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. - OLED **Preparative methods in solid state chemistry:** General principles of solid state chemistry - Experimental procedure - Crystallizations of solutions, zeolite synthesis - Physical methods - Growth of single crystals, Bridgman and stockbarger methods, Hydrothermal methods.
UNIT - III	**Introduction to Nano science** Background to nanoscience and nanotechnology - scientific revolutions - nanosized effectssurface to volume ratio - atomic structure - molecules & phases - energy at the nanoscale molecular and atomic size - quantum effects-Definition of a nanomaterials - study of 1D,2D,3D nanomaterials and Quantum dots-classification of nanomaterials - dimensionality and size dependent phenomena; Quantum dots, Nanowires and Nanotubes-importance of the nanoscale materials and their devices.
UNIT - IV	**Preparation of Nano materials** Top down and bottom up method of synthesis of nanomaterrials - Grinding - high energy ball milling - chemical Vapor deposition method - lithography - laser ablation method - microwave method - Sol - gel technique - solvothermal methods - control of grain size - co - precipitation hydrolysis - sonochemical method combustion technique - growth of nanorods - solid-state sintering - grain growth. Electrodeposition - electrospinning technique. Arc method - carbon nanotubes.
UNIT - V	**Properties and Application of Nano material** Role of size in nanomaterials in Electronic Properties-Band Structures - Hall effects, Confinement and transport in nanostructure - Dia, Para, Ferromagnetic materials, Superparamagnetism and it s limit - Effect of particle size on dielectric properties, Ferroelectrics - Surface Plasmon resonance phenomena, optical properties of semiconductor nanoparticles - catalytic properties of nanomaterials. Environmental Applications- Bioremediation- removal of bacteria and microbes-sensors for DNA-Proteins, and Biological applications - self assembly systems - tissue culturenanopharma - Applications of Nanomagnetic materials: Nanomagnetism - Bionanomagnetism - types of magnet materials - tag and drag drug delivery.

Reference Books:

1. Lehn, J.M.Supramolecular Chemistry, VCH, Wienheim, 1995.
2. Desiraju, G.R.Crystal Engineering: The Design of Organic Solids, Elsevier, Amsterdam, 1989.
3. Desiraju, G.R. (2001). Current Science, 81, 1038.
4. Rao, C.N.R. (2001). Current Science, 81, 1030.
5. Solid state chemistry and its applications by Anthony R.West, John Wiley & sons.
6. T.Pradeep, NANO: The Essentials, Understanding Nanoscience and Nanotechnology, McGraw Hill publications.

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Course outcomes

CO1	Classify the languages of supramolecular chemistry.
CO2	Development of MOF and organometallic compounds.
CO3	Introduction to Nano science.
CO4	Preparative methods of nano materials.
CO5	Properties of nano materials.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	4	4	4	4	4	3	3	3	3	3	3	**3.45**
CO2	4	3	4	3	3	3	3	4	3	3	4	**3.36**
CO3	4	3	3	3	4	3	3	3	3	3	4	**3.27**
CO4	4	3	4	3	4	4	4	3	3	3	3	**3.45**
CO5	4	3	4	4	4	3	3	3	3	3	3	**3.36**
Mean overall score												**3.38**

Result: The Score for this course is 3.38 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. P.MUTHUKUMAR

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 5	COURSE CODE: P21CH3C9

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - III SEMESTER - CORE COURSE - IX

(For the candidates admitted from the year 2021-2022 onwards)

ORGANIC CHEMISTRY - II

Course Educational Objectives:

1. To study the basic concepts of UV, IR and Mass spectroscopy.
2. To understand the oxidation and reduction reactions, organo photochemistry.
3. To study the pericyclic reactions and heterocycles.

UNIT - I	**UV and IR Spectroscopy Mass Spectroscopy** **UV Spectroscopy:** Introduction - Instrumentation - sample handling techniques - Woodward - Fischer and Scoot rules for conjugated dienes, polymers, ketones, aldehydes, α, β - unsaturated acids - Differentiation of geometrical isomers - and positional isomers - Disubstituted benzene derivatives - Study of steric effect in aromaticity. **IR Spectroscopy:** Molecular vibrations - factors influencing vibrational frequencies - applications of IR spectroscopy to organic compounds - group frequency concept - hydrogen bonding - effect of inductive and mesomeric effects on carbonyl stretching frequency - effect of ring strain on carbonyl stretching frequency. **Mass Spectrometry:** Introduction - Instrumentation - Resolution, EI and CI methods - Base peak, isotopic peaks, metastable peak, parent peak - Determination and use of molecular formula - Recognition of molecular ion peak - FAB - Fragmentation: General rules - Pattern of fragmentation for various classes of compounds - McLafferty rearrangement - Importance of metastable peaks.
UNIT - II	**Oxidation and Reduction reactions** **Reduction:** Catalytic hydrogenation - Wilkinson Catalyst, dehydrogenation, reduction with LAH, NaBH4, teritarybutoxy aluminium hydride, NaCNBH3, tributyltin hydride, alkali metals for reduction. **Oxidation:** Osmium tetroxide, Sharpless asymmetric epoxidation, Ozone, DDQ, Lead tetraacetate, Selenium dioxide, DMSO with either Ac2O or Oxalyl chloride, Dess - Martin reagent.
UNIT - III	**Organic Photochemistry** Fundamental concepts, Jablonski diagram - energy transfer - characteristics of photo reactions - photo reductions and photo oxidation - photoreactions of carbonyl compounds - Norrish type I and Norrish type II reactions, di-pi methane rearrangement - photochemistry of arenes, photochemistry of alkenes, cis-trans isomerisation - photosensitization and photoaddition - Barton reaction - Paterno Buchi reaction.
UNIT - IV	**Pericyclic Reactions** **Pericyclic reactions:** Concerted reactions - orbital symmetry and correlation diagram approach - FMO and PMO approach, Woodward-Hofmann rules - Electrocyclic reactions (1,3-butadiene - cyclobutene and 1,3,5 - hexatriene-cyclohexadiene systems) - cycloadditions [2+2]

