FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

DEPARTMENT OF CHEMISTRY

For those who joined in June 2019 onwards (for the academic year-2020-2021)

PROGRAMME CODE : PSCH

COURSE CODE	COURSE TITLE	Hours/week	Credits	Maximum Marks		
				CIA	ESEM	Total
SEMESTER 1						
19PG1C1	**INORGANIC CHEMISTRY -I** (Basic Concepts, Covalent and Ionic Bonding, Solid State and Crystallography, and Nuclear Chemistry)	6	4	40	60	100
19PG1C2	**ORGANIC CHEMISTRY -I** (Reaction Mechanism and Stereochemistry)	6	4	40	60	100
19PG1C3	**PHYSICAL CHEMISTRY -I** (Applied Electro Chemistry & Statistical Thermodynamics)	6	4	40	60	100

19PG1C4	**INORGANIC QUALITATIVE ANALYSIS**	4	2	40	60	100
19PG1C5	**ORGANIC QUALITATIVE ANALYSIS**	4	2	40	60	100
19CIEDC	**ESSENTIALS OF LIFE**	3	3	40	60	100
	LIBRARY	1	-	-	--	
Total		**30**	**19**			
	SEMESTER –11					
19PG2C6	**INORGANIC CHEMISTRY –II** (Advanced coordination chemistry)	6	**4**	40	60	100
19PG2C7	**ORGANIC CHEMISTRY –II** (Elimination and addition reactions, organic spectroscopy and conformational analysis)	6	4	40	60	100
19PG2C8	**PHYSICAL CHEMISTRY –II** (Chemical kinetics and quantum mechanics)	6	4	40	60	100
19PG2C9	**INORGANIC QUANTITATIVE ANALYSIS**	4	2	40	60	100
19PG2C10	**ORGANIC QUANTITATIVE ANALYSIS**	4	2	40	60	100
19C2EDC	**ESSENTIALS OF LIFE**	3	3	40	60	100
	LIBRARY	1	-	-	-	-
Total		**30**	**19**			
	SEMESTER III					
19PG3C11	**ORGANIC CHEMISTRY -III** (Spectroscopy and Pericyclic Reactions)	6	5	40	60	100

19PG3C12	**PHYSICAL CHEMISTRY -III** (Group Theory, Surface Chemistry and Macromolecules)	6	5	40	60	100
19PG3C13	**GREEN CHEMISTRY**	6	5	40	60	100
19PG3CE1/19PG3CE2	**MATERIAL CHEMISTRY/BIO ORGANIC CHEMISTRY**	4	4	40	60	100
19PG3C14	**PHYSICAL CHEMISTRY PRACTICALS-I** (Electrical Experiments)	6	4	40	60	100
19PG3S1C1	**INTERNSHIP**	Off-class	3	50	50	100
	LIBRARY	2	-	-	-	-
Total		**30**	**26**			
SEMESTER 1V						
19PG4C15	**INORGANIC CHEMISTRY –III** (Organometallic chemistry-I &ii, basic concepts for bio-inorganic chemistry-I &ii and inorganic chains, rings and cages)	6	5	40	60	100
19PG4C16	**ORGANIC CHEMISTRY –IV** (Retrosynthesis, reactions and reagents, natural products)	6	5	40	60	100
19PG4C17	**PHYSICAL CHEMISTRY –IV** (Spectroscopy, kinetic theory of gases, photochemistry and radiation chemistry)	6	5	40	60	100
19PG4CE3/19PG4CE4	**ANALYTICAL CHEMISTRY/ CHEMICAL**	4	4	40	60	100

	ENGINEERING					
19PG4C18	**PHYSICAL CHEMISTRY PRACTICALS-II** (Non-electrical experiments)	6	4	40	60	100
19PG4CPR	**PROJECT**	offclass	3	50	50	100
	LIBRARY	2	-	-	-	-
Total		**30**	**26**			
	TOTAL	**120**	**90**			
OFF CLASS	**SOFT SKILLS**		4			
	COMPUTER APPLICATION COURSES		4			
	COMPREHENSIVE VIVA		2			
	MOOC COURSES		MIN- 2			
	READING CULTURE		1			
	TOTAL		13+			

OLD

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

ORGANIC CHEMISTRY –III- PG3C11

(Spectroscopy and Pericyclic Reactions)

(For those who joined in 2018 onwards)

5%
Deletion

Hrs/week: 6 **No.of credits:5**

COURSE OBJECTIVES: This paper provides an elaborate study oforganic spectroscopy and their applications in structural elucidation of organic compounds. This paper also deals with reactions that are taking place under photochemical conditions and pericyclic reactions.

