SCHOOL OF CHEMICAL SCIENCES

The School of Chemical Sciences consists of Departments of **Analytical Chemistry, Inorganic Chemistry, Organic Chemistry , Physical Chemistry, Polymer Science and Energy.**

School of Chemical Sciences, University of Madras was established in 1973 when part-time M.Phil Course common to Organic, Inorganic and Physical Chemistry was introduced. The Master of Science programme was introduced in 1976 wherein the first year students undergo a common chemistry programme and the students specialize in one of the areas of Chemistry in the second year: Physical Chemistry, Organic Chemistry and Inorganic Chemistry. Since 1987, the department of Analytical Chemistry also joined the School of Chemical Sciences and the teaching programme is conducted by admitting the students in all the four branches based on the performance of the students in the entrance examination.

The School of Chemical Sciences consists of four departments, Viz., Analytical Chemistry, Inorganic Chemistry, Organic Chemistry and Physical Chemistry and these departments were established in 1960, 1975, 1952 and 1952 respectively. From the academic year 1975-76 the departments are conducting courses (M.Sc. & M.Phil) collectively. The Chairperson, School of Chemical Sciences is coordinating the academic activities. The students of School of Chemical Sciences have been performing very well in the competitive examinations and are working in prestigious institutions in India and abroad.

The Department of **Analytical Chemistry** specializes in spectrometry, separation techniques, electroanalytical methods, corrosion control and implants studies. The Department has the facilities of a workshop, air-conditioned room of equipments, telecommunication network, library and computation laboratory. The sophisticated instruments of the Department includes UV-Visible spectrophotometers, Polarographs, Cyclic Voltammeter, potentistate/Galvanostate, Gas chromatograph, Ion analyzer, corrosion monitoring system, microscope (Hot stage), refractometer, data acquisition system and computers. The Department offers consultancy in analytical problems relating to chemical industries, environment, material science, biomaterials, chelating resins, electroanalytical studies, chemically modified electrodes etc.

The Department of **Inorganic Chemistry** concentrates on research work in Photochemistry, Coordination Chemistry, Bioinorganic Chemistry, Catalysis and Laser Chemistry. The facilities in the Department include Spectrophotometers, Fluorimeters, photochemical, electrochemical systems, flash photolysis spectrometer, Nd-YAG pumped laser flash photolysis spectrometer, excimer laser, time-correlated Single Photon Counting spectrometer, IR, UV-Visible, esr, gas chromatograph, cyclic voltammeter and pulse polarograph.

The Department of **Organic Chemistry** specializes in the fields of synthesis of carbocyclics and their rearrangements, heterocyclic compounds of pharmacological interest, Macrocyclic compounds and molecules with spatial conjugation and laser dyes, asymmetric synthesis, Bio-organic chemistry and photochemistry. The facilities of the department include Jeol 90 MHz NMR and mass spectrometer, Schimadzu UV-vis spectrophotometer, FT IR, C,H,N elemental analyzer, GC, HPLC and Polarimeter. The staff of this department offer consultancy services in the synthesis of any type of industrially important organic compounds, application of any type of organics and solving structure through spectra.

The department of **Physical Chemistry** researches in Homo- and hetero - multisite catalysts, triphase catalysis, synthesis, characterization and kinetics of polymerization, model enzyme reactions, conducting polymers, defluridisation studies, electrocatalysis by metal complexes, electron transfer reactions, electrochemical studies on copper -halide interactions, ion-selective electrodes, SANS study of microemulsions, polymerization and oxidation reactions in microemulsion, synthesis, characterisation and catalytic activity of anionic clays, sorption studies of surfactants on polymeric surfaces electroanalytical oxygen evolution at oxide electrodes as in photo assisted splitting of water, Development of polymer-modified catalytic electrodes for detection of neurotransmitter enzymeless biosensors etc. The facilities of the Department include Gas Chromatography Varian 3700 with Data

The intense specialization of the Department on Polymers has resulted in the creation of Department of **Polymer Science** in 1983 . Keen research of this department pertain to synthesis of dendritic and hyper-branched polymers, Ziegler-Natta Polymerization, polyurethanes, Polymer Chemistry, modification of Polymers, synthesis and characterization of new polymers and bio-polymers. The sophisticated instrumental facilities and equipments of the department are : UV-VIS spectrophotometer, FT-IR spectrophotometrer, computers, electronic balance, tensile testing machine, rubber mixing mill, etc. The consultancy potential of the department exists in the areas of polyurethanes, polymer synthesis, polymer composites and metal containing polymers.

The Department of **Energy** was established (1983) to provide a knowledge base for the ever increasing energy needs and informations on conventional and non-conventional energy soruces and better utilization and conservation of the existing energy soruces. The Department of the energy is actively involved in research areas such as photocatalysis in presence of radiation matching the solar spectrum, fast reations, visible light-assisted

photoelectrochemistry, direct coversion of solar energy into photopotential and electricity, hydrogen fuel production from water and aqueous solutions, solid electrolytes and solid state batteries. The facilities of the department include UV and visible continous photolysis setup, stopped flow spectrophotometer, UV-visible spectrophotometer, photochemical reaction assembly, high temperature furnaces, pelletizer, four probe conductivity setup, BAS 100A electrochemical Analyser (USA), HP4284A Precision LCR meter.

Faculty

S.Rajeswari	- Chairperson

Analytical Chemistry

S.Rajeswari, Ph.D.	- Professor and Head
P.Riyazuddin, Ph.D.	- Professor
S.Sriman Narayanan, Ph.D.	- Professor
T.Raju,Ph.D.	- Reader

Inorganic Chemistry

M.Kandaswamy, Ph.D.	- Professor and Head
P.Ramamurthy, Ph.D.	- Professor
V.Narayanan, Ph.D.	- Lecturer
S.Balasubramanian, Ph.D.	- Lecturer
K. Pandian	- Lecturer

Organic Chemistry

R. Raghunathan. Ph.D.	- Professor and Head
P. C. Srinivasan, Ph.D.	- Professor
P. Rajakumar, Ph.D.	- Professor
M. Bakthadoss, Ph.D.	- Lecturer
A. K. Mohanakrishnan, Ph.D.	- Lecturer
T. Mohandas, Ph.D.	- Lecturer

Physical Chemistry

V.R.Vijayaraghavan, Ph.D.	- Professor and Head
T.Balakrishnan, Ph.D.	- Professor (on lien)
J.Santhanalakshmi, Ph.D.	- Professor
K.Chandrasekara Pillai, Ph.D.	- Professor
E.Murugan, Ph.D.	- Lecturer
E.J.Padma Malar, Ph.D.	- Research Scientist (UGC)

Polymer Science

A. Sultan Nasar, Ph.D.	- Reader & Head-in-Charge
G. Harichandran, Ph.D.	- Lecturer
N.Rajendiran	- Lecturer

Energy [Chemistry-Interdisciplinary]

P. Maruthamuthu, Ph.D.	-Professor (on lien)
S. Austin Suthanthiraraj, Ph.D.	- Professor and Head-in-charge

M.Sc., ANALYTICAL CHEMISTRY

Subject Code	Title of the Course	C/E	Credits			
			L	T	P	C
I SEMESTER						
CHE C001	Fundamental of Analytical Chemistry	C	3	0	0	3
CHE C101	Coordination and Nuclear Chemistry	C	3	0	0	3
CHE C201	Stereochemistry and Organic Reaction Mechanism	C	3	0	0	3
CHE C301	Thermodynamics and Chemical Kinetics	C	3	0	0	3
CHE C302	Physical Chemistry Practical – I	C	0	0	2	2
CHE C202	Organic Chemistry Practical – I	C	0	0	2	2
CHE E101 CHE E201	Inorganic Reaction Mechanism OR Name Reactions in Organic Chemistry	E	3	0	0	3
II SEMESTER						
CHE C002	Analytical Instrumentation	C	3	0	0	3
CHE C102	Main Group Elements and Inorganic Polymers	C	3	0	0	3
CHE C203	Organic Reaction Mechanism	C	3	0	0	3
CHE C303	Quantum Chemistry and Group Theory	C	3	0	0	3
CHE C003	Analytical Chemistry Practical – I	C	0	0	2	2
CHE C101	Inorganic Chemistry Practical – I	C	0	0	2	2
CHE E301	Solid State Chemistry	E	3	0	0	3
III SEMESTER						
CHE C601	Physical Methods in Chemistry	C	4	0	0	4
CHE C602	Biological Chemistry	C	4	0	0	4
CHE C004	Practical – Analysis of Complex Materials and Separation Techniques	C	0	0	2	2
CHE C005	Practical – Instrumental Methods	C	0	0	2	2
CHE E003	Classical Thermal and Radionalytical Methods of Analysis	E	3	0	0	3
CHE E004	Optical and Surface Ananytical Techniques	E	3	0	0	3
IV SEMESTER						
CHE C006	Separation Techniques	C	4	0	0	4
CHE E603	Novel Reagents in Organic Synthesis	E	3	0	0	3
CHE E304	Electrochemistry and Electroanlytical Chemistry	E	3	0	0	3
CHE C007	Project	C	0	0	6	6

ABSTRACT OF THE SYLLABUS

CHE C001	Fundamentals of Analytical Chemistry	C	3	S.Rajeswari P. Riyazuddin S.Sriman Narayanan

Treatment of analytical data and sampling, Chemical Equilibria, Neutralization Reactions, Redox, Precipitation and Complexometric titrations.

CHE C101	Coordination and Nuclear Chemistry	C	3	M.Kandaswamy P.Ramamurthy V.Narayanan

Stability and Stereochemical aspects, Structural aspects and Crystal Field Theory, Molecular Orbital Theory.

CHE C201	Stereochemistry and organic reaction mechanism	C	3	P.C.Srinivasan R.Raghunathan M.Bakthadoss

Elements of Stereochemistry, Confirmation analysis and Mechanism of substitution in aliphatic and aromatic compounds. Aromaticity.

CHE C301	Thermodynamics and Chemical Kinetics	C	3	J.Santhanalakshmi K.Chandrasekar Pillai

Second law of thermodynamics, Maxwell relation and thermodynamic equation of state-Partial molar properties-concept of fugacity and activity- activity coefficient, Phase rule and phase equilibria, Electrochemistry - Debye -Huckel theory, Conductivity of electrolytes, Onsagar equation. Electrochemical cells, electrode kinetics.

Chemical kinetics-complex reactions, transition state theory and collision theory - reactions in solution-effect of solvent polarity and ionic strength. Heterogeneous catalysis-various isotherms, fast reactions.

CHE C302	Physical Chemistry- Practical – I	C	2	J.Santhanalakshmi K.Chandrasekar Pillai

Experiments in conductivity, EMF, kinetics, phase equilibria, solution equilibria, colligative properties and thermochemistry.