	and [2+4] systems (ethylene-cyclobutane, ethylene and 1,3 - butadiene - cyclohexene systems) - selection rules - cycloreversion (reterocycloaddition reactions) - heterocyclic additions - 1,3 - dipolar cycloaddition - sigmatropic rearrangements – Sommelet - Hauser, Cope, Fries and Clasien rearrangements.
UNIT - V	**Heterocycles** **Nomenclature:** Trivial, systematic and replacement nomenclatures - Chemistry of non - aromatic heterocycles: Oxiranes - Thiiranes - Aziridines - Azetidines - Tetrahydrofurans - Pyrrolidines - Tetrahydropyrans - Piperidines - Ring synthesis and reactivity of the following aromatic heterocycles: Oxazoles - Thiazoles - Imidazoles - Isooxazoles - Isothiazoles - Pyrazoles - Triazoles - Pyrimidines - Purines - Triazines.

Reference Books:

1. Advanced Organic Chemistry, J.March, Wiley Eastern, New Delhi, 3rd edn., 1986.
2. Stereochemistry of Organic Compounds: Principles and Applications, D.Nasipuri, Wiley Eastern, New Delhi, I edn., 1992.
3. Organic Reaction Mechanisms, Raj K.Bansal, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2nd edn., 1995.
4. Molecular Reactions and Photochemistry, Depuy and Champman, Prentice - Hall, New Delhi, 1987.
5. Organic Chemistry, I.L.Finar, Vol.2 ELBS, 5th edn., 1974.
6. Basic Principles of Organic Stereochemistry, P.Ramesh, Ist edn., Meenu Publications, Madurai, 2005.
7. Stereochemistry of Carbon Compounds, E.L.Eliel, McGraw Hill Book Company, New York, 1975.

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

Course outcomes

CO1	Explain about IR, UV and mass spectroscopy.
CO2	Examine the oxidation and reduction reactions.
CO3	Developed skills in organophotochemistry.
CO4	Create the knowledge in FMO theory and cyclo addition reaction.
CO5	Explain about Heterocycles.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	
CO1	5	4	4	4	4	3	4	3	4	3	3	**3.73**
CO2	5	3	4	3	4	4	3	4	3	4	4	**3.73**
CO3	5	4	3	3	4	3	3	3	3	3	4	**3.45**
CO4	5	3	4	3	4	4	4	3	4	3	3	**3.64**
CO5	5	4	4	4	4	3	3	3	3	4	3	**3.63**
Mean overall score												**3.66**

Result: The Score for this course is 3.66 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	
Skill oriented	✓	Entrepreneurship oriented	

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. K.BALASUBRAMANI

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 5	COURSE CODE: P21CH3C10

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - III SEMESTER - CORE COURSE - X

(For the candidates admitted from the year 2021-2022 onwards)

PHYSICAL METHODS IN CHEMISTRY - I

Course Educational Objectives:

1. To study about the theoretical principles of spectroscopy.
2. To understand the basic concepts of Raman and Mossbauer spectroscopy.
3. To study the NMR spectroscopy and basic concepts of solid state chemistry.