UNITI-^{1}H-NMRSPECTROSCOPY (15 HRS)

i) Introduction – Relexation process – Instrumentation(not required) – Chemicalshift–Factorsinfluencingchemicalshift–Inductiveeffect,Vanderwaals deshielding, anisotropic effects, Hydrogen bonding, solvent effects.

2%

ii) H^{1}-NMRspectroscopy-coupling constantJ-factors influencing coupling constant J- classification (ABX, AMX, ABC &A2B2) Geminal,Vicinal and longrange coupling- Shiftreagents-NOE.

UNITII-^{13}C-NMR SPECTROSCOPY & 2D-NMRSPECTROSCOPY (15HRS)

C^{13}-Spectroscopy–introduction-chemical shifts (aliphatic, olefinic, alkyne, aromatic)-coupling constants. Broad band decoupling, Off-resonancedecoupling.2D NMR techniques such as HOMOCOR, HETEROCOR, NOESY, DEPT,INEPT,APT,INADEQUATE. Instrumentation (notrequired)

UNIT–III MASSS PECTROSCOPY (15HRS.)

Mass Spectroscopy-Introduction –ion production-EI, CI, FD and FAB-factors affecting fragmentation, Fragmentation of organic compounds-molecular ion peak,metastable peak- McLafferty rearrangement-Nitrogenrule-Retrodiels-Alderreaction.

UNIT–IV ORGANIC PHOTOCHEMISTY (15HRS.)

Photochemistry of alkenes, intramolecular reactions of olefinic bond-

geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes(di-pi-methanerearrangement)

Photochemistry of carbonyl compounds- dimerisation and Paterno-Buchi reaction- intramolecular reaction- saturated, cyclic and acyclic,unsaturated compounds- Barton reaction, Norrish Type I and Type IIreactionsphotoreductionof ketones.

3%

UNIT–V:PERICYCLICREACTIONS (15HRS.)

Frontierorbitalsofethylene,1,3-butadiene,1,3,5-hexatrienes and allyl systems, classification of pericyclic reactions-FMO and PMO approaches (excluding Correlation diagram method)–Electrocyclic reactitons- conrotatory and disrotatory motions- 4n, 4n+2-Cycloaddition-suprafacial and antara facial additions,(2+2) and(4+2)cycloadditions, Cheleotropic reactitons-Sigmatropic rearrangement- 3,3 and 5,5-sigmatropic rearrangements, Claisen,Cope rearrangements.

REFERENCES:

1. R. E. Ireland, Organic synthesis, Prentice-Hall of India Privated Ltd.,1988.
2. Norman and J. M. Coxon, Principles of organic synthesis, ELBS, 3rd Ed.,1993.
3. Jagdamba Singh, Photochemistry and Pericyclic Reactions, New ageinternationalpublishers,2009.
4. K. K. Rohatgi-Mukherjee, fundamentals of photochemistry, New ageinternationalpublishers,2006.
5. lanFleming,Pericyclicreactions,oxfordPublishers,2009.
6. W.Kemp,Organicspectroscopy,McMillan,1991.
7. R. M. Silverstein and F. X. Webster, Spectrometric Identification of organiccompounds,John Wiley& Sons,Inc.,6th Ed.2004
8. P.S.Kalsi,Spectroscopy of organic compounds, New age internationalpublishers,6thedition, 2009.

NEW

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

ORGANICCHEMISTRY –III- 19PG3C11

5% Deletion

(Spectroscopy and Pericyclic Reactions)

(For those who joined in 2018 onwards)

Hrs/week: 6 **No.ofcredits:5**

COURSE DESCRIPTION: This course provides the study of different aspects of 1D and 2D NMR spectral techniques and mass spectroscopy. This paper enable the students to understand the concept and reactivity of organic reactions under photochemical conditions.

COURSE OBJECTIVES: This paper provides an elaborate study of organic spectroscopy and their applications in structural elucidation of organic compounds. This paper also deals with reactions that are taking place under photochemical conditions and pericyclic reactions.

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

- To acquire a complete knowledge of the basic principles of 1H-NMR, 13C-NMR and Mass spectroscopy
- To be acquainted with complete knowledge of photochemistry of ketone & cyclo addition reactions and to develop an understanding of the significance of the number, and splitting of signals in NMR
- To be competent to assign structures to simple molecules on the basis of nuclear magnetic resonance spectra
- To distinguish the similarities and differences of Pericyclic reactions and Cyclo addition and sigmatropic reactions
- To apply the Spectral concepts to solve the problems, to elucidate the

structures of simple organic compounds using the data from all the spectral techniques

UNITS

UNIT I-^{1}H -NMR SPECTROSCOPY (15 HRS)

i) Introduction – Relexation process – Instrumentation(not required) – Chemical shift – Factors influencing chemical shift – Inductive effect, Vanderwaalsdeshielding, anisotropic effects, Hydrogen bonding, solvent effects.

ii)H^{1}-NMR spectroscopy-coupling constant J-factors influencing coupling constant J-classification (ABX, AMX, & A2B2) Geminal,Vicinal and long range coupling- Shift reagents -NOE.