CHE C202	Organic Chemistry- Practical – I	C	2	A.K.Mohanakrishnan T.Mohandas M. Bakthadoss

Single and double stages preparations.

CHE E305	Electronics and Computers for Chemists	E	3	P.Riyazuddin S.Sriman Narayanan

Basic Electronics, Computers in Chemistry Programs in BASIC – Calculation pH, solubility product, Standard deviation, buffers, F and t tests, regression analysis.

CHE E101	Inorganic Reaction Mechanism	E	3	M.Kandaswamy V. Narayanan S.Balasubramanian

Inter and Labile Complexes, Stabilization of unusual oxidation states, Electron transfer reactions, Substitution Reactions, Reactions of organometallic compounds.

CHE E201	Name Reactions in Organic Chemistry	E	3	P.C.Srinivasan

Introduction to various name reactions involving C-C bond formation, heterocycle synthesis and modification of substituents.

CHE E306	Essentials of Statistical Thermodynamics	E	3	

Partition function, Thermodynamic parameters from statistical methods, Bose-Einstein, Maxwell-Boltzmann, Fermi Dirac statistics – Applications of statistical methods.

CHE C002	Analytical Instrumentation	C	3	S.Rajeswari T.Raju S.Sriman Narayanan

Absorption and Molecular Spectrometry, Atomic, Absorption spectrometry, Flame Photometry, Plasma Emission Spectrometry, Chromatographic Techniques – General aspects, Classification, Principle and applications of TLC, Paper Chromatography, GC and HPLC.

CHE C102	Main Group Elements and Inorganic Polymers	C	3	M.Kandaswamy P.Ramamurthy V.Narayanan

Inorganic polymers-isopoly acids - heteropoly acids - silicates - phthalocyanine polymers - boron hydrides - corboranes and metallo carboranes, nitrogen, phosphorous, sulphour polymers.

CHE C203	Organic Reaction Mechanism	C	3	A.K.Mohana Krishnan T.Mohandas P.Rajakumar

Mechanism of various Organic reactions and rearrangements.

CHE C303	Quantum Chemistry and Group Theory	C	3	V.R.Vijayaraghavan

Foundations of quantum theory, Schrodinger equation, structure of the atom. Molecular structure - MO and VB methods, VSEPR theory; HMO METHOD, Group theory. Applications in Spectroscopy, and quantum chemistry, rotationaland vibrational spectroscopy, Raman spectroscopy.

CHE C003	Analytical Chemistry – Practical – I	C	2	T.Raju S.Sriman Narayanan

Spectrophotometry, Potentiometry / pH metry, Polarography and Gas Chromatography.

CHE C101	Inorganic Chemistry - Practical – I	C	2	P.Ramamurthy V.Narayanan

Quantitative Analysis: Estimation of Mg^{2+}, Zn^{2+},Ca^{2+} and Ni^{2+} by complexometric method and hardness of water. Fe^{2+}, Mn^{2+}, Ni^{2+} by colorimetric method

Qualitative Analysis: Semimicro analysis of salts containing three less common cations and one common cation.
Ti, Mo, W, Se, Te, Ce, Th, Ti, Zr, V, Be, U and Li.

CHE E307	Analysis of Complex Materials	E	3	P.Riyazuddin S.Sriman Narayanan T. Raju

Ore and alloy analysis, Analysis of organic compounds, Fuel analysis, solid and liquid fuels.

CHE E104	Nuclear Chemistry	E	3	M.Kandaswamy P.Ramamurthy V.Narayanan S.Balasubramanian

Nuclear forces and nuclear structure, binding energies, nuclear stabilities, structure of nucleus, nuclear models, radioactive decay, hot-atom chemistry. Nuclear reactions,couloumb barrier, cross section, types of nuclear reactions, nuclear fusion and nuclear fission. Nuclear reactor, nuclear reactors in India, Detection of radiations and particle accelerators. Applications, Tracers applied in industries and agriculture. Lanthanides and actinides.

CHE E204	Functional Group Transformation in Organic Chemistry	E	3	A.K.Mohana Krishnan

Interconversion of various functional groups in Organic compounds by various methods.

CHE E301	Solid State Chemistry	E	3	V.R.Vijayaraghavn

Bonding in solids, band theory, properties of solids, defects and nonstoichiometry, solid electrolytes, nanochemistry.

CHE C601	Physical Methods in Chemistry	C	4	V.R.Vijayaraghavan P.Rajakumar P.Ramamurthy V. Narayanan S.Sriman Narayanan T.Raju

Electronic spectroscopy, application of group theory, formaldehyde butadiene, dissociation energy of diatomic molecules, Photoelectron Spectroscopy, esca

NMR – Principles, theory, chemical shift, spectra of organic molecules, coupling constants, Karplus curve, J values, ^{13}C-NMR-decoupling – double resonance techniques – Noe, and pulse techniques, FTNMR, NMR of phosphorous and Fluorine containing molecules - Mass spectra – Molecular ion peak, meta stable peak, techniques, Application in determining structure of compounds. ESR-g-value, anisotropy, simple organic radicals, transition metals and coordination compounds - X-ray diffraction – Bragg equation, space groups and point groups, diffraction methods. Mossbauer spectroscopy –theory and applications, Fe and Sn systems, Thermal methods of analysis – TGA, DTA and DSC – Principle and applications.

CHE C602	Biological Chemistry	C	4	M.Kandaswamy R.Raghunathan S.Balasubramanian T.Raju

Origin of elements in biological systems, Corbohydrates, proteins, lipids, nucleic acids, DNA, RNA. - Essential and trace metal ions, metal ion transport in biological systems. Enzymes, nomenclature and classification, kinetics of enzyme catalyzed reaction, effect of pH and temperature.- Coenzymes, heme enzymes,

oxygen carriers, hemeproteins, nonhemeoxygen carriers, model compounds for oxygen carriers. Nitrogen fixations, biological redox reactions, cytochromes, iron-sulfur proteins, photosynthesis and chlorophyll, biological energy transfer and storage. Applications, medicinal, metal ion poisoning. –

CHE C004	Practical – Analysis of Complex Materials and Separation Techniques	C	2	S.Rajeswari

Analysis of alloys, ores, and pharmaceuticals; separation techniques - chromatographic techniques.

CHE C005	Practical - Instrumental Methods	C	2	P.Riyazuddin

Spectrophotometry, potentiometry, Biamperometric titrations ,conductrometric titrations, Gas chromatography; Flame photometry, Nephelometry and Fluorimetry.

CHE C104	Inorganic Chemistry – Practical - II	C	2	S.Balasubramanian

Analysis of ores and alloys - dolomite, galena, pyrites, solder brass stainless stell, bronze etc.

CHE C105	Inorganic Chemistry – Practical - III	C	2	V.Narayanan

Chromatographic separation of inorganic compounds and estimation. synthesis of complexes and spectral analysis of cobalt, manganese, copper and nickel complexes. Solvent extraction of metal complexes.

CHE C204	Organic Chemistry – Practical – II	C	2	A.K.Mohankrishnan

Three stage preparations.

CHE C205	Organic Chemistry – Practical - III	C	2	M.Bakthadoss T.Mohandas

Synthesis of some oxygen and nitrogen containing heterocyclic compounds.

CHE C304	Physical Chemistry – Practical - II	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in chemical kinetics, thermodynamics, thermochemistry, photochemistry and enzyme kinetics - 15 experiments.

CHE C305	Physical Chemistry – Practical - III	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in conductivity, electrode equilibria, spectrophotometry, partial molar volumes, acid base equilibria - 15 experiments.

CHE E003	Classical and Radioanalytical methods of Analysis.	E	3	S.Rajeswari P.Riyazuddin

Analysis of complex materials - ore analysis, alloy analysis, analysis of organic Compounds - fuel and gas analysis - radioanalytical techniques

CHE E004	Optical and Surface Analytical Techniques	E	3	T.Raju S.Sriman Narayanan

Polarimetry, Refractometry, Chemical and Electron microscopy, X-ray spectroscopy, ESCA and Auger electron spectrometry.

CHE E602	Photochemistry	E	3	P.Maruthamuthu V.R.Vijayaraghavan T. Mohandas P.Ramamurthy V.Narayanan

Fundamentals of photochemistry - absorption - emission of radiation - lifetimes - photochemical laws - quantum yield - intersystem crossing – Stern-Volmer equation - electron transfer - energy transfer; - Photochemical techniques-flash photolysis - lasers in photochemistry; radiation chemistry - primary processes-track effects-dosimetry - pulse radiolysis - Inorganic photochemistry-photoredox reactions-substitution reactions -

photosensitisation reactions; organometallic photochemistry - metal carbonyls - photochemistry in energy conversion - formation of fuels - hydrogen production - semiconductor electrodes - chemically modified electrodes - photogalvanic cells. - Organic Photochemistry: Norrish reactions. photochemistry of cyclohexadieneones. Reactions of olefines. Oxidation reduction reactions. Reaction of oxygen with olefines. Reduction of ketones. singlet oxygen - selected reactions - Photo Fries reaction. Barton reaction and Di-pi-methane rearrangement.

CHE E105	Organometallic Chemistry	E	3	M.Kandaswamy P.Ramamurhty S.Balasubramanian

Types of ligands in organometallic compounds, 18 electron rule, general methods of preparations, carbon sigma donors, carbon pi donors, chain and cyclic pi donors, multidecker sandwitch complexes, metallocenes, bis pi-arene metal complexes. Complexes of pi acceptor ligands, mono and poly metal carbonyls, preparation, structure and reactivity, reaction pathways, substitution, addition elimination and rearrangemnt, ligand protonation, fluxinal isomerism, catalysis, hydrogenation, hydroformylationn, oxidation, polymerisation, cyclooligomerisation and isomerisation.

CHE E203	Chemistry of Heterocycles, Organo-lithiums and Assymmetric synthesis	E	3	P.C.Srinivasan R.Raghunathan

Synthesis of heterocycles with N, O and S – five and six membered rings. Preparation of Organolithiums, Assymmetric syntheis.

CHE E302	Advanced Chemical Thermodynamics and Kinetics	E	3	K.Chandrasekarapillai/E.Murugan

Statistical thermodynamics, Irreversible thermodynamics, Chemical kinetics – Gas and solution reactions

CHE E502	Solar Energy Materials and Energy Conversions.	E	3	S.Austin Suthanthiraraj

Nature of solar radiation, materials used for absorption of solar radiation, solar heating, Energy systems, energy storage and energy transport. Frontier energy conversions; entropy reduction.

CHE C006	Separation Techniques	C	4	S.Rajeswari S.Sriman Narayanan /T.Raju

Distillation, Solvent extraction, Floatation and dialysis. Theory and applications. Chromatographic techniques – Column, TLC, Paper and ion-exchange chromatorgraphy, GC, GC-MS, GCIR, HPLC, HPTLC, GPC, SFC theory and applications.