UNIT - I	**Theoretical principles of Molecular Spectroscopy:** Microwave spectroscopy - rotational spectra of diatomic molecules, rigid and nonrigid rotors, - Intensity of spectral lines, - Effects of isotopic substitution - Microwave spectra of polyatomic molecules - Linear and symmetric top molecules, Infrared spectra - diatomic molecules simple harmonic and anharmonic oscillators diatomic vibrating rotator, rotation-vibration spectrum of carbon monoxide- Raman spectra - Rotational Raman spectra of linear and symmetric top molecules - Vibrational Raman Spectra, Rotational fine structure - Electronic spectra of diatomic molecules.
UNIT - II	**Raman Spectroscopy** Description of Raman scattering, Rayleigh scattering, Stokes and anti- Stokes scattering, polarizability of the molecules, Placzek theory, selection rules for rotational Raman spectra of diatomic molecules, rotational Raman spectra, vibrational Raman spectra, Raman spectra of polyatomic molecules**.** **Mossbauer Spectroscopy** Isomer shifts - quadrupole splitting - magnetic interactions - applications to iron and tin compounds. NQR spectroscopy - characteristics of quadrupolar nucleus - effects of field gradient and magnetic field upon quadrupolar energy levels - NQR transitions - applications of NQR spectroscopy.
UNIT - III	**Advanced Spectroscopy** : **NMR** Dependence of J on dihedral angle - Vicinal and germinal coupling constants - Karplus equation - long range coupling constants, Influence of stereochemical factors on chemical shift of protons. ^{13}C-NMR Spectroscopy - Basic theory of FT - NMR, Relaxation - Broad band decoupling. Off resonance decoupling and chemical shifts of common functional groups, DEPT spectra. Identification of small compounds based on NMR data. 2D Techniques:^{1}H - ^{1}H COSY, ^{1}H - ^{13}C COSY - HMBC and NOESY.
UNIT - IV	**Advanced Spectroscopy:** **Electron spin resonance spectroscopy:** Basic principles - comparison between esr and nmr spectra - hyperfine splitting - factors affecting the magnitude of g - values - calculation of unpaired electron density on an atom in a delocalized system - applications to organic free radicals. **Optical rotator dispersion and circular dichroism:** Introduction to theory and terminology

	- cotton effect - ORD curves - axial haloketone rule and its applications - octant rule - its applications - applications of ORD to determine absolute configuration of monocyclic ketones - comparision between ORD and CD - their inter relationships.
UNIT - V	**X-ray diffraction:** X-ray diffraction by single crystal - Space groups - Systematic absences in X- ray data and identification of lattice types, glide planes and screw axes, X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Structure solution by Heavy atom method and direct method. Determination of absolute configuration of molecules. A brief account of Cambridge Structural Database (CSD) and Protein Data Bank (PDB).

Reference Books:

1. C.N.Banwell, Fundamental so molecular Spectroscopy, 3rd ed., TMH, New Delhi, 1983.
2. B.P.Straughan and S.Walker SpectroscopyVol.3, Chapman Hall London, 1976.
3. G.M.Barrow, Introduction to Molecular Spectroscopy, McGraw Hill, New York, 1964.
4. P.K.Ghosh, Introduction to Photoelectron Spectroscopy, John Wiley New York, 1989.
6. P.M.Silverstein, F.X.Wester, Spectroscopic Identification of Organic Compounds, 6th ed., Wiley 1998.
7. W.Kemp, Organic Spectroscopy, 3rd Ed., MacMillon, 1994.
8. J.R.Dyer, Application so Absorption Spectroscopy of Organic Compounds, Prentice Hall, 1965.
9. Y.R.Sharma, Elementary Organic Spectroscopy - Principles and Chemical applications, S.Chand, 1992.
10. P.S.Kalsi, Spectroscopy of Organic Compounds.
11. Clegg,W., Crystal structure determination, Oxford University press , New York,1998.
12. Stout. G. H.Jenson, L.H.X-ray structure determination: A Practical guide, John wiley and sons publication. New York, 1989.
13. Web Pages; Cambridge Structural Database(CSD)- - http://www.ccdc.cam.ac.uk/products/csd.
14. Protein Data Bank (PDB) - http://www.rcsb.org/pdb/home/home.do

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Course outcomes

CO1	Learn the theoretical principles of Microwave spectroscopy.
CO2	Learn the theoretical principles of Raman and Mossbauer spectroscopy.
CO3	Gains the knowledge in NMR spectroscopy and two dimensional techniques.
CO4	Analysis of ESR and ORD, CD.
CO5	Understanding of basic concepts of X-ray diffraction.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	5	4	4	4	3	3	4	3	4	3	3	3.63
CO2	5	3	3	3	4	4	3	4	3	4	4	3.64
CO3	5	4	3	4	4	3	3	4	3	3	4	3.63
CO4	5	3	4	3	4	4	4	3	4	4	3	3.73
CO5	5	4	4	4	4	3	3	3	3	4	3	3.63
Mean overall score												3.67

Result: The Score for this course is 3.67 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	
Skill oriented	✓	Entrepreneurship oriented	

Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

COURSE DESIGNER: Dr. T.DEEPA

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 6	COURSE CODE: P21CH3C11

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - III SEMESTER - CORE COURSE - XI

(For the candidates admitted from the year 2021-2022 onwards)

PHYSICAL CHEMISTRY - II

Course Educational Objectives:

1. To study the basics of quantum chemistry.
2. To understand the wave function of ID, 2D and 3D.
3. To understand the basics and applications of group theory.