UNIT II-^{13}C- NMR SPECTROSCOPY & 2D-NMR SPECTROSCOPY (15 HRS)

C^{13}-Spectroscopy–introduction-chemical shifts(aliphatic, olefinic, alkyne, aromatic)-coupling constants. Broad band decoupling, Off-resonance decoupling.

2D NMR techniques such as HOMOCOR, HETEROCOR, NOESY, DEPT, INEPT, APT, INADEQUATE. Instrumentation(not required)

UNIT –III MASS SPECTROSCOPY (15 HRS.)

Mass Spectroscopy-Introduction –ion production-EI,CI, FD and FAB-factors affecting fragmentation, Fragmentation of organic compounds-molecular ion peak,meta stable peak-Mc Lafferty rearrangement-Nitrogen rule-Retro diels-Alder reaction.

UNIT –IV ORGANIC PHOTOCHEMISTY (15HRS.)

Photochemistry of alkenes, intramolecular reactions of olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes (di-pi-methane rearrangement)

Photochemistry of carbonyl compounds- dimerisation and Paterno-Buchi reaction- intramolecular reaction- saturated, cyclic and acyclic α,β-unsaturated

compounds- Barton reaction, Norrish Type I and Type II reactions photoreduction of ketones

UNIT –V :PERICYCLIC REACTIONS (15HRS.)

Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatrienes classification of pericyclic reactions- FMO and PMO approaches (excluding Correlation diagram method) – Electrocyclicreactitons- conrotatory and disrotatory motions- 4n, 4n+2- Cycloaddition- suprafacial and antarafacial additions, (2+2) and (4+2) cycloadditions, Cheleotropicreactitons- Sigmatropic rearrangement- 3,3 and 5,5-sigmatropic rearrangements, Claisen, Cope rearrangements

REFERENCES:

1. R. E. Ireland, Organic synthesis, Prentice-Hall of India Privated Ltd., 1988.

2. Norman and J. M. Coxon, Principles of organic synthesis, ELBS, 3rd Ed., 1993.

3. Jagdamba Singh, Photochemistry and Pericyclic Reactions, New age international publishers, 2009.

4. K. K. Rohatgi-Mukherjee, fundamentals of photochemistry, New age international publishers, 2006.

5. lan Fleming, Pericyclic reactions, oxford Publishers, 2009.

6. W. Kemp, Organic spectroscopy, McMillan, 1991.

7. R. M. Silverstein and F. X. Webster, Spectrometric Identification of organic compounds, John Wiley & Sons, Inc., 6th Ed. 2004

8. P.S.Kalsi, Spectroscopy of organic compounds, New age international publishers, 6th edition, 2009.

OLD

FATIMA COLLEGE (AUTONOMOUS),MADURA-I625018

DEPARTMENTOF CHEMISTRY

Material Chemistry-PG3CE1

(For those who joined in 2018)

5 Hrs/week **No.of credits: 5**

OBJECTIVE: This course deals with study of synthesis, properties, structure and applications of nanoparticles.

COURSE DESCRIPTION

This paper deals with synthesis, properties and applications of nanomaterials. This paper also provides information about instrumentation techniques for characterising the nanomaterials.

UNITI: BASICS OF NANOMATERIALS (15 HRS)

Introduction – Basic concepts-quantum confinement effect, surface properties of nanoparticles. Classification of nanomaterials-one dimentional, two dimentional and three dimentional nanostructures. Carbon nanostructures- carbon molecules- carbon nanotubes- nanopolymers- nanocrystals.

Self-study: supramolecular structures

UNITII: SYNTHETICMETHODS OFNANOMATERIALS (15HRS)

Synthesis of semiconductors – sol gel synthesis & sono chemical approach and synthesis of ceramics. synthesis of carbon nanotubes - by carbon arc method and laser ablation method. Synthesis of fullerenes- by Pyrolysis of hydrocarbons, partial combustion of hydrocarbons and arc discharge method.

