A.D.M. COLLEGE FOR WOMEN (AUTONOMOUS),NAGAPATTINAM

(Nationally Re-accredited with 'A' grade by NAAC-3rd cycle)

PG & RESEARCH DEPARTMENT OF CHEMISTRY

(For the candidates admitted from the academic year 2020-2021 onwards)

M.Sc., CHEMISTRTY SYLLABUS

A.D.M.COLLEGE FOR WOMEN (AUTONOMOUS),

NAGAPATTINAM

M.Sc., CHEMISTRY

(for those admitted from the year 2020-2021 onwards)

Programme Educational Objectives:

PEO 1	• To develop critical analysis and problem solving skills required in the application of principles of chemistry
PEO 2	• To prepare students with a working knowledge of experimental techniques and instrumentation required to work independently in research or industrial environments.
PEO 3	• To develop student strength in organizing and presenting acquired knowledge coherently both orally and in written discourse,
PEO 4	• To prepare the students to successfully compete for current employment opportunities.
PEO 5	• Work alongside of physicists, engineers, environmentalists, biomedical scientists, pharmacists, doctors and other professionals to help solving scientific problems

STRUCTURE OF THE PROGRAMME

Papers	**No**	**Credit**	**Marks**
Core papers	8	41	800
Core practical's	6	18	600
Elective papers	5	25	500
Project	1	6	100
Total	**20**	**90**	**2000**

Marks/ Papers	**C.I.A**	**S.E**
Theory Papers	25	75
Practical Papers	40	60

Passing Minimum

A candidate shall be declared to have passed in each course if she secures not less than **40 %** marks in the End Semester Examination and 40% marks in the Continuous Internal Assessment and not less than **50% in the aggregate**, taking Continuous Internal Assessment and End Semester Examination marks together.

A.D.M.COLLEGE FOR WOMEN (AUTONOMOUS), NAGAPATTINAM
DEPARTMENT OF CHEMISTRY
M.Sc., CHEMISTRY
Course Structure Under CBCS
(for the candidates admitted from the Academic year 2019-2020 onwards)

SEM	COURSE	TITLE	INST HOURS/ WEEKS	CREDIT	EXAM HOURS	MARKS		TOTAL MARKS
						C.I.A	S.E	
I	Core Course I (CC)	Inorganic Chemistry I	6	5	3	25	75	100
	Core Course II (CC)	Organic Chemistry I	6	5	3	25	75	100
	Core Course III (CC)	Physical Chemistry I	6	5	3	25	75	100
	Core Practical I(CP)	Inorganic Chemistry practical I	6	3	6	40	60	100
	Core PracticalII(CP)	Organic Chemistry practical I	6	3	6	40	60	100
		Total	**30**	**21**				**500**
II	Core Course IV (CC)	Inorganic Chemistry II	6	5	3	25	75	100
	Core Course V (CC)	Organic Chemistry II	6	5	3	25	75	100
	Core Practical III (CP)	Inorganic Chemistry practical II	6	3	6	40	60	100
	Core Practical IV(CP)	Organic Chemistry practical II	6	3	6	40	60	100
	Elective Course I (EC)	Non-Conventional Energy sources / Computer applications and C programming	6	5	3	25	75	100
		Total	**30**	**21**				**500**
III	Core Course –VI (CC)	Physical methods in Chemistry	6	5	3	25	75	100
	Core Course – VII (CC)	Physical Chemistry II	6	6	3	25	75	100
	Core Practical-V (CP)	Physical Chemistry Practical – I	6	3	6	40	60	100
	Elective Course- II (EC)	Industrial Chemistry/ Bioinorganic Chemistry	6	5	3	25	75	100
	Elective Course –III (EC)	Green Chemistry/ Molecular modeling and drug design	6	5	3	25	75	100
	Total		**30**	**24**				**500**

IV	Core Course –VIII (CC)	Recent Trends in Chemistry	6	5	3	25	75	100
	Core Practical – VI(CP)	Physical Chemistry Practical – II	6	3	6	40	60	100
	Elective Course-IV(EC)	Applied Chemistry/ Forensic Science	6	5	3	25	75	100
	Elective Course – V(EC)	Analytical Techniques/ Petrol and Petrochemical products	6	5	3	25	75	100
	Project	Project	6	6	3	25	75	100
	Total		**30**	**24**				**500**
Grand Total			**120**	**90**				**2000**

PG & Research Department of Chemistry

Mark Allocation for Theory Papers

CIA	-	25Marks
External	-	75Marks
		100 Marks

CIA Component

Test	-	10Marks
Assignment	-	2Marks
Seminar	-	3 Marks
Quiz/GroupDiscussion	-	5 Marks
Attendance	-	5Marks
		25 Marks

Pattern of question Paper (Theory)

Section – A	10x2 = 20 Marks (NoChoice)
Section – B	5x5 = 25 Marks (Either/or)
Section – C	3 x 10 = 30 Marks (Any Three out of Five)
	Total 75 Marks

Programme Outcomes:

PO 1	Formulate new chemicals andmaterials.
PO 2	Perform chemical analysis to determine composition of various chemicalcompounds.
PO 3	Use knowledge of chemistry for solving problems in environmental, food processing, pharmaceutical, biochemical, agriculture, fuels and chemicals, textile processing, mining and many otherindustries.
PO 4	Use modern tools and techniques for the solution of problems inchemistry.
PO 5	Manage information, develop technical reports and makepresentations.

Programme Specific Outcomes:

PSO 1	Learn the classical status of the thermodynamics.
PSO 2	Carryout experiments in the area of organic analysis, estimation, separation, conductometric and potentiometric analysis.
PSO 3	Introduce advance techniques and ideas required in developing area of chemistry.
PSO 4	Provide theoretical background and develop practical skills for analyzing materials using modern analytical methods and instruments.
PSO 5	Indepth knowledge helps to qualify in competitive examination.
PSO 6	Provide theoretical background and develop practical skills for analyzing materials using modern analytical methods and instruments.
PSO 7	Indepth knowledge helps to qualify in competitive examination.
PSO 8	Enhance students ability to develop mathematical models for physical systems.

Course code & Title	MQA & INORGANIC CHEMISTRY I		
Class	M.Sc Chemistry	Semester	I
Cognitive Level	K-1 Acquire / Remember K-2 Understand K-3 Apply K-4 Evaluate K-5 Analyze K-6 Create		
Course Objectives	• To learn the structure of crystal lattice. • To study the concepts of different types of bonds. • To understand the concept of kinetics of reaction mechanism. • To know about the concept of Acids and bases. • To acquire knowledge about nuclear reactions.		
UNIT	Content		
I	**UNIT I IONIC BOND AND CRYSTAL STRUCTURE** 1:1 Radius ratio rules-calculation of limiting ratio rules of Coordination number 3 to 6. Classification of ionic Radius Ratio rules – Calculation of some limiting radius ratio values for Coordination number.3 (planar Triangle), Coordination number.4 (tetrahedral), Coordination number.6 (octahedral).Classification of Ionic structures – AX(ZnS, NaCl, CsCl,), AX_2 (CaF_2, TiO_2, CdI_2) 1:2 Lattice energy- Born Lande equation –Kapustinski equation-High Tc superconductors-Solid state reactions- Types and examples. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
II	**UNIT II BASICS OF CO-ORDINATION CHEMISTRY** 2:1 Theories, nomenclature of mono and polynuclear complexes. Crystal field theory – shapes of d orbitals. Splitting of d orbitals in octahedral symmetry – CFSE – strong field and weak field splitting – calculation of CFSE for dn system. Splitting in tetrahedral symmetry – only weak field splitting – reasons. Tetragonal symmetry – difference between tetrahedral and tetragonal symmetry. Jahn – Teller distortion – splitting pattern in trigonal, square planar, trigonal bipyramidal, square pyramidal, cubic symmetries. Factors affecting the magnitude of splitting (10 Dq), Oxidation state of the ligands, nature of the ligands – spectrochemical studies. Jorgensens relation. Evidences for CFT. 2:2 M.O. Theory – Octahedral, tetrahedral and square planar complexes. Pi bonding and M.O. theory – ligands having filled and empty pi bonds – effects on 10 Dq. Evidences for pi bonding – Nephelauxetic effect – angular overlap model. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
III	**UNIT III REACTION MECHANISM IN COORDINATION COMPLEXES** 3:1 Kinetics and mechanism of reactions in solution – labile and inert complexes – ligand displacement reactions in octahedral and square planar complexes – acid hydrolysis,base hydrolysis and anation reactions. 3:2 Trans effect – theory and applications – electron transfer reactions – electron exchange reactions – complementary and non-complementary types – inner sphere and outer sphere processes – application of electron transfer reactions in inorganic complexes – isomerisation and racemisation reactions of complexes. 3:3 Molecular rearrangements of four- and six-coordinate complexes – interconversion of stereoisomers – reactions of coordinated ligands – template effect and its applications for the synthesis of macrocyclic ligands – unique properties. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
IV	**UNIT IV ACIDS AND BASES** 4:1 Usanowich concept-generalised acid base concept-steric and solvation effect-measure of acid base strength. HSAB principle-classification of acid and base as hard and soft-E and C parameters-theoretical base of hardness and softness. 4:2 Non-aqueous solvent-Differentiating and Leveling Solvents-solvation number-medium		