UNIT - I	**Quantum Chemistry I** Success of quantum theory and failure of classical mechanics - black body radiation - photoelectric effect. Comptom effect and atomic spectra. Formulation of quantum mechanics -the wave nature of sub - atomic particles - wave particle dualism - Heisenberg's uncertainty principle - Schordinger wave equation. Concept of operators - sums and products of operators - commutator - linear and non - linear operators - Hermitian and Hamiltonian operators - Deriving operators for energy and angular momentum from known operators - Eigen values and eigen functions - postulates of quantum mechanics - physical interpretation of wave function - orthogonality and normalization theorems.
UNIT - II	**Quantum Chemistry II** Applications of wave mechanics - Schrodinger wave equation to free particle - particle in a one dimensional box - particle in a three dimensional cubic and rectangular box - degeneracy. One dimensional harmonic oscillator - classical treatment of simple linear harmonic oscillator and its limitations - quantum mechanical treatment - complete solutions for linear harmonic oscillator - Hermite polynomial and orthogonality - Normalized solution and energy values. Rigid rotator - rigid rotator as a model for a rotating diatomic molecule - solutions.
UNIT - III	**Quantum Chemistry III** Solving of Schrodinger equation for the H - atom (or H - like species) - e nergy levels. Atomic orbitals and their shapes - electron spin and Pauli's exclusion principle.- approximation methods - need for approximation methods - Perturbation theory (I order only) - application to H - like atoms - Variation method - Application to helium atom - Molecular orbital theory –LCAO - MO treatment - MO theory of simple heterodiatomic molecules like HF, CO and NO.

UNIT - IV	**Basics of Group Theory** Definition of a mathematical group and its properties - group multiplication table - cyclic groups - subgroups - classes - symmetry elements - symmetry operations - classes of symmetry operations - classification of molecular point groups. Matrix representations of symmetry operations - representation of groups - reducible and irreducible representations. The Great Orthogonality theorem and its consequences - character tables - construction of character tables for C_{2v} and C_{3v} point groups.
UNIT - V	**Applications of Group Theory in Chemistry** Group theory and quantum mechanics - direct product - wave function as bases for irreducible representation - spectral transition probabilities - Symmetry Adapted Linear Combinations (SALC) - projection operators and their use to construct SALC - Huckel approximation - concept of hybridization - secular determinant - symmetry factoring of secular equations - electronic spectra - selection rule - electronic transition in formaldehyde - vibrational spectra - normal modes of vibration - selection rules - mutual exclusion principle -IR and Raman activity of fundamentals in CO_2 and H_2O.

Reference Books:

1. Introductory Quantum Chemistry, A.K.Chandra, Tata McGraw-Hill Publishing Company, 4thedn. 1994.
2. Quantum Chemistry, R.K.Prasad, Wiley Eastern, New Delhi, 1992.
3. Introductory Quantum Mechanics, Y.R.Waghmare, Eurasia Publishing House, New Delhi, 1989.
4. Fundamentals of Quantum Chemistry, Anandaraman, MacMillan, India, 2001
5. F.A.Cotton, Chemical Applications of Group Theory, 3rd edn., Wiley - Interscience Publications, 2006.
6. P.K.Bhattacharya, Group Theory and its Chemical Applications, Himalayan Publishing house, 1986.
7. Ramakrishnan and M.S.Gopinathan, Group Theory in Chemistry, Vishal Publications, 1998.

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Course outcomes

CO1	Gain the knowledge of quantum mechanics.
CO2	Examine the applications of 1D, 2D and 3D Schrodinger wave equation.
CO3	Learn the MO theory of hetero diatomic molecules.
CO4	Construct the character tables of C_{2V} and C_{3V} point groups.
CO5	Applications of Group theory.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	5	4	4	3	3	3	3	3	4	3	3	**3.45**
CO2	5	3	3	3	4	4	3	4	3	4	4	**3.64**
CO3	5	4	3	3	4	3	3	4	3	3	4	**3.55**
CO4	5	3	4	3	4	4	4	3	4	4	3	**3.73**
CO5	5	4	4	3	4	3	3	3	3	4	3	**3.63**
Mean overall score												**3.60**

Result: The Score for this course is 3.60 (High Relationship)

Nature of Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. P.MUTHUKUMAR

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT:3	COURSE CODE: P21CH3C12P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - III SEMESTER - CORE COURSE - XII

(For the candidates admitted from the year 2021-2022 onwards)

PHYSICAL CHEMISTRY PRACTICAL - I

Course Educational Objectives:

1. Examine the kinetics of reaction.
2. Analyze phase component equilibria, distribution law, adsorption, water analysis

Any ten experiments (to be decided by the course teacher) out of the following experiments.

a) Acid hydrolysis of ester - Comparison of strengths of acids.

b) acid hydrolysis of Ester - Determination of energy of activation (Ea).

c) Kinetics - Persulphate - Iodine reaction - Determination of order, effective of ionic strength on rate constant.

d) Determination of molecular weight of substance by Transition Temperature method.

e) Determination of molecular weight of substances by Rast method.

f) Determination of Critical Solution Temperature (CST) of phenol- water system and effect of impurity on CST.

g) Study of phase diagram of two components forming a simple eutectic. i. Study of phase diagram of two components forming a compound.

h) Study of phase diagram of three components system.

i) Determination of molecular weight of substances by cryoscopy.

j) Determination of integral and differential heat of solutions by colorimetry.

k) Polymerization - Rate of polymerization of acrylamide.

l) Distribution law - Study of Iodine - Iodine equilibrium.

m) Distribution law - Study of association of benzoic acid in benzene.

n) Adsorption - Oxalic acid/Acetic acid on charcoal using freundlich isotherm.

o) Estimation of Total hardness by EDTA method.

p) Determination of molecular weight of the polymer by viscometry method.