Self-study: Purification carbon nanotubes

UNIT III: PROPERTIES OF NANOMATERIALS (15 HRS)

Properties of carbon nanotubes,Thermal conductivity, Kinetic property, Elecrical and electronic, mechanical and vibrational properties and tensile strength. Properties of fullerenes-physical and chemical properties. Metalnanoclusters, rare gas and molecular clusters.

Self-study-Properties of semiconducting nanoparticles

UNITIV: CHARACTERIZATION TECHNIQUES (15 HRS)

Microscopy, Atomic forcemicroscope (AFM), scanning electronmicroscope (SEM), transmission electron microscope (TEM), scanning probemicroscope (SPM),scanning tunellingmicroscope (STM). Spectroscopy-UV-visiblespectroscopy, Infra-redspectroscopy, Nuclearmagnetic resonancespectroscopy, Raman spectroscopy and Photoelectron spectroscopy.

Self-study: X-raydiffractiontechnique (XRD).

UNITV: APPLICATIONS OF NANOMATERIALS (15 HRS)

Nanosensors:

Applications of optical nanosensors, chemical nanosensors, electrochemical nanosensors, micro-electro mechanical sensors and biosensors

Nanocatalyst:

Applications Of platinum, palladium, silver, cobalt nanoparticles, CNTs and polymer naomaterials as catalyst.

Nanomedicine: Nanomaterials in drug delivery, photodynamic therapy, molecular imaging, cancertreatment, molecularmotors, neuro-electronic interfaces and tissue engineering

Self-study-Applications of nano devices.

References

1. Charles P. Poole, Jr., Frank J. Owens, Introduction tonanotechnology,JohnWiley& Sons-India,2010.
2. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill PublishingCompanyLimited, 2007.
3. A.S.Bhatia,Dr.S.M.Ishtiaque,NanoscienceandCarbonNanotubes,Deep&DeepPublicationsPvt.Ltd.
4. MarkRatner,DanielRatner,Nanotechnology,AGentleIntroductionToTheNextBigIdea,PearsonEducation,5thEdn,2009.
5. Dr.S.Shanmugam,Nanotechnology,MJPPublishers,2010.

NEW

FATIMA COLLEGE (AUTONOMOUS),MADURA-I625018

DEPARTMENTOF CHEMISTRY

Material Chemistry-19**PG3CE1**

(For those who joined in 2018)

20%

4 Hrs/week **No.of credits: 4**

OBJECTIVE: This course deals with study of synthesis, properties, structure and applications of nanoparticles.

COURSE DESCRIPTION

This paper deals with synthesis, properties and applications of nanomaterials. This paper also provides information about instrumentation techniques for characterising the nanomaterials.

Course outcome

After completion of the course the students should be able :

- To gain knowledge about the basic principles of nanochemistry and classification of nanomaterials.
- To describe several synthesis of inorganic nanoparticles, one-dimensional nanostructures (nanotubes, nanorods, nanowires), thin films, nanoporous materials, and nanostructured bulk materials**,**
- To criticize the importance of various instrumentation techniques such as NMR, IR, UV, X-ray diffraction, ESR etc., for elucidating the structures of nanomaterials.
- To depict the structure of carnonnanoatructures, organic nanopolymers and supra molecular structures
- To recognize the important role of nanomaterials in various fields.

UNITI: BASICS OF NANOMATERIALS (12 HRS)

2%

Introduction – Basic concepts-quantum confinement effect, surface properties of nanoparticles. Classification of nanomaterials-one dimentional, two dimentional and three dimentional nanostructures. Carbon nanostructures-carbon molecules-carbon nanotubes- nanopolymers- nanocrystals.

Self-study: supramolecular structures

UNITII: SYNTHETICMETHODS OFNANOMATERIALS (12HRS)

3%

Synthesis of semiconductors – sol gel synthesis & sono chemical approach and synthesis of ceramics.synthesis of carbon nanotubes - by carbon arc method and

laser ablation method. Synthesis of fullerenes- by Pyrolysis of hydrocarbons, partial combustion of hydrocarbons and arc discharge method.

Self-study: Purification carbon nanotubes

UNIT III: PROPERTIES OF NANOMATERIALS (12 HRS)

Properties of carbon nanotubes,Thermal conductivity, Kinetic property, Elecrical and electronic, mechanical and vibrational properties and tensile strength.Properties of fullerenes-physical and chemical properties. Metalnanoclusters, rare gas and molecular clusters.

5%

Self-study-Properties of semiconducting nanoparticles

UNITIV: CHARACTERIZATION TECHNIQUES (12 HRS)

Microscopy, Atomic forcemicroscope (AFM), scanning electronmicroscope (SEM), transmission electron microscope (TEM), scanning probemicroscope (SPM),scanning tunellingmicroscope (STM). Spectroscopy-UV-visiblespectroscopy, Infra-redspectroscopy, Nuclearmagneticresonancespectroscopy, Raman spectroscopy and Photoelectron spectroscopy.