CHE E603	Transition Metal Chemistry	C	4	M.Kandaswamy / P.Ramamurhty V.Narayanan / S.Balasubramanian

Inert and labile complexes - substitution reactions-dissociative and associative processes-hydrolysis, isomerisation and racemisation reactions-trans effect - redox reactions - inner sphere and outer sphere - complimentary and non-complimentary reactions; nitrosyls - phosphine, arsine and cyanide complexes-stabilisation of unusal oxidation states - ligand design - template methods - macrocylcic effect - synthesis of macrocyclic ligands; magentic moments - Van Vleck equation- magenetic properties of A,E,T terms -spin orbit coupling - antiferromagnetic interactions - magnetic behaviour of lanthanides and actinides.

CHE E304	Orbital symmetry and Modern Synthetic Methodology	C	4	R.Raghunathan / P.Rajakumar

Introduction to Woodward Hoffmann rules to concerted reactions, Aromatic, nonaromatic and anitiaromatic systems. Mechanism of photochemical reactions. Synthon, formation of C-C, C=C bonds, disconnection approach, protective groups, sulphur, retero synthetic analysis.

CHE C007	Quantum Chemistry and Macromolecules	C	4	V.R.Vijayaraghavan E.J.Padma Malar / E.Murugan

Schrodinger equation - solutions to particle in a box, SHO, rigid rotar hydrogen atom- approximation methods; MO and VB methods, H_2^+, MO method for diatomics, HMO method, SCF method, Solids Bonding in solids, Band theory, Properties of solids, low dimensional solids, Macromolecules, molecular weight of polymers, mechanism of polymerization.

CHE E603	Novel Reagents in Organic Synthesis	E	3	P.C. Srinivasan S.Balasubramanian M.Bakthadoss

Use of palladium, nickel and silicon in Organic synthesis.

CHE E304	Electrochemistry and Electroanalytical Chemistry	E	3	K.Chanderasekara Pillai P.Riyazuddin

Electrical double layer. Thermodynamics and models, Polarography – Theory and Instrumentation – Derivative Polarography – Amperometry – Cyclic Voltammetry and stripping voltammetry, Potentiometry, Ion selective electrodes, Potentiometric titrations, coulometric titrations – Electrogravimetry – Theory and instrumentation.

CHE E204	Chemistry of Natural Products	E	3	P.C.Srinivasan A.K.Mohanakrishnan

Total syntheis of some examples of alkaloids, steroids and terpenes, Brief introduction to their biogenesis.

CHE E501	Conventional, non-conventional and renewable energy sources and environment.	E	3	P. Maruthamuthu

Various forms of energy and their interconversion, Information on Ozone hole formation and remeady, the effect of excessive use of energy on environment. Role of solar radiation on pollution control problems.

CHE C007	Project Work Viva-Voce	C	6	All Faculty

M.Sc. INORGANIC CHEMISTRY

Subject Code	Title of the Course	Core/ elective	Credits			
			L	T	P	C
I SEMESTER						
CHE C001	Fundamental of Analytical Chemistry	C	3	0	0	3
CHE C101	Coordination and Nuclear Chemistry	C	3	0	0	3
CHE C201	Stereochemistry and Organic Reaction Mechanism	C	3	0	0	3
CHE C301	Thermodynamics and Chemical Kinetics	C	3	0	0	3
CHE C302	Physical Chemistry Practical – I	C	0	0	2	2
CHE C202	Organic Chemistry Practical – I	C	0	0	2	2
CHE E201	Name Reactions in Organic Chemistry	E	3	0	0	3
II SEMESTER						
CHE C002	Analytical Instrumentation	C	3	0	0	3
	Structure and bonding	C	3	0	0	3
CHE C203	Organic Reaction Mechanism	C	3	0	0	3
CHE C303	Quantum Chemistry and Group Theory	C	3	0	0	3
CHE C003	Analytical Chemistry Practical – I	C	0	0	2	2
CHE C101	Inorganic Chemistry Practical – I	C	0	0	2	2
CHE E002 CHE E301	Analysis of Complex Materials OR Solid State Chemistry	E	3	0	0	3
III SEMESTER						
CHE C601	Physical Methods in Chemistry	C	4	0	0	4
CHE C602	Biological Chemistry	C	4	0	0	4
CHE C104	Inorganic Chemistry Practical – II	C	0	0	2	2
CHE C105	Inorganic Chemistry Practical – III	C	0	0	2	2
CHE E602	Photochemistry	E	3	0	0	3
CHE E103	Organometallic Chemistry	E	3	0	0	3
IV SEMESTER						
CHE C106	Transition Metal Chemistry	C	4	0	0	4
CHE E603	Novel Reagents in Organic Synthesis	E	3	0	0	3
CHE E304	Electrochemistry and Electroanlytical Chemistry	E	3	0	0	3
CHE C107	Project	C	0	0	6	6

CHE C001	Fundamentals of Analytical Chemistry	C	3	S.Rajeswari P. Riyazuddin S.Sriman Narayanan

Treatment of analytical data and sampling, Chemical Equilibria, Neutralization Reactions, Redox, Precipitation and Complexometric titrations.

CHE C101	Coordination and Nuclear Chemistry	C	3	M.Kandaswamy P.Ramamurthy V.Narayanan

Stability and Stereochemical aspects, Structural aspects and Crystal Field Theory, Molecular Orbital Theory.

CHE C201	Stereochemistry and organic reaction mechanism	C	3	P.C.Srinivasan R.Raghunathan M.Bakthadoss

Elements of Stereochemistry, Confirmation analysis and Mechanism of substitution in aliphatic and aromatic compounds. Aromaticity.

CHE C301	Thermodynamics and Chemical Kinetics	C	3	J.Santhanalakshmi K.Chandrasekar Pillai

Second law of thermodynamics, Maxwell relation and thermodynamic equation of state-Partial molar properties-concept of fugacity and activity- activity coefficient, Phase rule and phase equilibria, Electrochemistry - Debye -Huckel theory, Conductivity of electrolytes, Onsagar equation. Electrochemical cells, electrode kinetics. Chemical kinetics-complex reactions, transition state theory and collision theory - reactions in solution-effect of solvent polarity and ionic strength. Heterogeneous catalysis-various isotherms, fast reactions.

CHE C302	Physical Chemistry- Practical – I	C	2	J.Santhanalakshmi K.Chandrasekar Pillai

Experiments in conductivity, EMF, kinetics, phase equilibria, solution equilibria, colligative properties and thermochemistry.

CHE C202	Organic Chemistry- Practical – I	C	2	A.K.Mohanakrishnan T.Mohandas M. Bakthadoss

Single and double stages preparations.

CHE 1013	Electronics and Computers for Chemists	E	3	P.Riyazuddin S.Sriman Narayanan

Basic Electronics, Computers in Chemistry Programs in BASIC – Calculation pH, solubility product, Standard deviation, buffers, F and t tests, regression analysis.

CHE E101	Inorganic Reaction Mechanism	E	3	M.Kandaswamy V. Narayanan S.Balasubramanian

Inter and Labile Complexes, Stabilization of unusual oxidation states, Electron transfer reactions, Substitution Reactions, Reactions of organometallic compounds.

CHE E201	Name Reactions in Organic Chemistry	E	3	P.C.Srinivasan

Introduction to various name reactions involving C-C bond formation, heterocycle synthesis and modification of substituents.

CHE 1019	Essentials of Statistical Thermodynamics	E	3	

Partition function, Thermodynamic parameters from statistical methods, Bose-Einstein, Maxwell-Boltzmann, Fermi Dirac statistics – Applications of statistical methods.

CHE E002	Analytical Instrumentation	C	3	S.Rajeswari / T.Raju S.Sriman Narayanan

Absorption and Molecular Spectrometry, Atomic, Absorption spectrometry, Flame Photometry, Plasma Emission Spectrometry, Chromatographic Techniques – General aspects, Classification, Principle and applications of TLC, Paper Chromatography, GC and HPLC.

CHE C102	Main Group Elements and Inorganic Polymers	C	3	M.Kandaswamy P.Ramamurthy V.Narayanan

Inorganic polymers-isopoly acids - heteropoly acids - silicates - phthalocyanine polymers - boron hydrides - corboranes and metallo carboranes, nitrogen, phosphorous, sulphour polymers.

CHE C203	Organic Reaction Mechanism	C	3	A.K.Mohana Krishnan T.Mohandas / P.Rajakumar

Mechanism of various Organic reactions and rearrangements.

CHE C303	Quantum Chemistry and Group Theory	C	3	V.R.Vijayaraghavan

Foundations of quantum theory, Schrodinger equation, structure of the atom. Molecular structure - MO and VB methods, VSEPR theory; HMO METHOD, Group theory. Applications in Spectroscopy, and quantum chemistry, rotationaland vibrational spectroscopy, Raman spectroscopy.

CHE C003	Analytical Chemistry – Practical - I	C	2	T.Raju S.Sriman Narayanan

Spectrophotometry, Potentiometry / pH metry, Polarography and Gas Chromatography.

CHE C101	Inorganic Chemistry - Practical - I	C	2	P.Ramamurthy V.Narayanan

Quantitative Analysis: Estimation of Mg^{2+}, Zn^{2+},Ca^{2+} and Ni^{2+} by complexometric method and hardness of water. Fe^{2+}, Mn^{2+}, Ni^{2+} by colorimetric method

Qualitative Analysis: Semimicro analysis of salts containing three less common cations and one common cation.

Ti, Mo, W, Se, Te, Ce, Th, Ti, Zr, V, Be, U and Li.

CHE E002	Analysis of Complex Materials	E	3	P.Riyazuddini S.Sriman Narayanan T. Raju

Ore and alloy analysis, Analysis of organic compounds, Fuel analysis, solid and liquid fuels.

CHE E104	Nuclear Chemistry	E	3	M.Kandaswamy P.Ramamurthy V.Narayanan S.Balasubramanian

Nuclear forces and nuclear structure, binding energies, nuclear stabilities, structure of nucleus, nuclear models, radioactive decay, hot-atom chemistry. Nuclear reactions,couloumb barrier, cross section, types of nuclear reactions, nuclear fusion and nuclear fission. Nuclear reactor, nuclear reactors in India, Detection of radiations and particle accelerators. Applications, Tracers applied in industries and agriculture. Lanthanides and actinides.

CHE E204	Functional Group Transformation in Organic Chemistry	E	3	A.K.Mohana Krishnan

Interconversion of various functional groups in Organic compounds by various methods.

CHE E301	Solid State Chemistry	E	3	V.R.Vijayaraghavn

Bonding in solids, band theory, properties of solids, defects and nonstoichiometry, solid electrolytes, nanochemistry.