	effect-pH measurement in non-aqueous media-liquid ammonia, SO_2, H_2SO_4, HCN, HF as solvents. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
V	**UNIT V NUCLEAR CHEMISTRY** 5:1 Nuclear properties - modes of radio active decay. Alpha and beta decay, orbital electron capture, nuclear isomerism, internal conversion 5:2 Detection and determination of radio activity. Cloud chamber, nuclear emulsion, Geiger Muller counter, scintillation and cherankov counters 5:3 Nuclear reaction -Transmission, fission, fusion, spallation and fragmentation reactions. Neutron sources - neutron activation and isotopic dilution analysis. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
Text Book	**Text Books:** J.E. Huheey, Inorganic chemistry,Pearson Education Publisher,4th edn,2016. M.C.Day, J.Selbin &H.H.Sisler, Theoretical Inorganic chemistry, Literary Licensing Publisher, 2012.
Reference Book	1. J.D. Lee, A new concise Inorganic chemistry, Wiley India Publishers, 4th edition, 2015. 2. Geoffrey.A.Lawrance, Introduction of coordination chemistry, John Wiley & Sons Publishers, 1st edition,2010. 3. R.K.Sharma, Inorganic Reaction Mechanism: Discovery Publishing House, New Delhi, 2011. 4. ArunBahl, B.S.Bahl, G.D.Tuli, Essential of Physical chemistry,S.Chand Publishers, 1stmulticolour revised edition 2008. 5. John.R.Lamarash, Introduction to Nuclear Reactor Theory, Addison-Wesley Publishers- 3rd edition 2014.
e- Resources	**Web Resources:** • www.science direct.com • https://sites.google.com • www.freebook centre.net
Course Outcomes	**Course Outcomes:** On completion of the Course, Students should be able to • Understand the address of the ionic bond and know the types of ionic structure. • Determine the stability of complexes and to apply various reaction of coordination compound • Apply CFSE for coordination compounds • Apply various concepts of acids and bases to interpret the types of materials. • Use various radioactive detectors and apply various nuclear reactions.

Mapping of Cos with PSOs & Pos

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	M	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO4	S	M	S	S	M	M	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**MQC & PHYSICAL CHEMISTRY I**		
Class	**M.Sc., Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To study the theories of kinetics • To understand the concepts of catalysis and fast reactions • To learn the concept of group theory • To learn the importance concepts of statistical mechanics. • To learn the concept of quantum statistics.		
UNIT	**Content**		
I	**UNIT I CHEMICAL KINETICS – I** 1:1Kinetics of complex reaction- opposing, consecutive and parallel reactions,chain reactions – thermal and photochemical reaction between hydrogen and halogens, gas phase autoxidation, explosions, hydrogen – oxygen reaction. 1:2 Theory of unimolecular reactions – Lindemann's theory – Hinshelwood theory – treatment of ARR theory, Slater's treatment. 1:3 Principles of microscopic reversibility, steady state approximation –Theories of reaction rates – simple collision theory – absolute reaction rate theory (ARRT) to simple unimolecular and bimolecular processes – potential energy surfaces – kinetic isotopic effect. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
II	**UNIT II CHEMICAL KINETICS – II** 2:1 Factors influencing reaction rates in solution – application of ARRT to solution kinetics – effect of solvents, double sphere and single sphere model and effect to ionic strength – influence of pressure on rates in solution – significance of volume of activation – substituent effect , Hammett and Taft equations. 2:2 Homogeneous catalysis: Acid – base catalysis – Hammett – Deyrup acidity function – Bronsted relation – Enzyme catalysis – mechanism of single substrate reactions – Michaelis – Menten law – influence of pH and temperature. 2:3 Fast reaction: Luminescence and energy transfer processes – Study of kinetics by stopped flow technique, relaxation methods T and P jump methods flash photolysis and magnetic resonance method**.** **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
III	**UNIT III GROUP THEORY** 3:1 Elements of group theory : Properties of a group and subgroup – classes – group multiplication tables – isomorphism groups – symmetry elements and symmetry operations – interrelations among symmetry operations –point groups-assignment of point groups to molecules – matrix representation theory – consequences of great orthogonality theorem and construction of character tables – characters, reducible		

	and irreducible representations – Direct products. 3:2 Application of group theory: Finding symmetry of normal and active modes of vibration for H_2O and BF_3 only. Symmetry selection rules for IR and Raman Spectra. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
IV	**UNIT IV STATISTICAL MECHANICS** 4:1 Basic concepts and classical statistics : Statistical mechanics – calculation of thermodynamic probability of a system – Ensembles – phase space – Eragodic hypothesis – definition of micro and macro states – different methods of counting macro states – distinguishable and indistinguishable particles – classical statistics – derivation of Maxwell Boltzmann distribution law. 4:2 Translational, rotation, vibration, electronic partition function – calculation of enthalpy, internal energy, entropy and other thermodynamic functions in terms of partition functions – applications of partition function to mono atomic gases and diatomic molecules. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
V	**UNIT V QUANTUM STATISTICS** 5:1 Quantum statistics – Bose Einstein and Fermi – Dirac statistics – comparison of them with Boltzmann statistics Heat capacity of solids – Einstein and Debye's treatments – concept of negative Kelvin temperature. 5:2 Third law of thermodynamics: Need for the third law – Nernst heat theorem and other forms of stating the third law. Thermodynamic quantities at absolute zero – statistical meaning of third law – apparent exception to the third law. 5:3 Non-equilibrium thermodynamics: Thermodynamics of irreversible processes – Onsager's reciprocal relations – Steady – state conditions. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
Text Book	**Text Books:** Keith J. Laider, John H. Meiser, Physical chemistry publisher CBS, publication 2nd edition, 2006. Donald A. Macquarie, Quantum chemistry publisher-university science book, publication 2nd edition, 2007.
Reference Book	**Reference Books:** 1. Peter Atkins, Julio de paula& James keeler, Physical Chemistry, Oxford university -11th Edition, 2018 2. James E.house, Principle of chemical kinetics, Academic Press publication, 2ndedition, 2007 3. F.A Cotton Chemical applications of group theory, John willey and sons, publications, Singapore - 3rd edition, 2003. 4. R.K.Pathria and Paul D. Beale, Statistical mechanics , Academic press publication -3rd edition, 2011 5. Alastair I.M Ral, Jim Napolitano,Quantum mechanism ,CRC press publication 6th edition,2015 6. R.K Prasad, Quantum Chemistry , New age international publishers,New delhi, 4th edition, 2014.
e- Resources	**Web Resources:** 1. www.ace.organicchem.com 2. https://archive.org

Course Outcomes	**Course Outcomes:** On completion of the Course, Students should be able to • To pursue research program • Ensures the students to acquire knowledge on chemical kinetics • To assign the symmetric elements and point group of molecules. • Solve all problem pertaining to Statistical mechanics • Ensures the students to acquire knowledge on non-equilibrium thermodynamics.

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	M	S	S	S	W	S	S	S	S	M	S	S	S
CO2	S	M	S	M	S	M	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	W	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	M	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQEY & ORGANIC CHEMISTRY PRACTICAL – I**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To perform the qualitative analysis of a given organic mixture. • To carry out the separation by paper chromatography technique.		
UNIT	**Content**		
I	**EXPERIMENTS:** • Analysis of mixture of Organic Compounds • Separation by paper Chromatography Technique.		
Reference Book	**Reference Books:** 1. V.K. Ahluwalia, P. Bhagat, R. Aggarwal, Laboratory Techniques in Organic Chemistry, I.K. International, 2005. 2. N.S. Gnanaprakasam, G. Ramamurthy, Organic Chemistry Lab Manual, S.V. Printers. 3. A.I. Vogel, A.R. Tatchell, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of		
e- Resources			
Course Outcomes	**Course Outcomes** On completion of the Course, Students should be able to • Performing the chromatography by which complex mixtures are separated are analyzed. • Doing the estimation of chemicals for knowledge about of concentration and purity.		

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	M	M	M	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQDY & INORGANIC CHEMISTRY PRACTICAL I**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To estimate the metal ions using quantitative analysis. • To carry out the colorimetric estimations of metal ions.		
UNIT	**Content**		
I	**I. Estimation of mixture solutions:** 1. Estimation of Copper and Zinc 2. Estimation of Iron and Nickel 3. Estimation of Copper and Nickel 4. Estimation of Calcium and Magnesium		
II	II Colorimetric estimations of **Copper, Iron, and Nickel**		
Reference Book	**Reference Books:** 1. A.I. Vogel's, Quantitative Inorganic Analysis, 5th Ed., Prentice Hall, 1996.		
Course Outcomes	**Course Outcomes:** On completion of the Course, Students should be able to • The advanced method of estimation of metal ions through complexation. • To acquire knowledge about colorimetric analysis.		