Self-study: X-raydiffractiontechnique (XRD).

UNITV: APPLICATIONS OF NANOMATERIALS (12 HRS)

10%

Nanosensors:

Applications of optical nanosensors, chemical nanosensors, electrochemical nanosensors, micro-electro mechanical sensors and biosensors

Nanocatalyst:

Applications Of platinum, palladium, silver, cobalt nanoparticles, CNTs and polymer naomaterials as catalyst.

Nanomedicine: Nanomaterials in drug delivery, photodynamic therapy, molecular imaging, cancertreatment, molecularmotors, neuro-electronic interfaces and tissue engineering

Self-study-Applications of nano devices.

References

1. Charles P. Poole, Jr., Frank J. Owens, Introduction tonanotechnology,JohnWiley& Sons-India,2010.

2. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill PublishingCompanyLimited, 2007.
3. A.S.Bhatia,Dr.S.M.Ishtiaque,NanoscienceandCarbonNanotubes,Deep&DeepPublicationsPvt.Ltd.
4. MarkRatner,DanielRatner,Nanotechnology,AGentleIntroductionToTheNextBigIdea,PearsonEducation,5thEdn,2009.
5. Dr.S.Shanmugam,Nanotechnology,MJPPublishers,2010.

OLD

FATIMA COLLEGE (AUTONOMOUS) MADURAI-18

DEPARTMENT OF CHEMISTRY

PHYSICAL PRACTICALS-I-PG4C16

(For those who joined from 2007 onwards)

Hours per week: 6+5 **credits: 4**

Course Objective:

This course gives lab experience on physical experiments.

PHYSICAL CHEMISTRY EXPERIMENTS

50%
Deletion

- **Conductometric Titration of Strong acid with a Strong Base.**
- **Conductometric Titration of Mixture of Strong acid and Weak acid with a Strong Base.**
- **Verification of Ostwald's Dilution law and Determination of Dissociation Constant.**
- **Alkaline Hydrolysis of Ethylacetate by conductometrically.**
- **Determination of the strength of HCl using pH meter.**
- **Determination of strength of HCl and CH_3COOH by pH titration.**
- **Potentiometric Titration of FAS.**
- **Determination of solubility product by Potentiometrically.**
- **Adsorption Characteristics of Oxalic acid and charcoal**
- **Adsorption Characteristics of Acetic acid and charcoal**
- **Acid catalysed hydrolysis of methyl acetate-Volumetry**
- **Activation energy of acid catalysed hydrolysis of methyl acetate**
- **Effect of ionic strength on the rate of persulphate iodide reaction**
- **Catalytic constant of an acid (Acetone and iodine in the presence of an acid)**
- **Kinetic of oxidation of alcohols by $K_2Cr_2O_7$ by spectrophotometry.**
- **Kinetics of iodination of acetone by spectrophotometry.**

Reference Book

B.Viswanathan, P.S. Raghavan, Practical Physical Chemistry, 2005.

NEW

FATIMA COLLEGE (AUTONOMOUS) MADURAI-18
PHYSICAL CHEMISTRY PRACTICALS-II-19PG4C18
SEMESTER –IV

(Non-Electrical experiments)

(For those who joined from 2019 onwards)

HRS: 6 **CREDIT:4**

50% DELETION

Course Objective:

This course gives lab experience on physical experiments.

Course outcomes:

After completion of the course the students should be able to:

- Experience in some scientific methods employed in basic and applied physical chemistry
- Developed skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry
- Developed skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments
- Developed some understanding of the professional and safety responsibilities residing in working with chemical systems.
- **PHYSICAL CHEMISTRY EXPERIMENTS**
- Adsorption Characteristics of Oxalic acid and charcoal
- Adsorption Characteristics of Acetic acid and charcoal
- Acid catalysed hydrolysis of methyl acetate-Volumetry
- Activation energy of acid catalysed hydrolysis of methyl acetate
- Effect of ionic strength on the rate of persulphate iodide reaction
- Catalytic constant of an acid (Acetone and iodine in the presence of an acid)
- Kinetic of oxidation of alcohols by $K_2Cr_2O_7$ by spectrophotometry.
- Kinetics of iodination of acetone by spectrophotometry.

Reference Book

B.Viswanathan, P.S. Raghavan, Practical Physical Chemistry, 2005.

S. Medona.
HEAD
Department of Chemistry
Fatima College (Autonomous)
Madurai 18