CHE C601	Physical Methods in Chemistry	C	4	V.R.Vijayaraghavan P.Rajakumar / P.Ramamurthy V. Narayanan S.Sriman Narayanan / T.Raju

Electronic spectroscopy, application of group theory, formaldehyde butadiene, dissociation energy of diatomic molecules, Photoelectron Spectroscopy, esca - NMR – Principles, theory, chemical shift, spectra of organic molecules, coupling constants, Karplus curve, J values, ^{13}C-NMR-decoupling – double resonance techniques – Noe, and pulse techniques, FTNMR, NMR of phosphorous and Fluorine containing molecules - Mass spectra – Molecular ion peak, meta stable peak, techniques, Application in determining structure of compounds. ESR-g-value, anisotropy, simple organic radicals, transition metals and coordination compounds - X-ray diffraction – Bragg equation, space groups and point groups, diffraction methods. Mossbauer spectroscopy –theory and applications, Fe and Sn systems, Thermal methods of analysis – TGA, DTA and DSC – Principle and applications.

CHE C602	Biological Chemistry	C	4	M.Kandaswamy R.Raghunathan S.Balasubramanian / T.Raju

Origin of elements in biological systems, Corbohydrates, proteins, lipids, nucleic acids, DNA, RNA. - Essential and trace metal ions, metal ion transport in biological systems. Enzymes, nomenclature and classification, kinetics of enzyme catalyzed reaction, effect of pH and temperature. - Coenzymes, heme enzymes, oxygen carriers, hemeproteins, nonhemeoxygen carriers, model compounds for oxygen carriers. Nitrogen fixations, biological redox reactions, cytochromes, iron-sulfur proteins, photosynthesis and chlorophyll, biological energy transfer and storage. Applications, medicinal, metal ion poisoning.

CHE C004	Practical – Analysis of Complex Materials and Separation Techniques	C	2	S.Rajeswari

Analysis of alloys, ores, and pharmaceuticals; separation techniques - chromatographic techniques.

CHE C005	Practical - Instrumental Methods	C	2	P.Riyazuddin

Spectrophotometry, potentiometry, Biamperometric titrations ,conductrometric titrations, Gas chromatography; Flame photometry, Nephelometry and Fluorimetry.

CHE C104	Inorganic Chemistry – Practical - II	C	2	S.Balasubramanian

Analysis of ores and alloys - dolomite, galena, pyrites, solder brass stainless stell, bronze etc.

CHE C105	Inorganic Chemistry – Practical - III	C	2	V.Narayanan

Chromatographic separation of inorganic compounds and estimation. synthesis of complexes and spectral analysis of cobalt, manganese, copper and nickel complexes. Solvent extraction of metal complexes.

CHE C204	Organic Chemistry – Practical – II	C	2	A.K.Mohankrishnan

Three stage preparations.

CHE C205	Organic Chemistry – Practical - III	C	2	M.Bakthadoss / T.Mohandas

Synthesis of some oxygen and nitrogen containing heterocyclic compounds.

CHE C304	Physical Chemistry – Practical - II	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in chemical kinetics, thermodynamics, thermochemistry, photochemistry and enzyme kinetics - 15 experiments.

CHE C305	Physical Chemistry – Practical - III	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in conductivity, electrode equilibria, spectrophotometry, partial molar volumes, acid base equilibria - 15 experiments.

CHE E003	Classical and Radioanalytical methods of Analysis.	E	3	S.Rajeswari P.Riyazuddin

Analysis of complex materials - ore analysis, alloy analysis, analysis of organic Compounds - fuel and gas analysis - radioanalytical techniques

CHE E004	Optical and Surface Analytical Techniques	E	3	T.Raju S.Sriman Narayanan

Polarimetry, Refractometry, Chemical and Electron microscopy, X-ray spectroscopy, ESCA and Auger electron spectrometry.

CHE E602	Photochemistry	E	3	P.Maruthamuthu V.R.Vijayaraghavan T. Mohandas P.Ramamurthy V.Narayanan

Fundamentals of photochemistry - absorption - emission of radiation - lifetimes - photochemical laws - quantum yield - intersystem crossing – Stern-Volmer equation - electron transfer - energy transfer; - Photochemical techniques-flash photolysis - lasers in photochemistry; radiation chemistry - primary processes-track effects-dosimetry - pulse radiolysis - Inorganic photochemistry-photoredox reactions-substitution reactions - photosensitisation reactions; organometallic photochemistry - metal carbonyls - photochemistry in energy conversion - formation of fuels - hydrogen production - semiconductor electrodes - chemically modified electrodes - photogalvanic cells. - Organic Photochemistry: Norrish reactions. photochemistry of cyclohexadieneones. Reactions of olefines. Oxidation reduction reactions. Reaction of oxygen with olefines. Reduction of ketones. singlet oxygen - selected reactions - Photo Fries reaction. Barton reaction and Di-pi-methane rearrangement.

CHE E103	Organometallic Chemistry	E	3	M.Kandaswamy P.Ramamurhty S.Balasubramanian

Types of ligands in organometallic compounds, 18 electron rule, general methods of preparations, carbon sigma donors, carbon pi donors, chain and cyclic pi donors, multidecker sandwitch complexes, metallocenes, bis pi-arene metal complexes. Complexes of pi acceptor ligands, mono and poly metal carbonyls, preparation, structure and reactivity, reaction pathways, substitution, addition elimination and rearrangemnt, ligand protonation, fluxinal isomerism, catalysis, hydrogenation, hydroformylationn, oxidation, polymerisation, cyclooligomerisation and isomerisation.

CHE E203	Chemistry of Heterocycles, Organo-lithiums and Assymmetric synthesis	E	3	P.C.Srinivasan / R.Raghunathan

Synthesis of heterocycles with N, O and S – five and six membered rings. Preparation of Organolithiums, Assymmetric syntheis.

CHE E302	Advanced Chemical Thermodynamics and Kinetics	E	3	K.ChandrasekarapillaiE.Murugan

Statistical thermodynamics, Irreversible thermodynamics, Chemical kinetics – Gas and solution reactions.

CHE C006	Separation Techniques	C	4	S.Rajeswari S.Sriman Narayanan / T.Raju

Distillation, Solvent extraction, Floatation and dialysis. Theory and applications. Chromatographic techniques – Column, TLC, Paper and ion-exchange chromatorgraphy, GC, GC-MS, GCIR, HPLC, HPTLC, GPC, SFC theory and applications.

CHE C106	Transition Metal Chemistry	C	4	M.Kandaswamy P.Ramamurhty /V.Narayanan S.Balasubramanian

Inert and labile complexes - substitution reactions-dissociative and associative processes-hydrolysis, isomerisation and racemisation reactions-trans effect - redox reactions - inner sphere and outer sphere - complimentary and non-complimentary reactions; nitrosyls - phosphine, arsine and cyanide complexes-stabilisation of unusal oxidation states - ligand design - template methods - macrocylcic effect - synthesis of macrocyclic ligands; magentic moments - Van Vleck equation- magenetic properties of A,E,T terms -spin orbit coupling - antiferromagnetic interactions - magnetic behaviour of lanthanides and actinides.

CHE C206	Orbital symmetry and Modern Synthetic Methodology	C	4	R.Raghunathan / P.Rajakumar

Introduction to Woodward Hoffmann rules to concerted reactions, Aromatic, nonaromatic and anitiaromatic systems. Mechanism of photochemical reactions. Synthon, formation of C-C, C=C bonds, disconnection approach, protective groups, sulphur, retero synthetic analysis.

CHE C306	Quantum Chemistry and Macromolecules	C	4	V.R.Vijayaraghavan E.J.Padma Malar /E.Murugan

Schrodinger equation - solutions to particle in a box, SHO, rigid rotar hydrogen atom- approximation methods; MO and VB methods, H_2^+, MO method for diatomics, HMO method, SCF method, Solids Bonding in solids, Band theory, Properties of solids, low dimensional solids, Macromolecules, molecular weight of polymers, mechanism of polymerization.

CHE E603	Novel Reagents in Organic Synthesis	E	3	P.C. Srinivasan S.Balasubramanian / M.Bakthadoss

Use of palladium, nickel and silicon in Organic synthesis.

CHE E304	Electrochemistry and Electroanalytical Chemistry	E	3	K.Chanderasekara Pillai P.Riyazuddin

Electrical double layer. Thermodynamics and models, Polarography – Theory and Instrumentation – Derivative Polarography – Amperometry – Cyclic Voltammetry and stripping voltammetry, Potentiometry, Ion selective electrodes, Potentiometric titrations, coulometric titrations – Electrogravimetry – Theory and instrumentation.

CHE E204	Chemistry of Natural Products	E	3	P.C.Srinivasan A.K.Mohanakrishnan

Total syntheis of some examples of alkaloids, steroids and terpenes, Brief introduction to their biogenesis.

CHE C107	Project Work Viva-Voce	C	6	All Faculty

M.Sc., ORGANIC CHEMISTRY

Subject Code	Title of the Course	Core/ elective	Credits			
			L	T	P	C
I SEMESTER						
CHE C001	Fundamental of Analytical Chemistry	C	3	0	0	3
CHE C101	Coordination Chemistry	C	3	0	0	3
CHE C201	Stereochemistry and Organic Reaction Mechanism	C	3	0	0	3
CHE C301	Thermodynamics and Chemical Kinetics	C	3	0	0	3
CHE C302	Physical Chemistry Practical – I	C	0	0	2	2
CHE C202	Organic Chemistry Practical – I	C	0	0	2	2
CHE E101	Inorganic Reaction Mechanism	E	3	0	0	3
II SEMESTER						
CHE C002	Analytical Instrumentation	C	3	0	0	3
CHE C102	Main Group Elements and Inorganic Polymers	C	3	0	0	3
CHE C203	Organic Reaction Mechanism	C	3	0	0	3
CHE C303	Quantum Chemistry and Group Theory	C	3	0	0	3
CHE C003	Analytical Chemistry Practical – I	C	0	0	2	2
CHE C103	Inorganic Chemistry Practical – I	C	0	0	2	2
CHE E002	Analysis of Complex Materials	E	3	0	0	3
III SEMESTER						
CHE C601	Physical Methods in Chemistry	C	4	0	0	4
CHE C602	Biological Chemistry	C	4	0	0	4
CHE C204	Organic Chemistry – Practical II	C	0	0	2	2
CHE C205	Organic Chemistry- Practical III	C	0	0	2	2
CHE E602	Photochemistry	E	3	0	0	3
CHE E203	Chemistry of Heterocycles, Organolithiums and Assymmetric Synthesis	E	3	0	0	3

IV SEMESTER						
CHE C206	Orbital Symmetry and Modern Synthetic Methodology	C	4	0	0	4
CHE E603	Novel Reagents in Organic Synthesis	E	3	0	0	3
CHE E204	Chemistry of Natural Products	E	3	0	0	3
CHE C207	Project	C	0	0	6	6

CHE C001	Fundamentals of Analytical Chemistry	C	3	S.Rajeswari P. Riyazuddin S.Sriman Narayanan

Treatment of analytical data and sampling, Chemical Equilibria, Neutralization Reactions, Redox, Precipitation and Complexometric titrations.

