CHEMISTRY

PROFESSORS

Bharadwaj PK	pkb	7034	7340
Chakraborty T (On leave)	tapasc	7772	7357
Chandra A	amalen	7976	7241
Chandrashekar V	vc	7259	7617
Chandrasekhar TK (On leave)	tkc	7282	7426
Gajbhiye NS	nsg	7080	7423
Gupta BD	bdg	7046	7730
Gupta Bhaya P	pinaki	7372	
Khan FA	faiz	7864	7394
Manogaran S	s m	7303	7340
Moorthy JN	moorthy	7438	
Mukherjee RN	rnm	7437	7708
Sarkar S	abya	7265	7386
Sathyamurthy N (On leave)	nsath	7367	7390
Singh VK	vinodks	7291	7774
Sundar Manoharan S	ssunder	7425	6043
Vankar YD (Head)	vankar	7492	7169
Verma S	sverma	7643	7962
Yadav VK	vijendra	7439	7939

ASSOCIATE PROFESSORS

Bera JK	jbera	7336	
Ghorai MK	mkghorai	7518	7539
Gurunath R	gurunath	7417	6039
Goswami D	dgoswami	7520	7187
Rao Maddali LN	maddali	7532	7163
Srihari K	srihari	7043	7469

ASSISTANT PROFESSORS

Anantha Raman G	garaman	7517	
Ranganathan M	madhavn	6037	
Rath SP	sprath	7251	6069

Convenor, DUGC :	Ghorai MK	mkghorai	7518
Convenor, DPGC :	Rao MLN	maddali	7163/7532
Faculty Counsellor:	Bera JK	jbera	7336

The Department of Chemistry has an undergraduate programme leading to Master's (M.Sc.) degree and a postgraduate programme leading to Doctorate (Ph. D.) degree. The Department offers a two-year M.Sc. programme through a nationwide entrance test called JAM to those with a Bachelor's degree from other Institutions. In addition, there is a five-year integrated M. Sc. programme for students who have completed their higher secondary or intermediate education in science. Admission to this programme is through the IIT JEE examination. The Ph.D. programme attempts to instil the spirit of research. It includes an integrated sequence of course work and research in various branches of chemistry such as inorganic, organic and physical chemistry, including bio-related areas.

The Department strives to provide undergraduates majoring in various Engineering and Science subjects, a basic understanding of the principles of chemistry and an awareness of its technological importance. A course in General Chemistry with laboratory content on experimental methods in chemistry is compulsory for all undergraduate students. The courses on physical and industrial organic chemistry are taken by those undergraduate students who have a particular interest in them.

Laboratory Facilities

Adequate laboratory facilities exist in the Department for teaching both undergraduate and graduate students. We have a well developed undergraduate laboratory to carry out experiments in inorganic, organic and physical areas. M.Sc. students work on research projects with faculty members in their research laboratories which are well equipped for Ph.D. and postdoctoral research in almost every field of chemistry. The Department believes that the training of chemists to a high level of professional competence can best be done in an environment of active and significant research. Accordingly, research forms one of the major activities of the Department. The research interests of the Faculty include analytical chemistry, applied chemistry, biophysical chemistry, chemical reaction dynamics, computer simulation of liquids, chemistry of natural products, fullerene chemistry, magnetic resonance (NMR and ESR), mass spectrometry, molecular beams and clusters, laser spectroscopy, mechanistic organic chemistry, organo-metallic chemistry, physical photochemistry, Organic photochemistry, polymer chemistry, solid state chemistry, synthetic main group chemistry, structural studies using X-ray diffraction, synthetic organic chemistry, theoretical chemistry, transition metal chemistry, bio-inorganic chemistry, bio-organic chemistry and enzyme chemistry and supramolecular chemistry.