Mapping of Cos with Pos & PSOs:

CO/PO	PO					PSO							
	1	2	3	4	5	1	2	3	4	5	6	7	8
CO1	S	S	S	S	S	W	S	S	S	S	S	M	S
CO2	M	S	S	S	S	W	S	S	S	S	S	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	MQB & ORGANIC CHEMISTRY – I		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To understand the criteria for aromaticity and elimination reactions. • To introduce advanced level study in stereochemistry • To learn the classification, structure of steroids • To study about the rearrangements • To introduce retro synthetic analysis and modern synthetic reagents		
UNIT	**Content**		
I	**UNIT I AROMATICITY** 1:1 Elements of aromaticity – Huckel's and Craig's rule – effects of aromaticity on bond lengths – ring currents. Nonbenzenoid aromatic compounds – aromatic character in three, five, seven and eight membered rings – anti aromaticity – systems with 2, 4, 8 and 10 electron systems. Annulenes and syndones – alternant and non – alternant hydrocarbons**.** 1:2Elimination reactions**:** E1, E2, E1CB and Ei – mechanisms – stereochemistry of eliminations – Hoffman and saytzeff rules – Competition between elimination and substitution reactions – Chugaev reaction dehydration of alcohols, dehydrohalogenation – Hoffman degradation. Cope elimination – Bredt's rule. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
II	**UNIT II ORGANIC STEREOCHEMISTRY** 2:1 Configurational nomenclature – D and L nomenclature R-S nomenclature of acylic and cyclic chiral compounds – stereochemistry of allenes, spiranes, biphenyls (atropisomerism), Stereochemistry of Ansa compounds, cyclophanes. Definition of terms prochirality. Enantiotopic and diastereotopic group – asymmetric synthesis – Cram's rule 2:2 Dynamic strereochemistry: Quantitative correlation between conformation and reactivity, Winstein-Eliel equation, Curtin – Hammett principle. Conformation, reactivity and mechanisms of cyclic systems-saponification of an ester, esterification of an alcohol, chromic acid oxidation of 2,2-aminocyclohexanol-stereospecific, stereoselective,diastereoselective & Enantioselective reaction **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
III	**UNIT III STEROIDS** 3:1 Classification – structural elucidation of cholesterol (synthesis not required) – structural elucidation and synthesis of vitamin D – estrone, progesterone,equilenin, and androsterone. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
IV	**UNIT IV MOLECULAR REARRANGEMENTS & ITS MECHANISMS** 4:1 C=C Rearrangements: Wagner Meerwein, Dienone – phenol, Stevens, Wittig, Favorski rearrangements. C=N Rearrangements:Wolf, Lossen, Schmidt rearrangements. C=O Rearrangements: Bayer – Villiger rearrangement 4:2 Heterocyclic compounds: Synthesis and reactions of azoles – pyrazole, imidazole, oxazole and thiazole – synthesis and reactions of oxazine, pyridazine, pyrimidine and pyrazine. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		

V	**UNIT V MODERN SYNTHETIC METHODOLOGY** 5:1: Retrosynthetic analysis or Synthon approach. -- An introduction to reterosynthesis - synthon – synthetic equivalent – target molecule, functional group interconversion. Disconnection approach-One group disconnections-Disconnection of alcohols,olefins, ketones. Two group disconnections – 1,3-dioxygenated skeletons-1,5-dicarbonyl compounds .Illogical two group disconnections strategy **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
Text Book	1. P.S Kalsi organic reactions & mechanism 2nd edition new age international publishers 2002, 2. J. March, Advanced Organic Chemistry, 4th edition john wiley and sons, New York 2006. 3. Starkey, L., S., Introduction to Strategies for Organic Synthesis, Wiley, 2012
Reference Book	1. Carey B.F.A Sundberg, Advanced Organic Chemistry Part A & B Springer 5th edition,2007. 2. D. Nasipuri, Stereochemistry of Organic Compounds-Principles and Applications, 4nd New Academic Science Publisher, 2012 3. O.P.Agarwal, Chemistry of organic natural products Vol. I and Vol. II, Goel Publications, 2014. 4. Sanyal&Sanyal,Rearrangement and reagents, BharatiBhawan publishers and distributors 4thedition ,2003. 5. Willis, C. L., Wills, M., Organic Synthesis, Oxford Chemistry Primers, 31, Oxford Science Publications, 1996.
e- Resources	• https://www.quora.com • https://www.rsc.org • https://www.e-booksdirectory.com
Course Outcomes	On completion of the Course, Students should be able to • To understand the concept of aromaticity and stability of molecules. • Gain the knowledge in the field of stereochemistry. • To understand the synthesis and structure of steroids • Studying the rearrangement will stimulate the knowledge for preparing chemical compounds. • To introduce synthetic methodology of preparation of compounds.

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	M	S	M	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	M	M	S	S	S	S	S	M	S	S	S
CO6	S	S	S	S	S	M	S	S	S	S	S	S	S	S

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**MQG & ORGANIC CHEMISTRY– II**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To introduce advanced level study in addition reactions. • To learn electrophilic and nucleophilic substitution reactions • To learn the structural elucidation and properties of natural products. • To introduce the concepts of photochemistry and pericyclic reactions. • To introduce the advanced concepts in mass spectroscopy.		
UNIT	**Content**		
I	**UNIT IADDITION REACTIONS** 1:1 Addition to carbon – carbon multiple bonds: Birch reduction, hydroxylation, hydroboration, epoxidation, Diels – Alder reaction, Michael addition, ozonolysis, carbenes and their addition to double bonds. 1:2 Addition to carbonyl groups :Mannich, crossed Cannizzaro, Stobbe, Benzoin, formation of ketenes, Oppenauer oxidation, MPV reduction, Darzon'sglycidic ester condensation, Wittig reaction. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
II	**NUCLEOPHILIC& ELECTROPHILIC SUBSTITUTION REACTIONS** 2:1**:** SN_1, SN_2 and SN_I mechanisms – effects of substrate structure, leaving group, attacking nucleophiles and solvent – neighbouring group participation – substitutions at allylic carbons and reactivity – ambident nucleophiles. 2:2: Aliphatic Electrophilic Substitution - SE_1, SE_2 and SE_I mechanisms – effect of substrate structure, leaving group and solvent – Stark – enamine reaction – decarboxylation of aliphatic acids – halogenation of aldehydes and ketones. 2:3: Aromatic Electrophilic Substitution –Aromatic ion mechanism – Orientation and reactivity – nitration, halogenation – Friedel – Crafts reaction – Gattermann, Kolbe – Schmidt, Reimer – Tiemann, Hauben – Haesch reaction. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
III	**UNIT III NATURAL PRODUCTS** 3:1: Antibiotics: Structural elucidation and synthesis of penicillin, streptomycin – cephalosporin C. 3:2: Terpenes : Structural elucidation, medicinal values and synthesis of α – pinene, camphor and zingiberene, biosynthesis of terpenes 3:3: Alkaloids: Structural elucidation, medicinal values and synthesis of quinine, reserpine morphine – Cinchonine and papaverine. Biosynthesis of alkaloids. 3:4: Vitamins**:** Physiological importance – structural elucidation of vitamins – B_6, B_{12}, E,K. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
IV	**UNIT IV ORGANIC PHOTOCHEMISTRY AND PERICYCLIC REACTIONS** 4:1 Fundamental concepts – Joblonski diagram – energy transfer – characteristics of photoreaction and photoxidation – photoreaction of ketones and enones – Norrish type I &II reactions. Photochemistry of alkenes, dienes and aromatic compounds. Photosensitisation – photoaddiation – Barton		

	reaction – paterno - Buchi reaction. Phosphorescence, fluorescence, chemi luminescence. 4:2 Pericyclic reactions - Concerted reactions – stereochemistry – orbital symmetry and correlation diagram – Frontier molecular orbital approach – Woodward Hoffmann rules – electrocyclic reactions – cycloadditions, selection rules, sigmatropic rearrangements – selection rules with simple examples – 1, 3 and 1, 5 – hydrogen shifts – Cope and Claisen rearrangements. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
V	**UNIT V MASS SPECTROSCOPY** 5:1Basic principles – resolutions – base peaks, isotopic peaks, metastable peaks, parent peaks, determination of molecular formula – recognition of molecular ion peak, FAB fragmentation – general rules. Nitrogen rule – pattern fragmentation of various classes of compounds. McLafferty rearrangement, importance of metastable peaks. 5:2 Optical rotatory Dispersion and circular dichroism: Introduction to theory and terminology, cotton effect and ORD curves. Axial haloketone rule and its applications – Octant rule and its applications. Application of ORD to determine absolute configuration of simple monocyclic ketones – comparison between ORD and CD and their inter-relationship. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
Text Book	1. Robert J. Ouellette and J.DavidRawn Organic chemistry –Structure, mechanism and synthesis, 2nd edition 2019. 2. James M. Thompson Mass spectrometry -Jenny Stanford publisher, 2017. 3. Y.R Sharma S.ChandElementary organic spectroscopy, S.Chandpublisher, 2013. 4. J.M Coxton&B.Halton,Organicphotochemistry,Cambridge university press 2nd edition ,2011.
Reference Book	1. Subrata Sen Gupta, Reaction Mechanism in Organic Chemistry oxford university press, 2016. 2. MichaelB.Smith and Jerry march March's Advanced organic chemistry reaction, mechanism and structure, 6th edition,2013. 3. O.P.Agarwal "Chemistry of organic natural products,Vol.I&II,Goel publishers ,2014. 4. JagdambasinghPhotochemistry and Pericyclic reaction,New age international publisher, 2019. 5. Robert M.Silverstein,Francis X. Webster,David H. Kiemie& David L. Bryce spectrometric identification of organic compounds, Wiley publication,2014.
e- Resources	1. https://www.topfreebooks.org. 2. https://www.rsc.org
Course Outcomes	On completion of the Course, Students should be able to 1. Ensures the students to understand, acquire knowledge on addition to C-C bond, and addition to carbonyl groups. 2. Ensures the students to understand, acquire knowledge on aromatic and aliphatic substitution reactions 3. To understand, acquire knowledge on antibiotics, terpenes, alkaloids and vitamins. 4. Ensures the students to understand, acquire knowledge on organic photochemistry and rearrangements. 5. Ensures the students to understand, acquire knowledge on mass spectroscopy.