CHE C101	Coordination Chemistry	C	3	M.Kandaswamy P.Ramamurthy V.Narayanan

Stability and Stereochemical aspects, Structural aspects and Crystal Field Theory, Molecular Orbital Theory.

CHE C201	Stereochemistry and organic reaction mechanism	C	3	P.C.Srinivasan R.Raghunathan M.Bakthadoss

Elements of Stereochemistry, Confirmation analysis and Mechanism of substitution in aliphatic and aromatic compounds. Aromaticity.

CHE C301	Thermodynamics and Chemical Kinetics	C	3	J.Santhanalakshmi K.Chandrasekar Pillai

Second law of thermodynamics, Maxwell relation and thermodynamic equation of state-Partial molar properties-concept of fugacity and activity- activity coefficient, Phase rule and phase equilibria, Electrochemistry - Debye -Huckel theory, Conductivity of electrolytes, Onsagar equation. Electrochemical cells, electrode kinetics. Chemical kinetics-complex reactions, transition state theory and collision theory - reactions in solution-effect of solvent polarity and ionic strength. Heterogeneous catalysis-various isotherms, fast reactions.

CHE C302	Physical Chemistry- Practical – I	C	2	J.Santhanalakshmi K.Chandrasekar Pillai

Experiments in conductivity, EMF, kinetics, phase equilibria, solution equilibria, colligative properties and thermochemistry.

CHE C202	Organic Chemistry- Practical – I	C	2	A.K.Mohanakrishnan T.Mohandas / M. Bakthadoss

Single and double stages preparations.

CHE E305	Electronics and Computers for Chemists	E	3	P.Riyazuddin S.Sriman Narayanan

Basic Electronics, Computers in Chemistry Programs in BASIC – Calculation pH, solubility product, Standard deviation, buffers, F and t tests, regression analysis.

CHE E101	Inorganic Reaction Mechanism	E	3	M.Kandaswamy V. Narayanan S.Balasubramanian

Inter and Labile Complexes, Stabilization of unusual oxidation states, Electron transfer reactions, Substitution Reactions, Reactions of organometallic compounds.

CHE 1017	Name Reactions in Organic Chemistry	E	3	P.C.Srinivasan

Introduction to various name reactions involving C-C bond formation, heterocycle synthesis and modification of substituents.

CHE 1019	Essentials of Statistical Thermodynamics	E	3	

Partition function, Thermodynamic parameters from statistical methods, Bose-Einstein, Maxwell-Boltzmann, Fermi Dirac statistics – Applications of statistical methods.

CHE C002	Analytical Instrumentation	C	3	S.Rajeswari T.Raju S.Sriman Narayanan

Absorption and Molecular Spectrometry, Atomic, Absorption spectrometry, Flame Photometry, Plasma Emission Spectrometry, Chromatographic Techniques – General aspects, Classification, Principle and applications of TLC, Paper Chromatography, GC and HPLC.

CHE C102	Main Group Elements and Inorganic Polymers	C	3	M.Kandaswamy P.Ramamurthy V.Narayanan

Inorganic polymers-isopoly acids - heteropoly acids - silicates - phthalocyanine polymers - boron hydrides - corboranes and metallo carboranes, nitrogen, phosphorous, sulphour polymers.

CHE C203	Organic Reaction Mechanism	C	3	A.K.Mohana Krishnan T.Mohandas P.Rajakumar

Mechanism of various Organic reactions and rearrangements.

CHE C303	Quantum Chemistry and Group Theory	C	3	V.R.Vijayaraghavan

Foundations of quantum theory, Schrodinger equation, structure of the atom. Molecular structure - MO and VB methods, VSEPR theory; HMO METHOD, Group theory. Applications in Spectroscopy, and quantum chemistry, rotationaland vibrational spectroscopy, Raman spectroscopy.

CHE C003	Analytical Chemistry – Practical - I	C	2	T.Raju S.Sriman Narayanan

Spectrophotometry, Potentiometry / pH metry, Polarography and Gas Chromatography.

CHE C103	Inorganic Chemistry - Practical - I	C	2	P.Ramamurthy V.Narayanan

Quantitative Analysis: Estimation of Mg^{2+}, Zn^{2+},Ca^{2+} and Ni^{2+} by complexometric method and hardness of water. Fe^{2+}, Mn^{2+}, Ni^{2+} by colorimetric method

Qualitative Analysis: Semimicro analysis of salts containing three less common cations and one common cation.

Ti, Mo, W, Se, Te, Ce, Th, Ti, Zr, V, Be, U and Li.

CHE E002	Analysis of Complex Materials	E	3	P.Riyazuddini S.Sriman Narayanan T. Raju

Ore and alloy analysis, Analysis of organic compounds, Fuel analysis, solid and liquid fuels.

CHE E104	Nuclear Chemistry	E	3	M.Kandaswamy P.Ramamurthy V.Narayanan S.Balasubramanian

Nuclear forces and nuclear structure, binding energies, nuclear stabilities, structure of nucleus, nuclear models, radioactive decay, hot-atom chemistry. Nuclear reactions,couloumb barrier, cross section, types of nuclear reactions, nuclear fusion and nuclear fission. Nuclear reactor, nuclear reactors in India, Detection of radiations and particle accelerators. Applications, Tracers applied in industries and agriculture. Lanthanides and actinides.

CHE 1018	Functional Group Transformation in Organic Chemistry	E	3	A.K.Mohana Krishnan

Interconversion of various functional groups in Organic compounds by various methods.

CHE 1020	Solid State Chemistry	E	3	V.R.Vijayaraghavn

Bonding in solids, band theory, properties of solids, defects and nonstoichiometry, solid electrolytes, nanochemistry.

CHE C601	Physical Methods in Chemistry	C	4	V.R.Vijayaraghavan P.Rajakumar P.Ramamurthy/ V. Narayanan S.Sriman Narayanan / T.Raju

Electronic spectroscopy, application of group theory, formaldehyde butadiene, dissociation energy of diatomic molecules, Photoelectron Spectroscopy, esca - NMR – Principles, theory, chemical shift, spectra of organic molecules, coupling constants, Karplus curve, J values, ^{13}C-NMR-decoupling – double resonance techniques – Noe, and pulse techniques, FTNMR, NMR of phosphorous and Fluorine containing molecules. - Mass spectra – Molecular ion peak, meta stable peak, techniques, Application in determining structure of compounds. ESR-g-value, anisotropy, simple organic radicals, transition metals and coordination compounds. - X-ray diffraction – Bragg equation, space groups and point groups, diffraction methods. Mossbauer spectroscopy – theory and applications, Fe and Sn systems, Thermal methods of analysis – TGA, DTA and DSC – Principle and applications.

CHE C602	Biological Chemistry	C	4	M.Kandaswamy R.Raghunathan S.Balasubramanian / T.Raju

Origin of elements in biological systems, Corbohydrates, proteins, lipids, nucleic acids, DNA, RNA. - Essential and trace metal ions, metal ion transport in biological systems. Enzymes, nomenclature and classification, kinetics of enzyme catalyzed reaction, effect of pH and temperature - Coenzymes, heme enzymes, oxygen carriers, hemeproteins, nonhemeoxygen carriers, model compounds for oxygen carriers. Nitrogen fixations, biological redox reactions, cytochromes, iron-sulfur proteins, photosynthesis and chlorophyll, biological energy transfer and storage. Applications, medicinal, metal ion poisoning.

CHE C004	Practical – Analysis of Complex Materials and Separation Techniques	C	2	S.Rajeswari

Analysis of alloys, ores, and pharmaceuticals; separation techniques - chromatographic techniques.

CHE C005	Practical - Instrumental Methods	C	2	P.Riyazuddin

Spectrophotometry, potentiometry, Biamperometric titrations ,conductrometric titrations, Gas chromatography; Flame photometry, Nephelometry and Fluorimetry.

CHE C104	Inorganic Chemistry – Practical - II	C	2	S.Balasubramanian

Analysis of ores and alloys - dolomite, galena, pyrites, solder brass stainless stell, bronze etc.

CHE C105	Inorganic Chemistry – Practical - III	C	2	V.Narayanan

Chromatographic separation of inorganic compounds and estimation. synthesis of complexes and spectral analysis of cobalt, manganese, copper and nickel complexes. Solvent extraction of metal complexes.

CHE C204	Organic Chemistry – Practical – II	C	2	A.K.Mohankrishnan

Three stage preparations.

CHE C205	Organic Chemistry – Practical - III	C	2	M.Bakthadoss T.Mohandas

Synthesis of some oxygen and nitrogen containing heterocyclic compounds.

CHE C304	Physical Chemistry – Practical - II	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in chemical kinetics, thermodynamics, thermochemistry, photochemistry and enzyme kinetics - 15 experiments.

CHE C305	Physical Chemistry – Practical - III	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in conductivity, electrode equilibria, spectrophotometry, partial molar volumes, acid base equilibria - 15 experiments.

CHE E003	Classical and Radioanalytical methods of Analysis.	E	3	S.Rajeswari P.Riyazuddin

Analysis of complex materials - ore analysis, alloy analysis, analysis of organic Compounds - fuel and gas analysis - radioanalytical techniques

CHE E004	Optical and Surface Analytical Techniques	E	3	T.Raju S.Sriman Narayanan

Polarimetry, Refractometry, Chemical and Electron microscopy, X-ray spectroscopy, ESCA and Auger electron spectrometry.

CHE E602	Photochemistry	E	3	P.Maruthamuthu V.R.Vijayaraghavan T. Mohandas / P.Ramamurthy V.Narayanan

Fundamentals of photochemistry - absorption - emission of radiation - lifetimes - photochemical laws - quantum yield - intersystem crossing – Stern-Volmer equation - electron transfer - energy transfer - Photochemical techniques-flash photolysis - lasers in photochemistry; radiation chemistry - primary processes-track effects-dosimetry - pulse radiolysis - Inorganic photochemistry-photoredox reactions-substitution reactions - photosensitisation reactions; organometallic photochemistry - metal carbonyls - photochemistry in energy conversion - formation of fuels - hydrogen production - semiconductor electrodes - chemically modified electrodes - photogalvanic cells. - Organic Photochemistry: Norrish reactions. photochemistry of cyclohexadieneones. Reactions of olefines. Oxidation reduction reactions. Reaction of oxygen with olefines. Reduction of ketones. singlet oxygen - selected reactions - Photo Fries reaction. Barton reaction and Di-pi-methane rearrangement.