STRUCTURE OF THE PROGRAMME M. Sc. (2-year)

SEM. I	SEM. II	SEM. III	SEM. IV
CHM 401	CHM 402	CHM 503	CHM 700
CHM 421	CHM 422	CHM 611	CHM 800
CHM 423	CHM 442	CHM 621	CHM 801
CHM 441	CHM 443	CHM 664	DE - 4
CHM 521	CHM 481	DE - 2	DE - 5
	DE - 1	DE - 3	

CHM 401	Organic Chemistry I	Departmental Elective	DE - I
CHM 402	Organic Chemistry II		DE - II
CHM 421	Physical Chemistry I		DE - III
CHM 422	Physical Chemistry II		DE - IV
CHM 423	Physical Chemistry Lab.		DE - V
CHM 441	Inorganic Chemistry I		
CHM 442	Inorganic Chemistry II		
CHM 443	Inorganic Chemistry Lab.		
CHM 481	Biosystems		
CHM 503	Organic Preparations Lab.		
CHM 521	Mathematics for Chemistry		
CHM 611	Physical Organic Chemistry		
CHM 621	Chemical Binding		
CHM 664	Modern Phy. Methods in Chemistry		
CHM 700	Project		
CHM 800	General Seminar		
CHM 801	Special Seminar		

CURRENT COURSE STRUCTURE FOR M.Sc. [5-YEAR] STUDENTS

CHEMISTRY

SEMESTER					
	FIRST	**SECOND**	**THIRD**	**FOURTH**	**FIFTH**
COURSE	CHM101 PHY101 PHY102 MTH101 ESC101 PE101 HSS-I-1/ ENG112	TA101 PHY103 MTH102 ESC102 CHM100 PE102	MTH203 CHM201 ESO-1 ESO-2 CHM301	HSS-I-2 TA201 CHM222 CHM302 CHM341 CHM404	HSS-II-1 CHM401 CHM421 CHM441 CHM503 OE-1
SEMESTER					
	SIXTH	**SEVENTH**	**EIGHTH**	**NINTH**	**TENTH**
COURSE	CHM343 CHM402 CHM422 CHM442 OE-2	CHM423 CHM611 CHM621 CHM664 OE-3 DE-1	CHM443 CHM481 DE-2 DE-3 OE-4 NDE-1	HSS-II-2 CHM700 OE-5 OE-6	CHM700 NDE-2 CHM800 CHM801

CHM 201N
CHM 222 Basic Physical Chemistry
CHM 301 Basic Organic Chemistry
CHM 302 Basic Organic Chemistry-II
CHM 341 Basic Inorganic Chemistry
CHM 343 Inorganic Chemistry Lab.
CHM 401 Organic Chemistry I
CHM 402 Organic Chemistry II
CHM 404 Organic Chemistry Lab.
CHM 421 Physical Chemistry I
CHM 422 Physical Chemistry II
CHM 423 Physical Chemistry Lab
CHM 441 Inorganic Chemistry I
CHM 442 Inorganic Chemistry II
CHM 443 Inorganic Chemistry Lab.
CHM 481 Biosystems
CHM 503 Organic Preparation Lab.
CHM 611 Physical Organic Chemistry
CHM 621 Chemical Binding
CHM 664 Modern Phy. Methods in Chemistry
CHM 700
CHM 800

ESO I
ESO II
MTH 203N Mathematics III
OE-I Open Elective-I
OE-II Open Elective-II
OE-III Open Elective-III
DE-I Departmental Elective-I
DE-II Departmental Elective-II
DE-III

NDE-1 Non Departmental Elective-1
NDE-2 Non Departmental Elective-2

COURSE DESCRIPTIONS

CHM 101 **GENERAL CHEMISTRY LABORATORY**

Experiments related to general, organic, physical and inorganic chemistry.