Reference Book:

1. Practical Physical chemistry, Vishwanathan & P.S. Raghavan.

Course outcomes

CO1	To calculate the energy of activation.
CO2	To construct the three dimensional phase diagram for a system.

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NUMBER OF CREDIT: 5	COURSE CODE: P21CH3E3

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - III SEMESTER - ELECTIVE COURSE - III

(For the candidates admitted from the year 2021-2022 onwards)

POLYMER CHEMISTRY

Course Educational Objectives:

1. To study the chemistry and the types of polymerization.
2. To study the polymerization techniques.
3. To understand the commercial polymers and additives.

UNIT - I	**Types and Chemistry of Polymerization** Classification of polymers, Types of polymerization - addition, free radical, ionic and coordination polymerization - Zigler-Natta, Stereo regular polymerization, Condensation polymerization - Mechanism and Kinetics of polymerization - degree of polymerization - kinetic chain length - factors affecting chain polymerization - inhibition and retardation - Carother's equation.
UNIT - II	**Copolymerization and Polymerization Techniques** Types of copolymers - ideal, alternating, block and graft copolymer - Types of copolymerization - Free radical copolymerization - polycondensation - copolymer equation - significance - monomer and radical reactivity - Q-e scheme - Determination of monomer reactivity ratio - Mayo - Lewis and Fineman Ross methods - block and graft copolymerization - methods of preparation and mechanism.
UNIT - III	**Polymer Characteristics and Characterization** Types of degradation - thermal, mechanical and photodegradations - management of plastics in the environment. The concept of number average and weight averages. Molecular weight methods - Molecular weight distribution, separation of polymers - precipitation and analytical methods - determination of molecular weights - Osmotic pressure, light scattering and viscosity methods. Analysis and testing of polymers - physical / mechanical and chemical analysis of polymers - spectroscopic methods, x-ray diffraction study.
UNIT - IV	**Structure, Properties and Fabrication of Polymers** Morphology and order in crystalline polymers - configurations of polymer chain - types of stereo isomerism in polymer - tacticity (eg. Mono and disubstitute polyethylene,

	polypropylene, polybutadiene) significance of stereoregularity. Polymer structure and physical properties - crystalline melting point Tm - melting points of homogeneous series - effect of chain flexibility and heat of fusion. The glass transition temperature, Tg-relationship between Tm and Tg, effects of molecular weight, chemical structure, property requirements and polymer utilization. Fabrications of polymers - Moulding, casting and spinning polymers.
UNIT - V	**Chemistry Commercial Polymers and Polymer Additives** Organic polymers polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxies resins. Dendrimers - Types and applications. Inorganic polymers - silicon polymers, glass, poly (organo phosphazenes) polymers, Basic concept of conducting polymers, liquid crystal polymer, biopolymer and biomedical polymer. Polymer additives: Fillers, plasticizers, colourants, auto oxidants, fire retardants and thermal stabilizers - polymer blends and composites.

Reference Books:

1. Text book of polymer science, F.W.Billmeyer Jr. 3rd edition, Wiley, India 2007.
2. Polymer science, V.R.Gowarikar, N.V.Viswanathan, New age international, 2003.
3. Principles of polymerization, George odian, 4th edition, John wiley and sons, 2007.
4. Polymer science and technology, Goel R.Fried, Prentice - Hall of India, New delhi, 2000.
5. Polymer science and technology of plastics and rubbers, P.Ghosh, Tata McGraw-Hill, New delhi, 1998.
6. Introductory polymer chemistry, G.S.Misra, Wiley eastern Ltd., 1993.

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Course outcomes

CO1	Understanding the types of polymerization.
CO2	Classify the polymerization techniques.
CO3	Analysis and testing of polymers and its characterization.
CO4	Knowledge in structure and properties of polymers.
CO5	Basic idea about commercial polymers.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	4	4	3	3	3	3	3	3	3	3	3	**3.18**
CO2	4	3	3	3	4	3	3	4	3	4	4	**3.45**
CO3	4	4	3	3	3	3	3	4	3	3	4	**3.36**
CO4	4	3	4	3	4	4	4	3	3	4	3	**3.55**
CO5	4	4	4	3	3	3	3	3	3	3	3	**3.27**
Mean overall score												**3.36**

Result: The Score for this course is 3.36 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. P.SIVAJEYANTHI

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 3	COURSE CODE: P21CH4C13P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - IV SEMESTER - CORE COURSE - XIII

(For the candidates admitted from the year 2021-2022 onwards)

PHYSICAL CHEMISTRY PRACTICAL - II

Course Educational Objectives:

1. Conductometric technique.
2. Potentiometric technique and pH metric techniques.

Any ten experiments (to be decided by the course teacher) out of the following experiments.

a) Conductometry - Acid - alkali titrations.
b) Conductometry - Precipitation titrations.
c) Conductometry - Displacement titrations.
d) Conductometry - Determination of dissociation constant of weak acids.
e) Conductometry - solubility product of sparingly soluble silver salts.
f) Verification or Onsager equation - conductivity method.
g) Determination of degree of hydrolysis and hydrolysis constant of a substance.
h) Potentiometric titrations - Acidic alkali titrations.
i) Potentiometric titrations - Precipitation titrations.
j) Potentiometric titrations - Redox titrations.
k) Potentiometry - Determination of dissociation constant of weak acids.
l) Potentiometry - Determination of activity and activity coefficient of ions.
m) Potentiometry - Determination of activity and activity coefficient of ions.
n) pH titration of ortho - phosphoric acid.
o) To determine the relative strength of two acids by conductance measurements.
p) To determine the pH of a buffer solution using a quinhydrone electrode.