Mapping of Cos with Pos & PSOs:

CO/PO	PO					PSO							
	1	2	3	4	5	1	2	3	4	5	6	7	8
CO1	S	S	S	M	S	W	S	S	M	S	S	S	S
CO2	S	S	S	S	M	M	S	S	S	S	S	S	S
CO3	S	S	S	S	S	W	S	S	S	S	S	S	S
CO4	S	S	S	S	S								
CO5													

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**MQF & INORGANIC CHEMISTRY – II**		
Class	**M.Sc., Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	• To bring understanding of Oxygen transport and energy transfer of proteins. • To study about inorganic chains and clusters • To know about organometallic compounds. • To learn about inorganic photochemistry. • To learn the basic principles of photo inorganic chemistry.		
UNIT	**Content**		
I	**UNIT I OXYGEN TRANSPORT AND ENERGY TRANSFER OF METAL PROTEINS** 1:1Haemoglobin and myoglobin – Oxygen transport and storage. Electron transfer and Oxygen activation. Ferridoxins and rubredoxins – Copper proteins – Classification – Electron transfer, Oxygen transport. Oxidases and reductases – Cytochrome oxidases – superoxide dismutase (Cu, Zn), Urease and hydrogenases. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
II	**UNIT II INORGANIC CHAINS, CAGES, RINGS AND CLUSTERS** 2:1Homocylic and heterocyclic inorganic ring systems-Isopoly and heteropoly anions-silicates, polysilicates and aluminosilicates, sulphur nitrides, borazines,phosphazens,phosphazene polymers- synthesis,properties and structure of boranes, [styx notation] heteroboranes, metalloboranes and metallocarboranes, silicones. 2:2 Metal-metal bonds-clusters-carbonyl clusters,anionic and hydridoclusters,carbideclusters,sulphur metal cluster,swade's rule-isolobal relationship between main group and transition metal fragments. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
III	**UNIT III ORGANOMETALLIC COMPOUNDS** 3:1 Complexes of pi-acceptor ligands. Carbonyls-18 electron rule-application to structure of carbonyls(simple and polynuclear). Carbonylate anions, carbonyl anions, Carbonylate hydrides- Dinitrogen complexes. 3:2 Catalysis by organo metallic compounds hydrogenation and hydroformulation of olefins – oxidation of olefins to aldehydes and ketones – polymerisation of alkenes cyclo-oligomerisation of acetylene- fischer –Tropschs synthesis. 3:3 Carbon pi donor complexes:Synthesis, structure and bonding of olefin, alkyne and allyl complexes. Metallocenes-stability and reactivity. Molecular orbital concept of Metallocenes. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
IV	**UNIT IV INORGANIC PHOTOCHEMISTRY** 4:1 Electronic transitions in metal complexes, metal-centered and charge-transfertransitions – various photophysical and photochemical processes of coordinationcompounds. 4:2 Unimolecular charge-transfer photochemistry of cobalt(III) complexes – mechanism of CTTM, photoreduction – ligand-field photochemistry of chromium(III) complexes –Adamson's rules, photoactive excited states, V-C model – photophysics and photochemistry of ruthenium – polypyridinecomplexes, emission and redox properties. 4:3 Photochemistry of organometallic compounds – metal carbonyl compounds – compounds with metal- metal bonding – Reinecke's salt chemical actinometer. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		

V	**UNITV MEDICINAL BIOINORGANIC CHEMISTRY** 5:1 Bioinorganic chemistry of quintessentially toxic metals – lead, cadmium, mercury, aluminium, chromium, copper and plutonium – detoxification by metal chelation – drugs that act by binding at the metal sites of metalloenzymes. 5:2 Chemotherapy – chemotherapy with compounds of certain non-essential elements –platinum complexes in cancer therapy – cisplatin and its mode of action – cytotoxic compounds of other metals. 5:3 Gold containing drugs as anti-rheumatic agents and their mode of action – lithium in psychopharmacological drugs – radiopharmaceuticals – technetium. **(Content – 15 Hrs, Assessment – 3 Hrs)** **(18 Hrs)**
Text Book	1. Shriver and Atkins "Inorganic Chemistry ´5th edition 2010, 2. Cotton, Wilkinson G: Murillo CA &Bochmann "Advanced Inorganic Chemistry "6 the Edition 2017. 3. W. Kaim and B. Schewederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley and Sons, New York, USA,2nd Ed., 2013.
Reference Book	1. James E.Huheey, Ellen A.Keiter, Richard L. L.KeiterOkhilK.Medhi Principles of structure and Reactivity 4th Edition Pearson Education India Publishers, 2006. 2. Shriver and Atkins "Inorganic Chemistry ´5th edition 2010, 3. R.C Mehroa Organometallic Chemistry New Age International Publisher, 2007. 4. Wiley VCH- Bio Inorganic Medicinal Chemistry, 2011. 5. Edward I Solomon A.B.P Lever Inorganic Electronic Structure and Spectroscopy Volume 2 Application and case studies, Wiley Black Well Publishers,2006.
e- Resources	1. www.science direct.com 2. https://sites.google.com 3. www.freebook centre.net
Course Outcomes	On completion of the Course, Students should be able to • To understand the role of metal ions in biological system • Ensures the students to understand, acquire knowledge on inorganic chains, cages and rings • Identify the synthesis, structure and bonding of carbon-pi-donor complexes • To study the basic principles of photo inorganic chemistry • To have an idea about the recent advances in medicinal bio inorganic chemistry

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	M	S	S	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S	M	M	S	S
CO5	S	M	S	S	S	S	S	S	S	S	S	S	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQIY & CORE PRACTICAL –III ORGANIC CHEMISTRY PRACTICAL – II**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	• To estimate the organic compounds. • To carry out the two stage preparation of organic compounds		
UNIT	**Content**		
I	**I Estimation of organic compounds** 1.Estimation of Phenol 2.Estimation of Aniline 3.Estimation of Ketone 4.Estimation of Glucose		
II	**I. Two Stage Preparations** 1. Preparation of p – bromoacetanilide from aniline 2. Preparation of p – nitroaniline from acetanilide 3. Preparation of aspirin from methyl salicylate 4. Preparation of benzilic acid from benzoin. 5. Preparation of p-Nitro benzoic acid from p-Nitro toluene		
Text Book			
Reference Book	1. J. Mohan, Organic Analytical Chemistry, Theory and Practice, Narosa, 2003. 2. V.K. Ahluwalia, P. Bhagat, R. Aggarwal, Laboratory Techniques in Organic Chemistry, I.K. International, 2005. 3. N.S. Gnanaprakasam, G. Ramamurthy, Organic Chemistry Lab Manual, S.V. Printers, 1987. 4. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, Prentice Hall,5th Ed., 1996.		
e- Resources			
Course Outcomes	On completion of the Course, Students should be able to • Doing the estimation of chemicals, which provide knowledge about the purity and concentration • Expertise in organic synthetic methods		

Mapping of Cos with Pos & PSOs:

CO/PO	PO					PSO							
	1	2	3	4	5	1	2	3	4	5	6	7	8
CO1	S	S	S	S	S	M	S	M	S	S	S	M	S
CO2	S	S	S	S	S	M	S	S	S	S	S	S	S

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**MQHY & CORE PRACTICAL–IV INORGANIC CHEMISTRY PRACTICALII**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	• To perform the qualitative analysis of a given Inorganic mixture. • To carry out the preparation of Inorganic complexes.		
UNIT	**Content**		
I	**1. Qualitative Analysis of Common and less common cations by Semi-micro technique.**		
II	**2. Estimation by Complexometry :** 1 Estimation of Zinc 2 Estimation of Magnesium 3 Estimation of Calcium 4 Estimation of Nickel.		
III	**3. Preparation of the following Inorganic complexes.** 1. Leadtetraacetate 2. TrithioureaCopper(II)Sulphate 3. TetrammineCopper(II)Sulphate 4. Prussion Blue 5. HexathioureaPlumbousNitrate (II)		
Reference Book	1. V.V. Ramanujam, Inorganic Semi Micro Qualititative analysis, National Pubs, 1988. 2. A.I. Vogel, Text Book of Quantitative Inorganic Analysis, 3rd Ed., Longman, 1966.		
Course Outcomes	On completion of the Course, Students should be able to • To develop skills in systematic qualitative analysis of mixture, • The students will get training in the complexometric titration, • To gains the skill to prepare inorganic complexes.		