CHM 201 **GENERAL CHEMISTRY**

L-T-P-D-[C]
3-1-0-1-[4]

Chemistry, man and matter, Experimental methods of structure determination, System at finite temperature, Molecular reaction of Transition Metal ion chemistry, Organometallic chemistry, 18-electron rule, simple ligands such as CO, ethylene, triphenyl phosphine etc.,' Homogeneous catalysis, Green chemistry, Structures of organic molecules. Conformations of ethane, butane, cyclohexane and monosaccharides such as glucose and fructose. Anomeric effect. E and Z configurations (inter conversions between E and Z). Optical activity, R and S (in brief), importance of optical activity in drug synthesis and biological activity, Synthesis of organic molecules, Photochemistry of organic and biomolecules, Chemistry of life processes, Biotechnology and Biomedical applications.

CHM 205/ SE 333 **INDUSTRIAL ORGANIC CHEMISTRY** **[Prereq. CHM 201]**

L-T-P-D-[C]
3-0-0-0-[4]

Various aspects of the energy and raw material supply: Coal, oil, natural gas, nuclear, and biomass as energy sources; Basic products of industrial synthesis: synthesis gas, methanol, formaldehyde, halogen derivatives of methane, chlorofluorohydrocarbons; Olefins:Historical perspective, cracking of hydrocarbons, ethylene, butanes, higher olefins, unbranched higher olefins and their use in metathesis reactions,

Acetylene: Significance and manufacturing process for acetylene, manufacture through calcium carbide, thermal process, applications of acetylene, 1,3-Dioolefins:1,3-Butadiene, industrial manufacture from cracking, dehydrogenation, applications of butadiene,

Synthesis using carbon monoxide: Hydroformylation, industrial operations, utilization of oxo products, carbonylation of olefins;

Oxidation products of ethylene: Ethylene oxide, process operation, ethylene glycol, ethylene glycol ethers, acetaldehyde, acetic acid, acetic anhydride,

Alcohols: Ethanol, propanol, butanols, amyl alcohols, aldol synthesis, polyhydric alcohols, neopentyl glycol.

Vinyl-halogen and oxygen compounds: Vinyl chloride, vinylidene chloride vinylacetate, binyl ethers;

Polyamides: Adipic acid, hexamethy-lenediamine, adiponitrile, lactams;

Propene conversion products; Propylene oxide, acetone, acrolein, allylchloride, acrylonitrile.;

Aromatics: Source of feedstocks, coking of hard coal, isolation, special separation techniques, condensed aromatics, naphthalene, anthracene, hydrodealkylation.

Benzene derivatives; Styrene, cumene, cyclohexane, phenol, maleic anhydride, nitrobenzene, aniline, diisocyanates. Oxidation products of xylene and naphthalene; Phthalic anhydride, esters of phthalic acid and derivatives, terephthalic acid.

CHM 222 **BASIC PHYSICAL CHEMISTRY** **[Prereq. CHM 201]**

L-T-P-D-[C]
3-1-0-0-[4]

States of matter and properties of gases, Thermodynamics, Chemical Kinetics.

CHM 301/ SE 332 **BASIC ORGANIC CHEMISTRY-I**

L-T-P-D-[C]
3-1-0-0-[4]

Nomenclature of organic molecules Structure and bonding, Stereochemistry, Reactive Intermediates, Substitution and Elimination Reactions, Molecular Rearrangements, Photochemistry.

CHM 302 **BASIC ORGANIC CHEMISTRY-II** **[Prereq. CHM 301]**

L-T-P-D-[C]
3-1-0-0-[4]

Oxidation, Reduction, C-C Bond Formations, Syhthesis of Polynuclear Hydrocarbons, Carbohydrates, Nucleotides, Amino Acids and Peptides.

CHM 310/ SE 336 **PHOTONS, MOLECULES 7 CHEMICAL DYNAMICS [Prereq. CHM 201]**

L-T-P-D-[C]
3-1-0-0-[4]

Molecular basis of elementary chemical reactions, relation between the microscopic and macroscopic observables, initial state selection and final state analysis with and without lasers, potential energy surfaces and reaction dynamics, computer simulation of chemical reactions, multiphoton processes and bond-selective chemistry.