Reference Books:

1. J.B Yadav, "Advanced Practical Physical Chemistry", 20th edn. GOEL publishing House, Krishna Pakashan Media Ltd., (2001).
2. Findlay's "Practical Physical Chemistry" Revised and edited by B.P.Levitt 9th ed., Longman, London, 1985.
3. J.N.Gurtur and R.K.Kappor, "Advanced Experimental Chemistry", Vol. I. Chand & Co., Ltd, New Delhi.
4. Practical Physical chemistry, Vishwanathan & P.S.Raghavan

Course outcomes

CO1	Determine the strength of redox, acid-alkali by potential measurements.
CO2	Verification of Onsager, Oswald dilution law by conductance measurements

COURSE DESIGNER:

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NUMBER OF CREDIT: 5	COURSE CODE: P21CH4C14

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - IV SEMESTER - CORE COURSE - XIV

(For the candidates admitted from the year 2021-2022 onwards)

PHYSICAL METHODS IN CHEMISTRY - II

Course Educational Objectives:

1. To study the vibrational, electronic spectroscopy and its complexes.
2. To analyze the magnetic properties in EPR spectroscopy.
3. Discuss about MRI, SEM, TEM, etc.

UNIT - I	**Vibrational Spectroscopy** **Vibrational spectroscopy -** classical description of molecular vibrations, the classical harmonic oscillator, quantum mechanics of molecular vibration, vibrational selection rules, anharmonic vibrations and Morse oscillator, bond dissociation energies and Birge - Sponer plots, calculation of force constants from vibrational spectrum, isotopic shift, rotational structure in vibrational spectra of diatomic molecules, vibrational selection rules, vibration of polyatomic molecules, normal modes, characteristic group vibrational energies, hydrogen bonds in IR spectra.
UNIT - II	**Electronic Spectroscopy** Microstates, terms and energy levels for d1 - d9 ions in cubic and square fields - intensity of bands - group theoretical approach to selection rules - effect of distortion and spin - orbit coupling on spectra - evaluation of 10Dq and β for octahedral complexes of cobalt and nickel - applications to simple coordination compounds - charge transfer spectra - electronic spectra of $[Ru(bipy)3]^{2+}$. Optical rotatory dispersion and circular dichroism and magnetic circular dichroism - applications to metal complexes.
UNIT - III	**EPR Spectroscopy and Magnetic properties** Theory of EPR spectroscopy - spin densities and McConnell relationship - factors affecting the magnitude of g and A tensors in metal species - zero-field splitting and Kramers degeneracy - spectra of V(II), Mn(II), Fe(II), Co(II), Ni(II) and Cu(II) complexes - applications of EPR to a few biological molecules containing Cu(II) and Fe(III) ions. Magnetic properties - types of magnetism - dia -, para -, ferro - and antiferro - magnetism - magnetic properties of free ions - first - order Zeeman effect - second-order Zeeman effect - states KT - states<<<KT - determination of magnetic moments and their applications to the elucidation of structures of inorganic compounds - temperature independent paramagnetism - magnetic properties of lanthanides and actinides - spin crossover in coordination compounds.

UNIT - IV	**Magnetic Resonance Imaging** Introduction to Magnetic Resonance - Principles of Spatial encoding in Magnetic Resonance- application of magnetic field gradients - Larmor frequency as a function of position - frequency encoding - the generation of profiles in NMR and ESR experiments run in the presence of gradients. 3D Fourier imaging, Echo Planar Imaging. Material and in vivo applications.
UNIT - V	**ANALYTICAL TOOLS AND TECHNIQUES** Fundamental theory, Instrumentation and applications of SEM, TEM, AFM, AAS, PES and STM spectroscopy. Thermal methods-Instrumentation, applications, limitations of DTA, TGA, DSC, Visco meter and BET surface analysis.