Mapping of Cos with Pos & PSOs:

CO/PO	PO												
	1	2	3	4	5	1	2	3	4	5	6	7	8
CO1	M	S	S	S	S	M	S	S	S	S	S	S	S
CO2	S	S	S	S	S	M	S	S	S	S	S	S	S

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**ELECTIVE COURSE-I** **MQE1 & NON – COVENTIONAL ENERGY SOURCES**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	• To understand the various types of energy sources. • To learn about the solar energy • To introduce the importance of wind energy & fuel cells. • To acquire knowledge about bioenergy. • To know the different tidal power plants.		
UNIT	**Content**		
I	**UNITI ENERGY SOURCES** 1:1 Introduction to energy - Different forms of energy - Primary & Secondary Energy sources - Various types of Conventional Energy Sources- Fossil fuel energy,Hydraulic energy & Nuclear energy - Various types of Non-Conventional Energy Sources - Wind energy,Tidal energy & Solar energy. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
II	**UNIT IISOLAR ENERGY** 2:1 Introduction - Solar Constant - Solar Radiation at the Earth's Surface - Solar Energy applications - Solar Cooker - Design principle , constructional details and limitations of Solar Cooker - Solar Water heater - Solar distillation - Solar Pumping - Electricity from Solar Energy - Street lighting system. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
III	**UNIT IIIWIND ENERGY AND FUEL CELLS** 3:1 Wind energy - Classification of wind mills - Horizontal Wind mills, Vertical Wind Mills – Advantages & Disadvantage of Wind energy. 3:2 Fuel cells – Introduction - Working of Fuel Cell - Advantages of Fuel Cells **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
IV	**UNIT IV BIO ENERGY** 4:1 Introduction - Bio Gas and its Compositions - Process of Bio gas, generation – Wet Process, dry Process - Raw Materials available for Bio gas Fermentation - Constructional Details of Biogas Plant - Utilization and benefits of Biogas Technology - Economical, social environmental and health benefits of bio gas - Utilization - KVIC Bio gas Plant - Advantages of Bio Gas technology. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
V	**UNIT V TIDAL POWER PLANTS** 5:1 Introduction to Tidal Power Plants - Classification of tidal Power Plants - Working of Different Tidal Power Plants - Factors affecting the suitability of the site for tidal power plant - Advantages and disadvantages of Tidal Power Plants - Components of Tidal Power plants. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
Text Book	1. G.D Raj,Non – Conventional Energy Sources, Khanna Publisher, 1998.		

	2. G.S. Sawhney,Non – Conventional Energy Sources, PHI Learning,2005. 3. N.K. Bansal,Non – Conventional Energy Source, Vikas Publishing house. 4. B.H.Khan, Non Conventional Energy Sources, Mc Graw Hill Publications,3rd Edition
Reference Book	1. Roger H.Charlier, Charles W. " Ocean Energy- Tide and Tidal Power"ISBN: Library of Congress Control Number: 2008929624_c Springer-VerlagBrerlin Heidelberg 2009. 2. John F.Walker&N.Jenkins, "Wind Energy Technology", John Willey and Sons Chichester, U.K – 1997. 3. T H Taylor Alternate Energy Sources by.AdamHilger Ltd, Bristol
e- Resources	1. https://www.topfreebooks.org
Course Outcomes	On completion of the Course, Students should be able to • To ensure the students understand the basic concept of energy. • Understand the solar devices such as solar cooker, solar water heater. • To get awareness about the wind energy and conversion to the generation of power. • An introduction of composition of biogas and generation of power. • To study about the principles of geothermal and tidal power plant

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	M	S	S	S	M	S	S	S	S	M	M	S	S
CO2	S	M	S	S	S	M	S	S	S	S	W	M	S	S
CO3	S	S	S	S	S	S	S	S	S	M	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	S	S	M	S	S	S	S	W	S	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	MQJ & CORE COURSE –VI PHYSICAL METHODS IN CHEMISTRY		
Class	M.Sc., Chemistry	Semester	I
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	• To acquire qualitative and quantitative knowledge of the fundamental concepts of various Spectroscopic methods. • To know the basic principles and applications of UV/Vis spectroscopy. • To distinguish between various spectroscopic transitions and interpret data for molecular Characterization. • To learn the basic principles of FT-IR, NMR spectroscopy. • To provide an advanced level in- depth understanding about EPR spectroscopy.		
UNIT	**Content**		
I	**UNIT I ULTRAVIOLET AND VISIBLE SPECTROSCOPY** Basic principles of electronic transitions — instrumentation and sample handling techniques. Application of UV – Visible spectroscopy – Woodward – Fisher – Scott rules – applications to conjugated cyclic ketones and alpha, beta unsaturated cyclic ketones – benzene and its substituted derivatives. Differentiation of Geometrical isomers and position isomers. **(Content – 15 Hrs, Assessment – 3 Hrs) (18Hrs)**		
II	**UNIT II INFRARED SPECTROSCOPY** Instrumentation and sampling techniques – types of stretching and bending vibrations – characteristic group frequencies – both internal and external – quantitative studies – organic structure determination. Finger print region – identification of functional groups – hydrogen bonding (intermolecular andintramolecular) **Raman Spectroscopy:** Raman Effect –selection rules – comparison of IR and Raman spectra – simple molecules– exclusion principle – Fermi resonance – Laser Raman spectroscopy. **(Content – 15 Hrs, Assessment – 3 Hrs) (18Hrs)**		
III	**UNIT III NMR SPECTROSCOPY** Chemical shifts and coupling constants (spin-spin coupling involving different nuclei ^{1}H, ^{31}P, ^{13}C) interpretation and applications to inorganic compounds. Effect of qudrapolar nuclei (^{2}H, ^{10}B, ^{11}B) on the ^{1}H NMR spectrum. NMR of paramagnetic molecules – isotopic shifts, contact and pseudocontact interactions – Lanthanide shift reagents. Stereochemistry of non-rigid molecules. Chemical and magnetic non-equivalent, first and second order protons spin- spin splitting- dependence of J on dihedral angle – vicinal and geminal coupling – karplus equation – long range coupling constant- influence of stereo chemical factors on chemical shift ofprotons – simplification of complex spectra – double resonance technique **(Content – 15 Hrs, Assessment – 3 Hrs) (18Hrs)**		

IV	**UNIT IV ^{13}C NMR SPECTROSCOPY** Basic principles – FT-NMR – relaxation – broad band decoupling – off resonance decoupling**.** **MOSSBAUER SPECTROSCOPY** Mossbauer transition and Doppler effect – isomer shift –Magnetic interactions- Mossbauer emission spectroscopy- quadruple effect of magnetic field on spectra – simple applications to iron and tin compounds. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
V	**UNIT V EPR SPECTROSCOPY** Basic principles – characteristics of – hyperfine splitting – selection rule – hyperfine splitting in various structures – Bis (salicyladiminecopper) (II) – factors affecting the magnitude of the g values, q values of transition metal ions – dependence on spin – orbit coupling and crystal field effects. Three conditions (i) spin– orbit coupling , crystal field ii) strength of crystal field breaking the spin – orbit coupling (iii) very large crystal - Krammers degeneracy – Magnitude of zero field splitting and signal – Effective spin mixing of states and zero field splitting. Line width in solid state EPR – spin – lattice relaxation – spin – spin relaxation – exchangeprocesses. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
Text Book	1. R.S.Drago,Physical Methods in Chemistry;SaundersCollegePublications, Philadelphia,1992. 2. F.A.CottonandG.Wilkinson,AdvancedInorganicChemistry,6thEd.,Wiley- Eastern Company, New Delhi, 1999. 3. J.R.Dyer,ApplicationsofAbsorptionSpectroscopyofOrganicCompounds,PHI Learning, New Delhi,2009. 4. Y.R.Sharma,ElementaryOrganicSpectroscopy–PrinciplesandChemical Applications; S. Chand and Co., New Delhi,1992. 5. P.S.Kalsi,SpectroscopyofOrganicCompounds;6thEd.,NewAgeInternational Publishers, New Delhi,2004.
Reference Book	1. R.S.Drago,PhysicalMethodsinInorganicChemistry;AffiliatedEastWestPress,Pvt.Ltd., NewDelhi,2012. 2. P.J.Wheatley,TheDeterminationofMolecularStructure;2ndEd.,Dover Publications,Mineola,1981. 3. G.J.Leigh,N.Winterton,ModernCoordinationChemistry;RoyalSocietyof Chemistry,UK,2002. 4. E.A.V.Ebsworth,StructuralMethodsinInorganicChemistry;3rdEd.,ELBS, GreatBritain,1987. 5. W. Kemp, Organic Spectroscopy; 3rd Ed., Palgrave, NewYork,2011.
e- Resources	1.https://www.chem.ucla.edu 2.https://www.orgchemboulder.com

Course Outcomes	After successfully completing this course, students will be able to: • Understand how to interpret nuclear magnetic resonance spectrum. • Know how to solve problems based on H1 and C13 NMR • Know applications of mass spectroscopy in determination of structures. • Understand methods of solving combines problems on all spectroscopic techniques • Explain the basic principle of UV Visible spectroscopy • Arrange components of the spectroscopic device

Mapping of Cos with Pos & PSOs:

CO/PO	PO					PSO								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	S	S	S	S	S	W	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQK & PHYSICAL CHEMISTRY II**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To learn the concepts and applications of wave mechanics. • To understand the quantum chemistry applications of chemical bonding. • To impart depth knowledge about Born-Oppenheimer approximation and Huckelel ectrontheory. • To study the electro kinetic phenomena and electrochemical oxidation and reduction. • To understand the absorption isotherms.		
UNIT	**Content**		
I	**UNIT I QUANTUM CHEMISTRY I** Classical mechanics – General principles and basic assumptions, conservation laws – Lagrangian and Hamiltonian equations of motion – inadequacy of classical mechanics.Wave particle dualism – uncertainty principle – postulates of quantum mechanics – operator algebra – operator, linear and Hermitian, eigen functions and eigen values, angular momentum operator, commutation relations.Applications of wave mechanics to simple systems – particle in a box – one and three dimensional, quantum numbers, zero – point energy – orthogonality and norma (Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)		
II	**UNIT II QUANTUM CHEMISTRY II** Rigid rotator – harmonic oscillator – rotational and vibrational quantum numbers and selection rules for rotational and vibrational transitions. Bohr's correspondence principle. Hydrogen atom – shapes and nodal properties of orbitals.Exactly solvable nature of systems – approximation methods – Many electron atoms – wave functions – one electron orbital – Pauli's principles and Slater determinants – variation method application to hydrogen and helium atoms – perturbation method for non degenerate systems – application of perturbation theory to helium atom. Hartree – Foekself-consistent field method – L-S and J-Jcoupling. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**		
III	**UNIT III QUANTUM CHEMISTRY III** Born – Oppenheimer approximation: Hydrogen molecule ion. LCAO – MO and VB treatments of the hydrogen molecule; electron density, forces and their role in chemical bonding. Hybridization and valence molecular orbitals of H_2O, NH_3.Huckel pi-electron theory and its application to ethylene, butadiene andbenzene. (Content – 15 Hrs, Assessment – 3 Hrs) (18Hrs)		