CHM 341 **BASIC INORGANIC CHEMISTRY** **[Prereq. CHM 201]**

L-T-P-D-[C]
3-0-0-0-[4]

Vector model of the atom (Russell-Saunders Coupling), the molecule and molecular ions, periodicity of the elements, shielding, the size of the atoms, ionization energy, electron affinity, inorganic solid state, Covalent bonding, Heteronuclear bonds, Types of chemical forces, Effects of chemical forces, Hard and soft acids and bases: Classification, acids and bases, Optical activity, Experimental evidence for metal-ligand orbital overlap.

CHM 343 **INORGANIC CHEMISTRY LAB** **0-0-6-0-4**

CHM 401 **ORGANIC CHEMISTRY-I** **[Prereq. CHM 301, CHM 302 or**
eqv. for **MSc (Int.) students]**
L-T-P-D-[C]
3-0-0-0-[4] Stereochemistry, Dynamic stereochemistry, Mechanistic and Stereochemical aspects, Reactive Intermediates: Carbenes, Nitrenes, Radicals, Carbo-cations.

Chm 402 **ORGANIC CHEMISTRY-II** **[Prereq. CHM 401]**
L-T-P-D-[C]
3-0-0-0-[4] Oxidations, Reductions, C-C Bond formations.

CHM 404 **ORGANIC QUALITATIVE AND QUANTATIVE ANALYSIS**
L-T-P-D-[C]
0-0-6-0-[4] Analysis of organic compounds (qualitative and quantitative) using both chemical and instrumental methods with emphasis on principles of organic reactions.

CHM 421 **PHYSICAL CHEMISTRY-I** **[Prereq. CHM 201, CHM 222**
L-T-P-D-[C] **or M.Sc. (Int.) students]**
3-0-0-0-[4]

Atomic Structure, chemical binding and molecular structure. Elements of molecular spectroscopy.

CHM 422 **PHYSICAL CHEMISTRY** **[Prereq. CHM 421]**
L-T-P-D-[C]
3-0-0-0-[4] Thermodynamics, Statistical Thermodynamics, Chemical kinetics.

CHM 423 **PHYSICAL CHEMISTRY, LALBORATORY**
L-T-P-D-[C]
0-0-8-0-[4] A Laboratory course designed to illustrate principles of physical chemistry.

CHM 441 **INORGANIC CHEMISTRY-I** **[Prereq. CHM 341 for**
L-T-P-D-[C] **M.Sc. (Int.) students]**
3-0-0-0-[4]

Principles of modern inorganic chemistry, discussion of the chemistry of non-transition elements.

CHM 442 **INORGANIC CHEMISTRY-II** **[Prereq. CHM 441]**
L-T-P-D-[C]
3-0-0-0-[4] Coordination Chemistry:- Bonding, Spectra, Magnetism, Structure and Reaction Mechanism, Supramolecular Chemistry, Molecular Magnetism, Organometallic Chemistry, Inorganic Chemistry of Biological systems.

CHM 443 **INORGANIC CHEMISTRY LABORATORY**

L-T-P-D-[C]
0-0-6-0-[4]

CHM 481/ SE 334 **BIOSYSTEMS** **[Prereq. CHM 201 (For M.Sc. (Int.)/B.Tech.)]**

Proteins, Nucleic acid, carbohydrates, and Glycoproteins, Metabolism, Enzymes and their kinetics. Biophysical techniques to purify and study Proteins. Nucleic acids: A,B and Z-DNA structures, Method of replication; sequencing of nucleic acids electrophoresis.

CHM 503 **ORGANIC PREPARATIONS LABORATORY**

L-T-P-D-[C]
0-0-6-0-[4]

Preparations of various organic compounds employing different reactions will be carried out, with a view to give the student sufficient training in synthetic organic chemistry.

CHM/521 CHM 600 **MATHEMATICS FOR CHEMISTRY**

L-T-P-D-[C]
3-0-0-0-[4]

Error Analysis, Scalars, vectors, curl, divergence and gradient, ordinary 3-0-0-0[4] differential equations, symmetry and group theory, matrices, etc.