CHE E105	Organometallic Chemistry	E	3	M.Kandaswamy P.Ramamurhty S.Balasubramanian

Types of ligands in organometallic compounds, 18 electron rule, general methods of preparations, carbon sigma donors, carbon pi donors, chain and cyclic pi donors, multidecker sandwitch complexes, metallocenes, bis pi-arene metal complexes. Complexes of pi acceptor ligands, mono and poly metal carbonyls, preparation, structure and reactivity, reaction pathways, substitution,addition elimination and rearrangemnt, ligand protonation, fluxinal isomerism, catalysis, hydrogenation, hydroformylationn, oxidation, polymerisation, cyclooligomerisation and isomerisation.

CHE E203	Chemistry of Heterocycles, Organo-lithiums and Assymmetric synthesis	E	3	P.C.Srinivasan / R.Raghunathan

Synthesis of heterocycles with N, O and S – five and six membered rings. Preparation of Organolithiums, Assymmetric syntheis.

CHE E302	Advanced Chemical Thermodynamics and Kinetics	E	3	K.ChandrasekarapillaiE.Murugan

Statistical thermodynamics, Irreversible thermodynamics, Chemical kinetics – Gas and solution reactions.

CHE E502	Solar Energy Materials and Energy Conversions.	E	3	P. Maruthamuthu S.Austin Suthanthiraraj

Nature of solar radiation, materials used for absorption of solar radiation, solar heating, Energy systems, energy storage and energy transport. Frontier energy conversions; entropy reduction.

CHE C006	Separation Techniques	C	4	S.Rajeswari S.Sriman Narayanan / T.Raju

Distillation, Solvent extraction, Floatation and dialysis. Theory and applications. Chromatographic techniques – Column, TLC, Paper and ion-exchange chromatorgraphy, GC, GC-MS, GCIR, HPLC, HPTLC, GPC, SFC theory and applications.

CHE C106	Transition Metal Chemistry	C	4	M.Kandaswamy P.Ramamurhty V.Narayanan S.Balasubramanian

Inert and labile complexes - substitution reactions-dissociative and associative processes-hydrolysis, isomerisation and racemisation reactions-trans effect - redox reactions - inner sphere and outer sphere - complimentary and non-complimentary reactions; nitrosyls - phosphine, arsine and cyanide complexes-stabilisation of unusal oxidation states - ligand design - template methods - macrocylcic effect - synthesis of macrocyclic ligands; magentic moments - Van Vleck equation- magenetic properties of A,E,T terms -spin orbit coupling - antiferromagnetic interactions - magnetic behaviour of lanthanides and actinides.

CHE C206	Orbital symmetry and Modern Synthetic Methodology	C	4	R.Raghunathan P.Rajakumar

Introduction to Woodward Hoffmann rules to concerted reactions, Aromatic, nonaromatic and anitiaromatic systems. Mechanism of photochemical reactions. Synthon, formation of C-C, C=C bonds, disconnection approach, protective groups, sulphur, retero synthetic analysis.

CHE C306	Quantum Chemistry and Macromolecules	C	4	V.R.Vijayaraghavan E.J.Padma Malar E.Murugan

Schrodinger equation - solutions to particle in a box, SHO, rigid rotar hydrogen atom- approximation methods; MO and VB methods, H_2^+, MO method for diatomics, HMO method, SCF method, Solids Bonding in solids, Band theory, Properties of solids, low dimensional solids, Macromolecules, molecular weight of polymers, mechanism of polymerization.

CHE E603	Novel Reagents in Organic Synthesis	E	3	P.C. Srinivasan S.Balasubramanian M.Bakthadoss

Use of palladium, nickel and silicon in Organic synthesis.

CHE E304	Electrochemistry and Electroanalytical Chemistry	E	3	K.Chanderasekara Pillai P.Riyazuddin

Electrical double layer. Thermodynamics and models, Polarography – Theory and Instrumentation – Derivative Polarography – Amperometry – Cyclic Voltammetry and stripping voltammetry, Potentiometry, Ion selective electrodes, Potentiometric titrations, coulometric titrations – Electrogravimetry – Theory and instrumentation.

CHE E204	Chemistry of Natural Products	E	3	P.C.Srinivasan A.K.Mohanakrishnan

Total syntheis of some examples of alkaloids, steroids and terpenes, Brief introduction to their biogenesis.

CHE E501	Conventional, non-conventional and renewable energy sources and environment.	E	3	P. Maruthamuthu

Various forms of energy and their interconversion, Information on Ozone hole formation and remeady, the effect of excessive use of energy on environment. Role of solar radiation on pollution control problems.

CHE C207	Project Work Viva-Voce	C	6	All Faculty

M.Sc., PHYSICAL CHEMISTRY

Subject Code	Title of the Course	Core/ elective	Credits			
			L	T	P	C
I SEMESTER						
CHE C001	Fundamental of Analytical Chemistry	C	3	0	0	3
CHE C101	Coordination and Nuclear Chemistry	C	3	0	0	3
CHE C201	Stereochemistry and Organic Reaction Mechanism	C	3	0	0	3
CHE C301	Thermodynamics and Chemical Kinetics	C	3	0	0	3
CHE C302	Physical Chemistry Practical – I	C	0	0	2	2
CHE C202	Organic Chemistry Practical – I	C	0	0	2	2
CHE E101 CHE E201	Inorganic Reaction Mechanism OR Name Reactions in Organic Chemistry	E	3	0	0	3
II SEMESTER						
CHE C002	Analytical Instrumentation	C	3	0	0	3
CHE C102	Main Group Elements and Inorganic Polymers	C	3	0	0	3
CHE C203	Organic Reaction Mechanism	C	3	0	0	3
CHE C303	Quantum Chemistry and Group Theory	C	3	0	0	3
CHE C003	Analytical Chemistry Practical – I	C	0	0	2	2
CHE C101	Inorganic Chemistry Practical – I	C	0	0	2	2
CHE E002	Analysis of Complex Materials	E	3	0	0	3
III SEMESTER						
CHE C601	Physical Methods in Chemistry	C	4	0	0	4
CHE C602	Biological Chemistry	C	4	0	0	4
CHE C304	Physical Chemistry Practical – II	C	0	0	2	2
CHE C305	Physical Chemistry Practical – III	C	0	0	2	2
CHE E602	Photochemistry	E	3	0	0	3
CHE E302	Advanced Chemical Thermodynamics and Kinetics	E	3	0	0	3
IV SEMESTER						
CHE C306	Quantum Chemistry and Macromolecules	C	4	0	0	4
CHE E603	Novel Reagents in Organic Synthesis	E	3	0	0	3
CHE E304	Electrochemistry and Electroanlytical Chemistry	E	3	0	0	3
CHE C307	Project	C	0	0	6	6

CHE C001	Fundamental of Analytical Chemistry	C	3	0	0	3

Treatment of analytical data and sampling, Chemical Equilibria, Neutralization Reactions, Redox, Precipitation and Complexometric titrations.

CHE C101	Coordination Chemistry	C	3	M.Kandaswamy P.Ramamurthy /V.Narayanan

Stability and Stereochemical aspects, Structural aspects and Crystal Field Theory, Molecular Orbital Theory.

CHE C201	Stereochemistry and organic reaction mechanism	C	3	P.C.Srinivasan R.Raghunathan / M.Bakthadoss

Elements of Stereochemistry, Confirmation analysis and Mechanism of substitution in aliphatic and aromatic compounds. Aromaticity.

CHE C301	Thermodynamics and Chemical Kinetics	C	3	J.Santhanalakshmi K.Chandrasekar Pillai

Second law of thermodynamics, Maxwell relation and thermodynamic equation of state-Partial molar properties-concept of fugacity and activity- activity coefficient, Phase rule and phase equilibria, Electrochemistry - Debye -Huckel theory, Conductivity of electrolytes, Onsagar equation. Electrochemical cells, electrode kinetics. Chemical kinetics-complex reactions, transition state theory and collision theory - reactions in solution-effect of solvent polarity and ionic strength. Heterogeneous catalysis-various isotherms, fast reactions.

CHE C302	Physical Chemistry- Practical – I	C	2	J.Santhanalakshmi K.Chandrasekar Pillai

Experiments in conductivity, EMF, kinetics, phase equilibria, solution equilibria, colligative properties and thermochemistry.

CHE C202	Organic Chemistry- Practical – I	C	2	A.K.Mohanakrishnan T.Mohandas / M. Bakthadoss

Single and double stages preparations.

CHE E305	Electronics and Computers for Chemists	E	3	P.Riyazuddin S.Sriman Narayanan

Basic Electronics, Computers in Chemistry Programs in BASIC – Calculation pH, solubility product, Standard deviation, buffers, F and t tests, regression analysis.

CHE E101	Inorganic Reaction Mechanism	E	3	M.Kandaswamy /V. Narayanan S.Balasubramanian

Inter and Labile Complexes, Stabilization of unusual oxidation states, Electron transfer reactions, Substitution Reactions, Reactions of organometallic compounds.

CHE E201	Name Reactions in Organic Chemistry	E	3	P.C.Srinivasan

Introduction to various name reactions involving C-C bond formation, heterocycle synthesis and modification of substituents.

CHE E306	Essentials of Statistical Thermodynamics	E	3	

Partition function, Thermodynamic parameters from statistical methods, Bose-Einstein, Maxwell-Boltzmann, Fermi Dirac statistics – Applications of statistical methods.

CHE C002	Analytical Instrumentation	C	3	S.Rajeswari / T.Raju S.Sriman Narayanan

Absorption and Molecular Spectrometry, Atomic, Absorption spectrometry, Flame Photometry, Plasma Emission Spectrometry, Chromatographic Techniques – General aspects, Classification, Principle and applications of TLC, Paper Chromatography, GC and HPLC.

CHE C102	Main Group Elements and Inorganic Polymers	C	3	M.Kandaswamy P.Ramamurthy V.Narayanan

Inorganic polymers-isopoly acids - heteropoly acids - silicates - phthalocyanine polymers - boron hydrides - corboranes and metallo carboranes, nitrogen, phosphorous, sulphour polymers.

CHE C203	Organic Reaction Mechanism	C	3	A.K.Mohana Krishnan T.Mohandas P.Rajakumar

Mechanism of various Organic reactions and rearrangements.

CHE C303	Quantum Chemistry and Group Theory	C	3	V.R.Vijayaraghavan

Foundations of quantum theory, Schrodinger equation, structure of the atom. Molecular structure - MO and VB methods, VSEPR theory; HMO METHOD, Group theory. Applications in Spectroscopy, and quantum chemistry, rotationaland vibrational spectroscopy, Raman spectroscopy.

CHE C003	Analytical Chemistry – Practical - I	C	2	T.Raju / S.Sriman Narayanan

Spectrophotometry, Potentiometry / pH metry, Polarography and Gas Chromatography.

CHE C101	Inorganic Chemistry – Practical - I	C	2	P.Ramamurthy V.Narayanan

Quantitative Analysis: Estimation of Mg^{2+}, Zn^{2+},Ca^{2+} and Ni^{2+} by complexometric method and hardness of water. Fe^{2+}, Mn^{2+}, Ni^{2+} by colorimetric method

Qualitative Analysis: Semimicro analysis of salts containing three less common cations and one common cation.