Reference Books:

1. R.S.Drago, Physical Methods in Inorganic Chemistry; Affiliated East - West Press Pvt. Ltd., New Delhi, 2012.
2. R.S.Drago, Physical Methods in Chemistry; Saunders College Publications, Philadelphia, 1992.
3. F.A.Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 6th Ed., Wiley - Eastern Company, New Delhi, 1999.
4. P.J.Wheatley, The Determination of Molecular Structure; 2nd Ed., Dover Publications, Mineola, 1981.
5. G.J.Leigh, N.Winterton, Modern Coordination Chemistry; Royal Society of Chemistry, UK, 2002.
6. E.A.V.Ebsworth, Structural Methods in Inorganic Chemistry; 3rd Ed., ELBS, Great Britain, 1987.
7. W.Kemp, Organic Spectroscopy; 3rd Ed., Palgrave, New York, 2011.
8. J.R.Dyer, Applications of Absorption Spectroscopy of Organic Compounds, PHI Learning, New Delhi, 2009.
9. Y.R.Sharma, Elementary Organic Spectroscopy - Principles and Chemical Applications; S. Chand and Co., New Delhi, 1992.
10. P.S.Kalsi, Spectroscopy of Organic Compounds; 6th Ed., New Age International Publishers, New Delhi, 2004.

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Course outcomes

CO1	Elaborate the quantum mechanics in vibrational spectroscopy.
CO2	Analyze the Co and Ni complexes in electronic spectroscopy.
CO3	Understanding the basic techniques of EPR.
CO4	Illustrate the MRI techniques.
CO5	Theory of SEM, TEM, AFM, etc.

Course Outcome (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcome (PSOs)**						**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	
CO1	4	4	3	4	4	4	4	3	3	3	3	**3.55**
CO2	4	4	4	3	4	4	4	4	3	4	4	**3.81**
CO3	4	4	4	3	3	4	4	4	3	3	4	**3.63**
CO4	4	4	4	4	4	4	4	3	3	4	3	**3.72**
CO5	4	4	4	4	4	3	3	3	3	3	3	**3.45**
Mean overall score												**3.66**

Result: The Score for this course is 3.66 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. M.VISHNUDEVAN

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT:	COURSE CODE: P21CH4E4

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - IV SEMESTER - ELECTIVE COURSE - IV

(For the candidates admitted from the year 2021-2022 onwards)

ANALYTICAL CHEMISTRY

Course Educational Objectives:

1. Analyze the sources of information and web resources.
2. Discuss about Thermal methods of analysis and electro analytical techniques.

UNIT- I	**Literature Survey** Print: Sources of information - Primary, Secondary, Tertiary sources - Journals - Journal abbreviations - Abstracts - Current titles - Reviews - Monographs - Dictionaries - Textbooks - Current contents - Introduction to Chemical Abstracts and Beilstein - Subject Index, Substance Index, Author Index, Formula Index and other Indices with examples. Digital: Web resources - E-Journal - Journal access - TOC alerts - Hot articles - Citation index - Impact factor H - Index - E-Consortium - UGC infonet - E-Books - Internet discussion groups and communities - Blogs - Preprint server - Search engines, Scirus, Google Scholar, Chem Industry, Wiki - Databases, Chem Spider, Science Direct, Sci Finder, Scopus.
UNIT - II	**Spectrophotometry** Atomic absorption spectrophotometry (AAS) - principle, instrumentation and applications, types of interferences. Flame emission spectroscopy (FES) - theory, instrumentation and applications - Difference between AAS and FES. Inductively coupled plasma atomic emission spectroscopy (ICEP-AES) - principle and applications.
UNIT - III	**Radiochemical and Thermal Methods of Analysis** Isotopic dilution methods - neutron activation analysis - Radiometric titrations - applications - principles, instrumentations and applications of thermogravimetry, Differential thermal analysis and differential scanning calorimetry - thermograms of calcium oxalate monohydrate and copper sulphate pentahydrate.
UNIT - IV	**Electroanalytical Techniques I** Polarography - principle - diffusion current - polarographic maxima - Ilkovic equation - Half wave potential - applications. Pulse voltammetry. Cyclic voltammetry - principle and simple analytical applications-interpretation of cyclic voltammogram Amperometry - principles and applications - types of amperometric titrations with examples - comparison with other titration methods.
UNIT - V	**Electroanalytical Techniques II** Basic principles of electrogravimetry - procedure - Coulometry - principle - coulometry at controlled potential - coulometry at constant current - coulometric titrations - advantages and applications. Anodic stripping voltammetry - principle and applications - ion selective electrodes - principle and applications.

Reference Books:

1. Instrumental methods of analysis, H,W.Willard, L.I.Merrit, J.J.A.Dean and F.A.Settle, CBS publishers, 1983.
2. Instrumental methods of analysis, Skoog and West, Saunders College Publications, 1992.
3. Instrumental methods of chemical analysis, B.K.Sharma, Goel publishing House, 19th Edn, 2000.
4. Electrochemical Methods, Fundamentals and Applications, A.J.Bard and L.R.Faulkner, John Wiley & Sons, 2nd edn., 2001.

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Course outcomes

CO1	Knowledge of literature survey using digital, Scopus etc.
CO2	Understand the principle, instrumentation and applications of AAS and FE.
CO3	Knowledge in TGA, DSC and DTA.
CO4	To study the principles of polarographic and Amperometry.
CO5	Basic principles of electrogravimetry and coloumetry.