IV	**UNIT IV SURFACE PHENOMENA** Adsorption and free energy reaction at interfaces – physisorption and chemisorption – potential energy diagrams, Lannard– Langmuir, BET isotherms – heats of adsorption, determination. Adsorption from solutions. Gibb's adsorption isotherm – solid – liquid interfaces – wetting and contact angle – solid gas interfaces –soluble and insoluble film. Surface tension – electrical phenomenon at interfaces, including electro kinetic, micelles and reverse micelles ,solubilisation, micro – emulsions or Miceller emulsions. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study ofsurfaces. Role of surface in catalysis semiconductor catalysis n and p type surfaces – kinetics of surface reactions involving adsorbed species – Langmuir – Hinshelwood mechanism, Langmuir – Rideal mechanism and Rideal – Eleymechanisms. **(Content – 15 Hrs, Assessment – 3 Hrs) (18 Hrs)**
V	**UNIT V ELECTROKINETIC PHENOMENA** Electrical double layer potential – theory of multilayers at electrode – electrolyte interface – double layer capacity – electrokinetic phenomena Zeta potential, electrosmosisand sedimentation potential.Process at electrodes – The rate of charge transfer – current density – Butler – Volmerequation – Tafelequation.Principlesof electrodeposition of metals, electrochemical corrosion, metals constructions and prevention of corrosion – Electrochemical oxidations and reduction. Electrochemical energy – storage systems primary and secondary batteries – fuelcells. **(Content – 15 Hrs, Assessment – 3 Hrs) (18Hrs)**
Text Book	1. R.K. Prasad, Quantum chemistry, Third reprint, New AgeInternationalLtd. 2. N. Tinkham, Group theory and quantum mechanics, McGrowHill(1964). 3. W.J. Morre, Physical chemistry, Vedition,OrientLongman.(1972). 4. H.W. Zemansekay, Heat and Thermodynamics,McGrawHilledition. 5. P.W. Atkins,Physical ChemistryELBS,VIedition.(2004)
Reference Book	1. B.C. Bood, Heterogeneous Catalysis principles and applications,Clarendonpress 2. P.H. Reiger, ElectroChemistry,PrenticeHall(USA1987)
e- Resources	**Web Resources:** 1. https://onlinelibrary.wiley.com 2. https://www.quora.com
Course Outcomes	**Course Outcome:** After successfully completing this course, students will be able to: • Understands the various theories of electrolytic conductance • Recognizes the dynamics of electrode reaction • Learns the classical status of thermodynamics • Appreciates the fundamentals of molecular thermodynamics • Estimates the basis of chemical surfaces • Understand of the quantum chemistry of free electron and H-atoms.

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	W	S	S	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	S	S	S	S	M	S	S	S

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**MQLY & CORE PRACTICAL -PHYSICAL CHEMISTRY PRACTICAL– I**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objective:** • To study the kinetics of some reactions. • To learn the technique of developing phase diagram of some binarysystems. • Students learn and understand the effect of ionic strength on the rateof constant. • Students get to know concepts of kinetics of chemicalreactions. • Surface analysis and adsorption concepts are learnt and experimented concept of adsorption isotherm isunderstood.		
UNIT	**Content**		
I	1. Determination of CST and study of the effectofimpuritytoCST. 2. Determination of distribution coefficient and determination of equilibrium constant for the formationofKI3. 3. Determination of the rate Constant for Persulphate Oxidation, both by titrimetryand clock reaction. 4. Comparison of acid strengthsbyKinetics. 5. Determinationoftheenergyofactivationandfrequencyfactor. 6. Association factor of benzoicacid between benzene andwater. 7. Determination of molecular weight by Rast macromethod. 8. Phase diagram – simpleeutecticsystem. 9. Phase diagram – threecomponentsystem. 10. Adsorption of oxalic acidoncharcoal.		
Text Book	1. Venkateswaran V, Veeraswamy R, Kulandaivelu A.R., Basic Principles of Practical Chemistry, 2nd Ed., New Delhi, Sultan Chand &sons,1997. 2. B.P. Levitt, Ed., Findlay`s Practical Physical Chemistry, 9th Ed.,Longman,1985. 3. J.N. Gurtu, R. Kapoor, Advanced Experimental Chemistry, Vol.I, S.Chand&Co.,1987.		
Course Outcomes	On completion of the Course, Students should be able to • Draw the phase diagram 3 component systems and analyze it • Determine the kinetics of the reactions • Predict the concentration of two analytes in a mixture		

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	M	M	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	M	S	S	S

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**MQE2 & ELECTIVE COURSE -II INDUSTRIALCHEMISTRY**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objective:** • To understand and develop efficacy in planning, designing, production processing and Marketing • To study water testing treatment and petroleum refining. • To acquire in depth knowledge of basic and applied area of industrychemistry. • To know the industrial production of soaps, detergents andperfumes. • To learn the process ofphotography.		
UNIT	**Content**		
I	**UNIT I Basic Ideas about Unit Operation** Basic ideas about unit operation – Flow charts – Chemical conversion – Batch versu continuous processing – chemical process selection – design – chemical process control chemical processeconomics– market evaluation – plant location –management i productivity and creativity. Research & development and its role inchemicalindustries. **Content- 15 Hrs, Assesment-3Hrs(18Hrs)**		
II	**UNIT II Petroleumand Detergents** Water conditioning for chemical factories – reuse – methods of conditioning demineralization – precipitation – desalting – industrial and sewage waste water treatment. Vegetable oils – Refining of edible oils – solvent extraction – processing of animal fat – hydrogenation– inter esterification – manufacture of soap from oils. Petroleum: Origin, refining, cracking, reforming, knocking and octane number, LPG, synthetic gas, synthetic petrol.Detergents – raw materials – manufacture – Biodegradability of surfactants–methods. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
III	**UNIT III Pulp, Paper and Plastics** Pulp and paper industries – Sulphite, Sulphate, Soda, Ground wood pulp for paper manu paper – speciality paper – paper stock – structural boards. Plastics – manufacture – resin – manufacturing processes – condensation polymerization manufacture of laminates and other derivatives – Hexamethylenetetramine plastics – vin Wood conversions – Hydrolytic wood – Phenolic treatment wood – chip wood and their manufacture & advantages – fireretardingwood. **Content- 15 Hrs, Assesment- 3Hrs(18Hrs**		
IV	**UNIT IV Perfumes** Introduction-Definition- uses and economics-.production of natural and synthetic perfum Flower perfumes –Fruit flavours-artificial flavours		

	Content- 15 Hrs, Assesment- 3Hrs (18Hrs)
V	**UNIT V Chemistry and Photography(18Hrs)** Sugar manufacture – starch and related products – miscellaneous starch. Manufacture of industrial alcohol – Butanol- acetone – vinegar – acetic acid – citric acid -lactic acid by fermentation. Industrial and military explosives – manufacture pyrotechniques – manufacture of safetymatches.Colour photography – theory – materials and process-special applications ofphotography. **Content- 15 Hrs, Assesment- 3Hrs(18Hrs)**
Text Book	1. Charkarbharthy B N, Industrial Chemistry, Oxford and IBH Publishing .Co.1st Edition. NewDelhi. 2. Daniels et al., Experimental Physical chemistry, 7th Ed, New York, Mc GrawHill,1970. 3. Sharma B K**,** Industrial Chemistry, geol Publishing House,Meerut.
Reference Book	1. Norris Shreve.R. andJoseph.A.Brink Jr -Chemical process Industries –. McGraw Hill, International BookCompany,London. 2. Brain A.C.S. Remhold-Production and properties of Industrial Chemicals – NewYork. 3. Burgh, AFermentation industries –Interscience,NewYork. 4. Gilbert.J.Hand book of Technology and Engineering –, Van Nostrand Reinhold,London. 5. Guthrie. V -Petroleum products Handbook.McGrawHill,Tokyo.
e- Resources	1. https://www.essentialchemicalindustry.org 2. https://www.tandfonline.com
Course Outcomes	• Identify and understand the unit operations involved in a process • Design common heat exchangers like double pipe and shell & tube to determine relevant design parameters • Understand the commercial processes used for the refining and processing of natural gas and crude petroleum • Solve materials and energy balances alone and simultaneously on chemical process system

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	S	S	S	M	S	S	W	S	S
CO2	S	S	S	S	S	S	S	M	S	M	S	M	S	S
CO3	S	S	S	S	M	S	S	S	S	S	M	S	S	S
CO4	S	S	S	M	M	S	S	S	M	S	M	S	S	M