CHM 602 **ADVANCED ORGANIC CHEMISTRY-II** **[Prereq. CHM 402]**

L-T-P-D-[C]
3-0-0-0-[4]

The course deals with concise and critical evaluation of many reactions of synthetic importance.

CHM 609 **PRINCIPLES OF ORGANIC CHEMISTRY** **[For Ph.D. Students only]**

L-T-P-D-[C]
3-0-0-0-[4]

Stereochemistry, mechanisms of selected reactions, Reactive intermediates, oxidation, Reduction, C-C bond formations, synthesis of some useful natural products.

CHM 611 **PHYSICAL ORGANIC CHEMISTRY**

L-T-P-D-[C]
3-0-0-0-[4]

[Prereq. CHM 402 for MSc Students]]

Orbital Symmetry and Frontier Orbitals, Stereoelectronic Effects in Organic Chemistry, Chemical Equilibria and Chemical Reactivity, Reactive Intermediates, Chemical Kinetics, Captodative Effect, Hammond's Postulate, Thermodynamic and Kinetic Control.

CHM 612 **FRONTIERS IN ORGANIC CHEMISTRY**

L-T-P-D-[C]
3-0-0-0-[4]

[[Prereq. CHM 402 for MSc students]

Developing facets of organic chemistry will be discussed. Special emphasis will be made relating to the stereo-chemistry involved.

CHM 614 **ORGANIC PHOTOCHEMISTRY** **[Prereq. CHM 402 or equiv.]**

L-T-P-D-[C]
3-0-0-0-[4]

Organic molecular transformations that are brought about by light will be discussed.

CHM 615 **ELECTROCYCLIC REACTIONS** **[Prereq. CHM 402 or equiv.]**

L-T-P-D-[C]
3-0-0-0-[4]

Aspects of concerted process will be discussed

CHM 616 **CHEMISTRY OF ORGANOMETALLIC COMPOUNDS** **[Prereq. CHM 442]**

L-T-P-D-[C]
3-0-0-0-[4]

The preparation of transformations of organometallic compounds will be discussed.

CHM 621 **CHEMICAL BINDING**

L-T-P-D-[C]
3-0-0-0-[4]

Intoroduction, The origin of quantum numbers, some 'constant potential' problems, commutation relationships, the atomic 'self-consistent-field' (SCF), Hartree and Hartree Fock methods. Screening effects Stater's rules and electron correlation overlap-hybridisation and examples thereof. Directed valence in space. Observable features of the chemical bond 'Chemical Binding'.

CHM 622 **CHEMICAL KINETICS** **Consent of Instructor**

L-T-P-D-[C]
3-0-0-0-[4]

Discussion of reaction rate theory, kinetics and mechanism of various types of reactions and catalysis.

CHM 626 **SOLID STATE CHEMISTRY**

L-T-P-D-[C]
3-0-0-0-[4]

Crystallography, X-ray method, chemistry of the defect solid state, electrical and thermal properties of solids.

CHM 629 **PRINCIPLES OF PHYSICAL CHEMISTRY** **[For Ph.D. Students only]**

L-T-P-D-[C]
3-0-0-0-[4]

Atomic and Molecular structure, Molecular Spectroscopy, Concepts of Statistical Thermodynamics, Electrochemistry, Chemical Kinetics, Photochemistry.

CHM 631 **APPLICATIONS OF MODERN INSTRUMENTAL METHODS**

L-T-P-D-[C]
3-0-0-0-[4]

[Prereq. CHM 402, chm 442]

Applications of multinuclear NMR (^{1}H, ^{13}C, ^{29}Si, ^{31}P, ^{19}F, ^{11}B, ^{119}Sn etc.). ESR, ENDOR (Electron Nuclear Double Resonance), Mossbauer and photoelectron spectroscopy towards structure elucidation of inorganic, organic and biologically important compounds .