Ti, Mo, W, Se, Te, Ce, Th, Ti, Zr, V, Be, U and Li.

CHE E002	Analysis of Complex Materials	E	3	P.Riyazuddini S.Sriman Narayanan T. Raju

Ore and alloy analysis, Analysis of organic compounds, Fuel analysis, solid and liquid fuels.

CHE E104	Nuclear Chemistry	E	3	M.Kandaswamy P.Ramamurthy V.Narayanan S.Balasubramanian

Nuclear forces and nuclear structure, binding energies, nuclear stabilities, structure of nucleus, nuclear models, radioactive decay, hot-atom chemistry. Nuclear reactions,couloumb barrier, cross section, types of nuclear reactions, nuclear fusion and nuclear fission. Nuclear reactor, nuclear reactors in India, Detection of radiations and particle accelerators. Applications, Tracers applied in industries and agriculture. Lanthanides and actinides.

CHE E204	Functional Group Transformation in Organic Chemistry	E	3	A.K.Mohana Krishnan

Interconversion of various functional groups in Organic compounds by various methods.

CHE E308	Solid State Chemistry	E	3	V.R.Vijayaraghavn

Bonding in solids, band theory, properties of solids, defects and nonstoichiometry, solid electrolytes, nanochemistry.

CHE C601	Physical Methods in Chemistry	C	4	V.R.Vijayaraghavan P.Rajakumar P.Ramamurthy V. Narayanan S.Sriman Narayanan / T.Raju

Electronic spectroscopy, application of group theory, formaldehyde butadiene, dissociation energy of diatomic molecules, Photoelectron Spectroscopy, esca - NMR – Principles, theory, chemical shift, spectra of organic molecules, coupling constants, Karplus curve, J values, ^{13}C-NMR-decoupling – double resonance techniques – Noe, and pulse techniques, FTNMR, NMR of phosphorous and Fluorine containing molecules - Mass spectra – Molecular ion peak, meta stable peak, techniques, Application in determining structure of compounds. ESR-g-value, anisotropy, simple organic radicals, transition metals and coordination compounds - X-ray diffraction – Bragg equation, space groups and point groups, diffraction methods. Mossbauer spectroscopy –theory and applications, Fe and Sn systems, Thermal methods of analysis – TGA, DTA and DSC – Principle and applications.

CHE C602	Biological Chemistry	C	4	M.Kandaswamy R.Raghunathan S.Balasubramanian / T.Raju

Origin of elements in biological systems, Corbohydrates, proteins, lipids, nucleic acids, DNA, RNA - Essential and trace metal ions, metal ion transport in biological systems. Enzymes, nomenclature and classification, kinetics of enzyme catalyzed reaction, effect of pH and temperature -

Coenzymes, heme enzymes, oxygen carriers, hemeproteins, nonhemeoxygen carriers, model compounds for oxygen carriers. Nitrogen fixations, biological redox reactions, cytochromes, iron-sulfur proteins, photosynthesis and chlorophyll, biological energy transfer and storage. Applications, medicinal, metal ion poisoning.

CHE C004	Practical – Analysis of Complex Materials and Separation Techniques	C	2	S.Rajeswari

Analysis of alloys, ores, and pharmaceuticals; separation techniques - chromatographic techniques.

CHE C005	Practical - Instrumental Methods	C	2	P.Riyazuddin

Spectrophotometry, potentiometry, Biamperometric titrations ,conductrometric titrations, Gas chromatography; Flame photometry, Nephelometry and Fluorimetry.

CHE C104	Inorganic Chemistry – Practical - II	C	2	S.Balasubramanian

Analysis of ores and alloys - dolomite, galena, pyrites, solder brass stainless stell, bronze etc.

CHE C105	Inorganic Chemistry – Practical - III	C	2	V.Narayanan

Chromatographic separation of inorganic compounds and estimation. synthesis of complexes and spectral analysis of cobalt, manganese, copper and nickel complexes. Solvent extraction of metal complexes.

CHE C204	Organic Chemistry – Practical – II	C	2	A.K.Mohankrishnan

Three stage preparations.

CHE C205	Organic Chemistry – Practical - III	C	2	M.Bakthadoss T.Mohandas

Synthesis of some oxygen and nitrogen containing heterocyclic compounds.

CHE C304	Physical Chemistry – Practical - II	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in chemical kinetics, thermodynamics, thermochemistry, photochemistry and enzyme kinetics - 15 experiments.

CHE C305	Physical Chemistry – Practical - III	C	2	V.R.Vijayaraghavan J.Santhanalakshmi

Experiments in conductivity, electrode equilibria, spectrophotometry, partial molar volumes, acid base equilibria - 15 experiments.

CHE E003	Classical and Radioanalytical methods of Analysis.	E	3	S.Rajeswari P.Riyazuddin

Analysis of complex materials - ore analysis, alloy analysis, analysis of organic Compounds - fuel and gas analysis - radioanalytical techniques

CHE E004	Optical and Surface Analytical Techniques	E	3	T.Raju S.Sriman Narayanan

Polarimetry, Refractometry, Chemical and Electron microscopy, X-ray spectroscopy, ESCA and Auger electron spectrometry.

CHE E602	Photochemistry	E	3	P.Maruthamuthu V.R.Vijayaraghavan T. Mohandas P.Ramamurthy V.Narayanan

Fundamentals of photochemistry - absorption - emission of radiation - lifetimes - photochemical laws - quantum yield - intersystem crossing – Stern-Volmer equation - electron transfer - energy transfer; - Photochemical techniques-flash photolysis - lasers in photochemistry; radiation chemistry - primary processes-track effects-dosimetry - pulse radiolysis -Inorganic photochemistry-photoredox reactions-substitution reactions - photosensitisation reactions; organometallic photochemistry - metal carbonyls - photochemistry in energy conversion - formation of fuels - hydrogen production - semiconductor electrodes - chemically modified electrodes - photogalvanic cells - Organic Photochemistry: Norrish reactions. photochemistry of cyclohexadieneones. Reactions of olefines. Oxidation reduction reactions. Reaction of oxygen with olefines. Reduction of ketones. singlet oxygen - selected reactions - Photo Fries reaction. Barton reaction and Di-pi-methane rearrangement.

CHE E105	Organometallic Chemistry	E	3	M.Kandaswamy P.Ramamurhty S.Balasubramanian

Types of ligands in organometallic compounds, 18 electron rule, general methods of preparations, carbon sigma donors, carbon pi donors, chain and cyclic pi donors, multidecker sandwitch complexes, metallocenes, bis pi-arene metal complexes. Complexes of pi acceptor ligands, mono and poly metal carbonyls, preparation, structure and reactivity, reaction pathways, substitution addition elimination and rearrangemnt, ligand

protonation, fluxinal isomerism, catalysis, hydrogenation, hydroformylationn, oxidation, polymerisation, cyclooligomerisation and isomerisation.

CHE E203	Chemistry of Heterocycles, Organo-lithiums and Assymmetric synthesis	E	3	P.C.Srinivasan / R.Raghunathan

Synthesis of heterocycles with N, O and S – five and six membered rings. Preparation of Organolithiums, Assymmetric syntheis.

CHE E302	Advanced Chemical Thermodynamics and Kinetics	E	3	K.Chandrasekarapillai/E.Murugan

Statistical thermodynamics, Irreversible thermodynamics, Chemical kinetics – Gas and solution reactions.

CHE E502	Solar Energy Materials and Energy Conversions.	E	3	P. Maruthamuthu S.Austin Suthanthiraraj

Nature of solar radiation, materials used for absorption of solar radiation, solar heating, Energy systems, energy storage and energy transport. Frontier energy conversions; entropy reduction.

CHE E502	Solar Energy Materials and Energy Conversions.	E	3	P. Maruthamuthu S.Austin Suthanthiraraj

Nature of solar radiation, materials used for absorption of solar radiation, solar heating, Energy systems, energy storage and energy transport. Frontier energy conversions; entropy reduction.

CHE C006	Separationc Techniques	C	4	S.Rajeswari S.Sriman Narayanan /T.Raju

Distillation, Solvent extraction, Floatation and dialysis. Theory and applications. Chromatographic techniques – Column, TLC, Paper and ion-exchange chromatorgraphy, GC, GC-MS, GCIR, HPLC, HPTLC, GPC, SFC theory and applications.

CHE C106	Transition Metal Chemistry	C	4	M.Kandaswamy P.Ramamurhty V.Narayanan S.Balasubramanian

Inert and labile complexes - substitution reactions-dissociative and associative processes-hydrolysis, isomerisation and racemisation reactions-trans effect - redox reactions - inner sphere and outer sphere - complimentary and non-complimentary reactions; nitrosyls - phosphine, arsine and cyanide complexes-stabilisation of unusal oxidation states - ligand design - template methods - macrocylcic effect - synthesis of macrocyclic ligands; magentic moments - Van Vleck equation- magenetic properties of A,E,T terms -spin orbit coupling - antiferromagnetic interactions - magnetic behaviour of lanthanides and actinides.

CHE C206	Orbital symmetry and Modern Synthetic Methodology	C	4	R.Raghunathan P.Rajakumar

Introduction to Woodward Hoffmann rules to concerted reactions, Aromatic, nonaromatic and anitiaromatic systems. Mechanism of photochemical reactions. Synthon, formation of C-C, C=C bonds, disconnection approach, protective groups, sulphur, retero synthetic analysis.

CHE C306	Quantum Chemistry and Macromolecules	C	4	V.R.Vijayaraghavan E.J.Padma Malar / E.Murugan

Schrodinger equation - solutions to particle in a box, SHO, rigid rotar hydrogen atom- approximation methods; MO and VB methods, H_2^+, MO method for diatomics, HMO method, SCF method, Solids Bonding in solids, Band theory, Properties of solids, low dimensional solids, Macromolecules, molecular weight of polymers, mechanism of polymerization.

CHE E603	Novel Reagents in Organic Synthesis	E	3	P.C. Srinivasan S.Balasubramanian M.Bakthadoss

Use of palladium, nickel and silicon in Organic synthesis.

CHE E304	Electrochemistry and Electroanalytical Chemistry	E	3	K.Chanderasekara Pillai P.Riyazuddin

Electrical double layer. Thermodynamics and models, Polarography – Theory and Instrumentation – Derivative Polarography – Amperometry – Cyclic Voltammetry and stripping voltammetry, Potentiometry, Ion selective electrodes, Potentiometric titrations, coulometric titrations – Electrogravimetry – Theory and instrumentation.

CHE E204	Chemistry of Natural Products	E	3	P.C.Srinivasan A.K.Mohanakrishnan

Total syntheis of some examples of alkaloids, steroids and terpenes, Brief introduction to their biogenesis.