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQE3 & GREEN CHEMISTRY**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To study the basic principles and alternative materials of sustainable green chemistry. • To learn the synthesis of ionic liquids and phase transfer catalysis. • To impart depth knowledge in supported catalysis and biocatalysis. • To learn the alternative synthesis reagent and reaction condition of green chemistry.		
UNIT	**Content**		
I	**UNIT I INTRODUCTION TO GREEN CHEMISTRY** Green chemistry – relevance and goals, Anastas, twelve principles of green chemistr Tools of green chemistry, alternative starting materials, reagent, catalysts, solvent, a processes with suitable examples. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
II	**UNIT II MICROWAVE ACTIVATION ORGANIC SYNTHESIS (MAOS)** Microwave activation – advantage of microwave exposure – specific effects of microwa reactions – solid supports reactions – Functional group transformations – condensations – oxidations-reductions reactions – multi-component reactions. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
III	**UNIT III IONIC LIQUIDS AND PTC** Introduction – synthesis of ionic liquids – physical properties – applications in alk hydroformylations – expoxidations – synthesis of ethers – Friedel craft reactions – Die reactions – knoevengel condensations – Wittig reactions – Phase transfer catalyst –s applications. **Content- 15 Hrs, Assesment- 3Hrs(18Hrs)**		
IV	**UNIT IV SUPPORTEDCATALYSTS AND BIO-CATALYSTS FOR GREENCHEMISTRY** Introduction – the concept of atom economy – supported metal catalysts – mesoporous the use of biocatalysts for green chemistry – modified bio catalysts – fermentat biotransformations - fine chemicals by microbial fermentations – vitamins and amin Baker's yeast mediated bio-transformations – bio-catalyst mediated Baeyer- Villiger re Microbialpolyestersynthesis. **Content- 15 Hrs, Assesment- 3Hrs(18Hrs)**		
V	**UNIT V ALTERNATIVE SYNTHESIS,REAGENTS AND REACTION CONDITIONS** A photochemical alternative to Friedel-crafts reactions – Dimethyl carbonate as a methylating agent – the design and applications of green oxidants- super critical carbon		

	dioxide forsyntheticchemistry. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**
Text Book	**Text books:** 1.V.K.Ahluwalia, Green Chemistry – Environmentally benign reactions-,Ane Books India (publisher).(2006).
Reference Book	**References Books:** 1. Paul T.Anastas& Tracy C.Williamson, Green chemistry – Designing chemist environment –SecondEdition(1998). 2. Paul T.Anastas&Tracy C.Williamson.Green chemistry –Frontiers in benign c synthesis and processes-Oxford University Press(1998). 3. Rashmi Sanghi&M.M.Srivastava,Green chemistry – Environment friendly lternatives- Narora PublishingHouse,(2003)
e- Resources	**Web Resources:** 1. https://www.ncbi.nlm.nih.gov 2. https://en.m.wikipedia.org
Course Outcomes	**Course Outcomes:** After successfully completing this course, students will be able to: • Explain Green chemistry and sustainability which relates to problems of societal concern. • Describe Green chemistry and sustainability developments that affect society, the environment and economic development. • Analyze a process and identify parameters that make environmentally friendly/sustainable/green. • Integrate, synthesize, and apply knowledge of the relationship between science and technology and societal issues in both focused and broad interdisciplinary contexts. • Demonstrate the ability to effectively communicate to others the concepts learned in the course. • Analyze and compare chemical/industrial processes based on their relative “greennes

Mapping of Cos with Pos & PSOs:

CO/PO	**PO3**					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	M	S	M	M	S	S
CO4	S	M	S	S	S	M	S	S	S	S	M	M	S	S
CO5	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO6	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO7	S	S	S	M	S	S	S	S	S	S	W	S	S	S
CO8	S	S	S	S	S	S	S	S	S	S	S	S	M	M

Strongly Correlating (S)

Moderately Correlating (M)

Weakly Correlating (W)

No Correlation (N)

Course code & Title	**MQM & RECENT TRENDS IN CHEMISTRY**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	• To gain knowledge in Nano Chemistry. • To acquire the ideas about material science. • To learn about Supramolecular chemistry in solutions. • To understand basic principles & reactions in Green Chemistry. • To study basic knowledge and resources in cheminformatics.		
UNIT	**Content**		
I	**UNIT I Nano Chemistry** Nano chemistry & fundamentals – Introduction – electronic structure –transport properties – mechanical properties – physical properties – applications – Nano tubes of other materials. Nano Science: Self assembled mono layers – Introduction – mono layers on gold – growth process – phase transitions – pattering mono layers – mixed mono layer – SAME and applications. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
II	**UNIT II Material Science** Crystal-crystal lattice-crystal defects-fullerene super conductors-High temperature materials-bio materials-thermo electronic materials- nano phase materials-smart material –NLO materials- conducting polymers. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
III	**UNIT III Supra Molecular Chemistry** Supra Molecular Chemistry – Concepts and Languages of supramolecular Chemistry – Supramolecular Reactivity and Catalysis. Catalysis by Reactive Macrocyclic Cation Receptor Molecules. Catalysis by Reactive Anion Receptor Molecules. Catalysis with Cyclophanes. Type Receptors. Supramolecular Metallocatalysis. Cocatalysis: Catalysis of Synthetic reactions. Biomolecular and Abiotic catalysis.Supramolecular Chemistry in solution: Cyclodextrin, Micelles, Dendrimmers, Gelators.Classification and typical reactions- Applications**.** **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
IV	**UNIT IV Green Chemistry** Green Chemistry – Photo Chemical Principles – Photo oxidation – photo degradation – Removal of hazardous chemicals from water – cleaner production concept – Implementation -Government rule. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
V	**UNIT V Chem-Informatics** Chem-Informatics: Introduction – Evaluation – History and uses – molecular modeling using computer Basic idea - chemical information data base design and their management – data base concepts – structural languages chemical data base design Chemical information sources – chemical information researches formula searching.		

	Content- 15 Hrs, Assesment- 3Hrs (18Hrs)
Text Book	**Text Books:** 1. T. Pradeep " Nano the essentials – understanding Nano Science and Nano Technology" Tata McGraw - hill publishing Ltd., New Delhi, 2007. 2. M.M. Srivatsava, Rashmi Sangi "Chemistry for Green Environment, Narosa publishing House, New Delhi 2005.
Reference Book	**References Books :** 1. C. N. R. Rao, A. Muller and A. K. Cheetham (Eds), The Chemistry of Nanomaterial and 2; Wiley- VCH;Germany,Weinheim,2004. 2. C. P. Poole, Jr: and F. J. Owens, Introduction to Nanotechnology;WileyInterscience NewJersey,2003. 3. P. T. Anastas and J. C. Warner, Green chemistry Theory and Practice; Oxford University Press, New York, 2005. 4. J.W.Steed&J.L.Atwood,SupramolecularChemistry,Wiley,2000. 5. Frank Jenson,IntroductiontoComputationalChemistry,Wiley,Newyork,1999.
e- Resources	**Web Resources:** 1.https://www.understandingno.com 2.https://webs.iiitd.edu.in
Course Outcomes	**Course outcomes :** After successfully completing this course, students will be able to: • Provide perspectives on future nanochemistry developments • Follow new developments in material application field. • Explain importance of materials in materials science and scientific filed • Have an appreciation of the significance and application of supramolecular chemistry, including in dynamic combinatorial chemistry, materials chemistry (e.g. soft materials, porous hybrid and other framework solids), biological systems and the controlled construction of nanoscale entities] • A functional understanding of the field of green chemistry. • Chemoinformatics is a rather new discipline in science. It has been described as the application of informatics methods to solve chemical problems.

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	W	S	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQNY & PHYSICAL CHEMISTRY** **PRACTICAL – II**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** 1. To develop skills to estimate acids and bases by conductometry. 2. To learn and acquire ability to estimate ionic species using potentiometer. 3. To understand the concept of electrodepotential.		
UNIT	**Content**		
I	**I-ConductometricTitrations** 1. Estimation of strong acids. 2.Estimation of mixture of acids 3. Estimation of mixture of bases 4. Estimation of halides 5. Verification of Ostwald's dilution law 6. Determination of solubility of sparingly soluble salt. **I. EMF MEASUREMENTS** 7. Estimation of KI [KMno4VsKI] 8. Estimation of KI[K2Cr2O7VsKI] 9. Estimation of mixture of halides [KCl +KI] 10. Estimation of strong acid [NaoHVsHCl] 11. Estimation of Acetic acid [NaoHVs CH3COOH] 12. Estimation of mixture of acids [NaoHVs HCl + CH3COOH] 13. Determination of dissociation constant of organicacid. 14. Determination of solubility of sparingly soluble salt. 15. Determination of p^H of buffer solutions.		