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	4	4	3	3	3	3	3	3	3	3	3	**3.18**
CO2	4	3	3	3	3	3	3	3	3	4	3	**3.18**
CO3	4	4	4	4	3	3	3	3	3	3	3	**3.36**
CO4	4	3	4	3	4	4	4	3	3	4	3	**3.55**
CO5	4	4	4	3	3	3	3	3	3	3	3	**3.27**
Mean overall score												**3.31**

Result: The Score for this course is 3.31 (High Relationship)

Nature of Course			
Knowledge and skill		Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. T.DEEPA

CHAIRMAN - BOS **CONTROLLER OF EXAMINATIONS**

NUMBER OF CREDIT: 5	COURSE CODE: P21CH4E5

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - IV SEMESTER - ELECTIVE COURSE - V

(For the candidates admitted from the year 2021-2022 onwards)

GREEN CHEMISTRY

Course Educational Objectives:

1. To study the principles of green chemistry.
2. To study about addition, condensation, oxidation and reduction reactions.

UNIT - I	**Introduction to Green Chemistry** Introduction to green chemistry - twelve principles of green chemistry - planning a green synthesis in a chemical laboratory - evaluating the type of reaction involved - rearrangement, addition, substitution, elimination and pericyclic reactions. Selection of appropriate solvent - aqueous phase reaction - reactions in ionic liquids - organic synthesis in solid state - solid supported organic synthesis - selection of starting materials - use of protecting group - use of catalyst - use of microwaves and sonication.
UNIT - II	**Addition and Condensation Reactions** Addition reactions - Michael addition in [aqueous medium and solid state] - Diels-Alder reactions in aqueous phase. Condensation reactions - Aldol condensation of aldehydes with nitroalkanes and nitriles - Aldol condensation in solid phase - benzoin condensation under catalytic conditions - applications.
UNIT - III	**Oxidation and Reduction Reactions** Oxidation reactions - Baeyer - Villiger oxidation in aqueous phase and solid state - enzymatic Baeyer - Villiger oxidation. Reduction reactions - Clemmensen reduction - mechanism - limitations - applications.
UNIT - IV	**Phase - Transfer Catalyst Reactions** Phase - transfer catalyst reactions - Heck reaction - Michael addition reaction - oxidation of toluene to benzoic acid - Reimer - Tiemann reaction - Baker - Venkataraman synthesis - Williamson ether synthesis - Dozen reaction.
UNIT - V	**Sonication Reactions** Sonication reactions - Barbier reaction - Reformatsky reaction - Simmons - Smith reaction - Strecker synthesis - Ullmann coupling reaction - Wurtz reaction - Bouveault reaction - concept of single pot synthesis.

Reference Books:

1. V. K.Ahluwalia, Green Chemistry; 2nd Ed., Ane Books Pvt Ltd., New Delhi, 2016. [UNIT- I, II, III, IV, V]
2. P. T.Anastas and J.C.Warner, Green chemistry Theory and Practice; Oxford University Press, New York, 2005. [Unit-I]
3. V.K.Ahluwalia and K.Agarwal, Organic Synthesis, Special Techniques; 2nd Ed., Narosa Publishing House, New Delhi, 2007. [Unit-I]

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Course outcomes

CO1	Understand the principles of green chemistry
CO2	learns the addition and condensation reaction
CO3	Knowledge in oxidation and reduction reactions
CO4	Explain the naming reaction and its synthesis
CO5	Discuss about sonication reactions

Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcome (PSOs)						Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	
CO1	4	4	3	3	3	3	3	3	3	3	3	**3.18**
CO2	4	4	3	4	3	4	3	3	3	4	3	**3.45**
CO3	4	4	4	4	3	3	3	3	3	3	3	**3.36**
CO4	4	3	3	3	3	3	3	3	3	4	3	**3.18**
CO5	4	4	4	3	3	3	3	3	3	3	3	**3.27**
Mean overall score												**3.28**

Result: The Score for this course is 3.28 (High Relationship)

Nature of Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Note:

Mapping	**1 - 20%**	**21 - 40%**	**41 - 60%**	**61 - 80%**	**81 - 100%**
Scale	**1**	**2**	**3**	**4**	**5**
Relation	**0.0 - 1.0**	**1.1 - 2.0**	**2.1 - 3.0**	**3.1 - 4.0**	**4.1 - 5.0**
Quality	**Very Poor**	**Poor**	**Moderate**	**High**	**Very High**

COURSE DESIGNER: Dr. D.RAJADURAI

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NUMBER OF CREDIT: 6	COURSE CODE: P21CH4PW

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 639 005

M.Sc., CHEMISTRY - IV SEMESTER - PROJECT WORK

(For the candidates admitted from the year 2021-2022 onwards)

PROJECT WORK

Course outcomes

To gain the knowledge in plan of the project and presentation of the project

SL. No	AREA OF WORK	Maximum Marks
1.	**PROJECT WORK:** **(i) Plan of the Project** **(ii) Execution of the plan / Collection of data / Organization of materials/ Fabrication Experimental study / Hypothesis, Testing etc., and Presentation of the report.** **(iii) Individual Initiative**	**20** **50** **10**
2.	**VIVA VOCE EXAMINATION**	**20**
TOTAL		**100**

PASSING MINIMUM - 50 MARKS.

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