CHE E501	Conventional, non-conventional and renewable energy sources and environment.	E	3	P. Maruthamuthu

Various forms of energy and their interconversion, Information on Ozone hole formation and remeady, the effect of excessive use of energy on environment. Role of solar radiation on pollution control problems.

CHE C307	Project Work Viva-Voce	C	6	All Faculty

M.Sc. POLYMER SCIENCE

Subject code	**Title of the course**	**Credits**			
		L	**T**	**P**	**C**
CHE C 401	Physical Chemistry – I	2	-	-	2
CHE C 402	Organic Chemistry – I	2	-	-	2
CHE C 403	Inorganic Chemistry – I	2	-	-	2
CHE E 401	Introduction to Polymers	3	-	-	3
CHE E 402	Reagents in Organic Synthesis	3	-	-	3
CHE C 404	Practicals – I Physical Chemistry	-	-	2	2
CHE C 405	Practicals – I Organic Chemistry	-	-	2	2
CHE C 406	Practicals – I Inorganic Chemistry	-	-	2	2
CHE C 407	Physical Chemistry – II	2	-	-	2
CHE C 408	Organic Chemistry – II	2	-	-	2
CHE C 409	Inorganic Chemistry – II	2	-	-	2
CHE E 403	Essentials of Polymer Physics	3	-	-	3
CHE E 404	Molecular spectroscopy	3	-	-	3
CHE C 410	Practicals – II Physical Chemistry	-	-	2	2
CHE C 411	Practicals – II Organic Chemistry	-	-	2	2
CHE C 412	Practicals – II Inorganic Chemistry	-	-	2	2
CHE C 413	Polymer Chemistry	4	-	-	4
CHE C 414	Physical Chemistry of Polymers	4	-	-	4
CHE C 415	Polymer Physics	4	-	-	4
CHE E 405	Speciality Polymers	3	-	-	3
CHE C 416	Polymer Practicals	-	-	4	4
CHE C 417	Plastics Technology	4	-	-	4

CHE C 418	Rubber and Fibre Technology	4	-	-	4
CHE E 406	Applied Polymer Science	3	-	-	3
CHE C 419	Research project	-	-	6	6

Courses abstract:

CHE C 401	Physical Chemistry I	4	-	-	

Quantum mechanics - valence and structure of molecules - states of matter-gases, liquids and solids - symmetry, group theory and spectroscopy.

CHE C 402	Organic Chemistry – I	2	-	-	2

Stereochemistry - methods of determining reaction mechanisms - effect of structure on reactivity - the Hammett and Taft equation - nucleophilic substitution and electrophilic substitution reactions - principles and typical examples.

CHE C 403	Inorganic Chemistry – I	2	-	-	2

Periodic properties and electronic configurations – acids and bases - principles of analytical chemistry - chemistry of hydrides - chemistry of silicates - a comparative study of the transition elements and inner transition elements.

CHE E 401	Introduction to Polymers	3	-	-	3

Step-growth polymerization – chain-growth polymerization, stereochemistry of polymers - number average, weight average and viscosity average molecular weight of polymers - glass transition temperature of polymers and copolymers.

CHE E 402	Reagents in Organic Synthesis	3	-	-	3

Use of different reagents in organic synthesis and functional group transformations.

CHE C 404	Practicals – I Physical Chemistry	-	-	2	2

Viscosity of mixtures Cryoscopy, Rast and Ebulioscopy Phase rule - transition temperature, c.s.t., eutectic, compound formation partition Heat of neutralisation, combustion

CHE C 405	Practicals – I Organic Chemistry	-	-	2	2

Analysis of two component and three component mixtures, separation and characterization with emphasis on characterization by derivatives.

CHE C 406	Practicals – I Inorganic Chemistry	-	-	2	2

Quantitative analysis of inorganic mixtures by gravimetric, titrimetric and colourimetric methods (Mixtures as met with in common ores and alloys).

CHE C 407	Physical Chemistry – II	2	-	-	2

Elements of statistical mechanics - electro chemistry - kinetics of chemical reactions -colloids - principles of chromatography - nuclear chemistry.

CHE C 408	Organic Chemistry – II	2	-	-	2

Free radical reactions - addition to carbon-carbon and carbon-oxygen multiple bonds - elimination reactions - molecular rearrangements - oxidation reduction mechanisms - heterocyclic chemistry - biologically important compounds - natural and synthetic polymers - concepts of aromaticity.

CHE C 409	Inorganic Chemistry – II	2	-	-	2

Structural inorganic chemistry - coordination chemistry.

CHE E 403	Essentials of Polymer Physics	3	-	-	3

Physical aspects of polymer solutions – rheology - kinetic theory of rubber elasticity - physical properties of polymers.

CHE E 404	Molecular spectroscopy	3	-	-	3

Theoretical treatment and applications of rota tional, vibrational, electronic, magnetic resonance, Mossbauer and photoelectron spectroscopy.

CHE C 410	Practicals – II Physical Chemistry	-	-	2	2

1. Determination of e.m.f., pH, potentiometric titrations
2. Determination of conductivity – titrations Kinetics of ester hydrolysis - inversion of cane sugar

CHE C 411	Practicals – II Organic Chemistry	-	-	2	2

About 10 preparations involving two or three stages involving the following processes, nitration, acylation, halogenation, diazotization, rearrangements, hydrolysis, reduction, alkylation and oxidation. Estimation of phenol, methyl ketones, glucose, nitro, amino and methoxy groups and unsaturation.

CHE C 412	Practicals – II Inorganic Chemistry	-	-	2	2

Semimicro qualitative analysis of common cation and anion containing the following less familiar elements: Tl, W, Sc, Te, Mo, Ce, Th, Ti, Zr, V, Be, U, Li and Cs. Simple inorganic preparations including some complex compounds.

CHE C 413	Polymer Chemistry	4	-	-	4

Development of polymer science - radical, ionic, coordination, metallocene, condensation, hydrogen-polyaddition, ring-opening, electrochemical, ring-opening metathesis and group transfer polymerization - copolymers - different kinds of polymerization techniques – polymer degradation.

CHE C 414	Physical Chemistry of Polymers	4	-+	-	4

Chemical and geometrical structure of macromolecules - concept of average molecular weight - theoretical considerations and empirical distribution model - molecular weight determination - the glassy state - determination of glass transition temperature - crystal structures of polymers.

CHE C 415	Polymer Physics	4	-	-	4

Physical aspects of polymer solutions - rheology and mechanical properties - kinetic theory of rubber elasticity - viscoelasticity description and theories - glassy state and glass transition

CHE E 405	Speciality Polymers	3	-	-	3

Dendrimers - hyperbranched polymers - non-linear optical and photonic polymers - liquid crystalline polymers - conducting polymers - biodegradable polymers

CHE C 416	Polymer Practicals	-	-	4	4

1. Polymer synthesis in bulk 2. Polymer synthesis by suspension method
3. Polymer synthesis by emulsion method 4. Preparation of polyurethane foams
5. Suspension copolymerization 6. IR and NMR spectra of polymers
7. Photopolymerization 8. Kinetics of addition polymerization
9. Verification of Mark-Howinck's equation 10. Thermal analysis of polymers
11. Compression Moulding 12 Injection moulding

CHE C 417	Plastics Technology	4	-	-	4

Additives for plastics - processing techniques - manufacture and properties of individual polymers

CHE C 418	Rubber and Fibre Technology	4	-	-	4

Molecular requirements for a rubber substance - rubber processing - manufacturing of rubber based articles - manufacture, compounding and applications of isoprene, butyl, butadiene, chloroprene, EPDM, thiokol and silicon rubbers - critical considerations for fibre forming materials - spinning methods.

CHE E 406	Applied Polymer Science	3	-	-	3

Adhesives - coatings - Composites.

CHE C 419	Research project	-	-	6	6

Each student shall undertake a project under the supervision of a faculty member and submit a report which shall be evaluated by the board of examiners consisting of the supervisor, head of the department and an external subject expert. The examiners shall also examine the candidate in a viva-voce examination.

M.Phil. ANALYTICAL CHEMISTRY

Course Code	Title of the Course	C/E	Credits				Faculty
			L	T	P	C	
First Semester							
CHE C001	Research Metholdology	C	4	1	0	5	P.Riyazuddin
CHE C002	Analytical techniques and Instrumentation – I	C	4	1	0	5	S.Sriman Narayanan T.Raju
CHE C003	Analytical techniques and Instrumentation – II	C	4	1	0	5	S. Rajeswari
M. Phil. M. Phil.Second Semester							
CHE C004	Dissertation and viva-voce	C	-	-	-	21	Supervisor

M.Phil. INORGANIC CHEMISTRY

Course Code	Title of the Course	C/ E	Credits				Faculty
			L	T	P	C	
First Semester							
CHE C101	Advanced Inorganic Chemistry	C	4	1	0	5	M.Kandaswamy/P.Ramamurhty V.Narayanan/S.Balasubramanian
CHE C102	Advanced Organic Chemistry	C	4	1	0	5	P.C.Srinivasan/R.Raghunathan P.Rajakumar
CHE C103	Advanced Physical Chemistry	C	4	1	0	5	T.Balakrishnan/J.Santhanalakshmi K.Chandra Sekara Pillai/E.Murugan
Second Semester							
CHE C104	Dissertation and Viva-Voce	C	-	-	-	21	Supervisor

M.Phil. ORGANIC CHEMISTRY

Course Code	Title of the Course	C/ E	Credits				Faculty
			L	T	P	C	
First Semester							
CHE C201	Advanced Inorganic Chemistry	C	4	1	0	5	M.Kandaswamy/P.Ramamurhty V.Narayanan/S.Balasubramanian
CHE C202	Advanced Organic Chemistry	C	4	1	0	5	P.C.Srinivasan/R.Raghunathan P.Rajakumar
CHE C203	Advanced Physical Chemistry	C	4	1	0	5	T.Balakrishnan/J.Santhanalakshmi K.Chandra Sekara Pillai E.Murugan
Second Semester							
CHE C204	Dissertation and Viva-Voce	C	-		-	-	21 Supervisor

M.Phil. PHYSICAL CHEMISTRY

Course Code	Title of the Course	C/E	Credits				Faculty
			L	T	P	C	
First Semester							
CHE 301	Advanced Inorganic Chemistry	C	4	1	0	5	M.Kandaswamy P.Ramamurhty V.Narayanan S.Balasubramanian
CHE 302	Advanced Organic Chemistry	C	4	1	0	5	P.C.Srinivasan R.Raghunathan P.Rajakumar
CHE 303	Advanced Physical Chemistry	C	4	1	0	5	T.Balakrishnan J.Santhanalakshmi K.Chandra Sekara Pillai E.Murugan
Second Semester							
CHE 304	Dissertation and Viva-Voce	C	-	-	-	21	Supervisor