Text Book	
Reference Book	**References Books:** 1. B.P. Levitt, Ed., Findlay`s practical Physical Chemistry, 9th Ed.,Longman,1985. 2. J.N. Gurtu, R. Kapoor, Advanced Experimental Chemistry, Vol.I, S.Chand&Co.,198
e- Resources	
Course Outcomes	**Course Outcomes:** On completion of the Course, Students should be able to • Understand conductometric titrations of: Strong acid Vs. strong base (ii) Weak acid vs. strong base, (iii) Mixture of strong acid and (iv)weak acid vs. strong base, Strong acid vs. weak base. • Develop skills in Potentiometric titrations of: (i) Strong acid vs. strong base (ii) Weak acid vs. strong base

CO/PO	PO												
	1	2	3	4	5	1	2	3	4	5	6	7	8
CO1	M	S	S	S	S	W	S	S	S	S	S	M	S
CO2	W	S	S	S	S	M	S	S	S	S	S	M	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQE4 & APPLIED CHEMISTRY**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To study about quality control measurements in industries. • To understand the textile processing and dyeing. • To learn the classification and application of paint. • To understand the importance of wealth from waste. **To know the mechanism of drug action and metabolism of drugs.**		
UNIT	**Content**		
I	**UNIT I QUALITY CONTROL MEASUREMENTS** Moisture, ash, crude protein, fat, crude fibre, carbohydrates, calcium, potassium, sodium and phosphate – Food adulteration – common adulterants in food, contamination of food stuffs – Microscopic examination of foods for adulterants – Pesticides analysis in food products – analysis of toxic metals in food (Hg, Cd, Co, Sn and Cr)- Determination of iodine, Saponification and acidvalueof an oil- Food standards- ISI and Agmark. **Content- 15 Hrs, Assesment- 3Hrs(18Hrs)**		
II	**UNIT II TEXTILE PROCESSING** Pretreatment: Sizing, Desizing- acid method, Scouring- kier boiling method, Bleaching – hypochlorite method, Mercerization, fastness properties – washing, rubbing and lightfast Dyeing: Dye fibre bond, % of shade, M:L ratio, % 0f exhaustion, equilibrium absorption of electrolyte. Reactive dye - principles of dyeing,Polyester dyes - carrier dyeing - mechanism a temperature dyeing. Mordant dyes – principles – specific examples. Acid dyes mechanism – role of electrolyte and dye bath assistants. Vat dyes – vatting – dyeing – o and after treatment. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
III	**UNIT III PAINT** Paint – definitions – ingredients and their role – terminology – emulsion, lacquer. Enamel – pot life, shelf life – varnish – thixotropy –classification of paints based on drying mechanism - under coats – Pigments – classification (organic & inorganic) – functions – properties such as hiding power, light fastness, particle size and shape Solvents used for paints – flash point.**Vehicles:** Oil – drying mechanism, Description of Alkyd, Epoxy, Polymetyl methacrylate, Urea formaldehyde, Melamine formaldehyde, urethane resins.Additives – Anti skinning agents,Powder coating, Solvent less finish. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
IV	**UNIT IV WEALTH FROM WASTE (Recycling)** Introduction – Recycling Technique – Construction materials from waste – Medicines from agricultural waste- liquid fuels from agricultural – Urban waste and bagasse for electricity – Agricultural waste for biomass into cheap and efficient fuel – Bacteria for paper making – Waste into objects of daily use – Garbage into fuel-How to use garbage to generatepower. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		

V	**UNIT V MEDICINAL CHEMISTRY** Mechanism of drug action and Metabolism of Drugs: Mechanism of action – Drug Receptors and Biological responses– Mechanism of different types of drug action – Metabolism of drugs – Chemical pathway of drug metabolismabsorption of drugs – Routes of administration - factors affect absorption – Digestion and absorption of protein – Digestion of fat. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**
Text Book	**Text Books:** 1. B. K. Sharma, H. Karur, Environmental chemistry –- Goelpublishing House,Meerut. 2. B. K. Sharma – Industrial chemistry - Goel publishingHouse,Meerut. 3. Gareth Thomas, Medicinal Chemistry: An Introduction, Wiley-Interscience, 2nd edition,2008.
Reference Book	**References Books :** 1.B. K. Sharma – Instrumental methods of chemical Analysis,Goel publishing House, Meerut urner –Principles of Paint Chemistry and Introduction to paint Technology Oxford & IBH Publishing &CoPaint Film Defects. 3.Wilson andGiswald's Textbook of Organic Medicinal and Pharmaceutical Chemistry by John Blockand John M Beale (Eds), Lippincott Williams & Wilkins, 11th edition,2003. 4. Richard B. Silverman,The Organic Chemistry of Drug Design and Drug Action, Academic press,2nd edition,2004
e- Resources	**Web Resources:** 1.https://pubs.acs.org 2.https://www.iiserbpr.ac.in
Course Outcomes	**Course Outcomes:** • Identify industrial problems related to chemistry and find solutions for them • Be able to work in quality control or analytical laboratories. • Organize and manage effectively in science laboratories • Function as industrial chemist, assistant research scientist in industrial, research and university • Labs, maintain general safety rules and codes of behavior in chemical laboratories.

Mapping of Cos with Pos & PSOs:

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQE5 & ANALYTICAL TECHNIQUES**		
Class	**M.Sc Chemistry**	**Semester**	**I**
Cognitive Level	**K-1 Acquire / Remember** **K-2 Understand** **K-3 Apply** **K-4 Evaluate** **K-5 Analyze** **K-6 Create**		
Course Objectives	**Course Objectives:** • To study thermo analytical techniques for chemical analysis. • To understand electro analytical techniques. • To learn the nature of errors and their types. • To gain sound knowledge on methods of crystal growth. • To learn diffraction studies and its applications.		
UNIT	**Content**		
I	**UNIT I THERMO ANALYTICAL METHODS** Thermogravimetry : Principle, factors affecting thermogram, instrumentation and thermal decomposition of$CaC_2O_4H_2O$ and$CuSO_4.5H_2O$ Differential Techniques : Instrumentation, experimental, instrumental factors of DTA and DS Thermal studies of $CuSO_4.5H_2O$ by DTA and determination of purity of pharmaceutical and transition studies by DSC- evaluation of thermodynamic parameters. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
II	**UNIT II ELECTROANALYTICAL METHODS** Electro gravimetry : Principle, instrumentation, deposition and separation Electrolysis at constant current and estimation of copper. Coulometry : Principle, controlled potential coulometry and separation of nickel and cobalt, coulometric titration, instrumentation – estimation of Sb(III) Potentiometry : Principle, potentiometric titration, equivalence point potential for (i)Fe^{2}+-Ce ^{4}+ system (ii) Fe^{2}+ - MnO_4^-/H+ system. Colorimetry Beer- lambert's law and spectrophotometric method of estimation, principle and methods of visual colorimetry.Estimation of iron and nickel by visual colorimetry. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**		
III	**UNIT III DATA ANALYSIS** **ERRORS** : Various types of errors – precision and accuracy – significant figures – various statistical test on accuracy of results, positive & negative deviation from accurate results – the binomial distribution, the Gaussian distribution – the normal distribution of random errors, mean value, variation and standard deviation, reliability interval, deviation from the Gaussian law of error distribution. Student's t-distribution & t-tests, comparison of the mean with the expected value, comparison of the results of two different methods, comparison of precision of two methods by F-tests, gross errors and elimination of outlying results.Graphical methods Linear regression, regression line, standard deviation, correlationco-efficient. **Content- 15 Hrs, Assesment- 3Hrs(18Hrs)**		
IV	**UNIT IV CRYSTALLOGRAPHY** Single crystal growth – low and high temperature, solution growth technique – gel and sol-gel		

	methods. Melt growth – Bridgeman – stockberger method, Czochralski methods. Flux technique, physical and chemical vapour transport methods. Characterization – TGA/DTA/DSC methods, SEM/TEM analysis. Determination of hardness. Applicationsofsingle crystals. **Content- 15 Hrs, Assesment- 3Hrs(18Hrs)**
V	**UNIT V DIFFRACTIONSTUDIES** X-ray Diffraction -Powder and single crystal method, advantages over neutron diffraction methods, applications of x-ray diffraction method. Neutron diffraction, advantages over Electron diffraction, limitations. Electron diffraction studies -limitations and applications. **Content- 15 Hrs, Assesment- 3Hrs (18Hrs)**
Text Book	**Text Books:** 1.A.K.Srivastava,P.C.JainChemicalAnalysis:AnInstrumentalApproach for B.Sc.Hons.&M.Sc classes, S.ChandCompanyLtd. 2.D.C.Harris,QuantitativeChemicalAnalysis;4t^{h}Ed.,W.H.Freeman Publications,NewYork,1995. 3.A.K.Srivastava, P.CJain.Instrumental Methods ofChemicalAnalysis 4.S.Gopalan.AnalyticalChemistry 5. Clegg,W, Crystal structure determination, Oxford University press , New York.
Reference Book	**References Books:** 1.D.B.HibbertandJ.J.Gooding,DataAnalysisforChemistry; Oxford University Press, UK,2006 2.J.Topping,ErrorsofObservationandTheirTreatment;4thEd .,ChapmanHall, London,1984. 3. MahinderSingh.Text Book of Analytical Chemistry InstrumentalTechniques.
e- Resources	**1.https://edu.rsc.org**
Course Outcomes	**Course Outcome:** After successfully completing this course, students will be able to: • Explain the theoretical aspects of key analytical techniques and instruments • Strategically plan analytical campaigns to apply to different types of samples and research objectives, including selection of the most appropriate technique/instrumentation for the students' research project. • Undertake the correct sample preparation and characterization prior to analysis by the chosen techniques or instruments. • Design an analytical work-flow to acquire data • Process data from the chosen instruments and demonstrate understanding of the limitations and quality of the data. Justify the approach taken to data processing.

CO/PO	PO					**PSO**								
	1	2	3	4	5	1	2	3	4	5	6	7	8	9
CO1	S	S	S	S	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Strongly Correlating (S)
Moderately Correlating (M)
Weakly Correlating (W)
No Correlation (N)

Course code & Title	**MQP & CORE COURSE PROJECT**		
Class	**M.Sc Chemistry**	**Semester**	**IV**
Internal :25 **External : 75**		**No. of Hours/Week 6**	