CHM 632 **ENZYME REACTIONS MECHANISM AND ENZYME KINETICS**

L-T-P-D-[C] **[Prereq. CHM 481]**

3-0-0-0-[4]

Nomenclature of enzyme, Three dimensional structure of enzymes, families of enzymes, structure of enzyme substrate complex and methods of examining them, basic equations of enzyme kinetics, enzyme inhibition.

CHM 636 **PHYSICAL PHOTOCHEMISTRY**

L-T-P-D-[C]

3-0-0-0-[4]

Theory of electronic absorption spectra, fluorescence and phosphorescence spectra, internal conversion and intersystem crossing, solvent effects on absorption and emission spectra, exciplexes and eximers, energy transfer.

CHM 637 **MOLECULAR SPECTROSCOPY**

L-T-P-D-[C]

3-0-0-0-[4]

Molecular Symmetry and Group Theory, Matrix Methods, Time dependent states and spectroscopy of vibration and rotation of diatomic molecules, rotation of polyatomic molecules, vibration of polyatomic molecules, electronic spectroscopy.

CHM 641 **ADVANCED INORGANIC CHEMISTRY-I** **[Prereq. CHM 442]**

L-T-P-D-[C]

3-0-0-0-[4]

An advanced course on the physical principles of inorganic chemistry with illustrations from the chemistry of transition and non-transition elements.

CHM 642 **ADVANCED INORGANIC CHEMISTRY-I** **[Prereq. CHM 442]**

L-T-P-D-[C]

3-0-0-0-[4]

Mechanisms of inorganic reactions and ligand field theory.

CHM 646 **BIO-INORGANIC CHEMISTRY**

L-T-P-D-[C]

3-0-0-0-[4]

Studies of metallo-biomolecules in relation to electron transfer, atom transfer, electron and oxygen carrier reactions using transition metals and model systems.

CHM 647 **MACROCYCLES, RINGS AND POLYMERS** **[Prereq. CHM 442]**

L-T-P-D-[C]

3-0-0-0-[4]

Basic Concepts; Molecular forces and Chemical bonding; Molecular weight; testing and analysis; polymerization reactions, Ziegler-Natta Catalysis, Inorganic rings and polymers, Ferrocene and organometallic macromolecules, sulfur-nitrogen polymers, polysilane, poly-silazane, B-N polymers, precursors for ceramics, Phthalocyanins, conducting polymers, Host-Guest complexation, Supramolecular Chemistry.

CHM 648 **THE CHEMISTRY OF METAL CARBON BOND: STRUCTURE, REACTIVITY AND APPLICATIONS** **[Prereq. CHM 442]**

L-T-P-D-[C]
3-0-0-0-[4]

Study of bonding in compounds with M-C bond and with M-M bond. Applications of these compounds in Catalysis and in Organic Synthesis.

CHM 649 **PRINCIPLES OF INORGANIC CHEMISTRY** **[For Ph.D. Students only]**

L-T-P-D-[C]
3-0-0-0-[4]

Principles of modern inorganic chemistry discussion of the chemistry of non transition elements, Coordination Chemistry, organometallic chemistry, Inorganic chemistry of biological systems.

CHM 650 **STATISTICAL MECHANICS AND ITS APPLICATIONS TO CHEMISTRTY**

L-T-P-D-[C]
3-0-0-0-[4]

Principles of classical and quantum statistical mechanics and their applications to chemical problems.

CHM 651 **CRYSTAL AND MOLECULAR STRUCTURE DETERMINATION**

L-T-P-D-[C]
3-0-0-0-[4]

Bragg's law, reciprocal lattice concept, space group and geometrical crystallography, the phase problem, Patterson Fourier synthesis, Harkar-Kasper inequalities, refinement of crystal structures, modern X-ray diffraction techniques.

CHM 654 **SUPRAMOLECULAR CHEMISTRY**

L-T-P-D-[C]
3-0-0-0-[4]

Concepts and language of supramolecular chemistry, molecular recognition, quantification of non-covalent forces, energetics of supramolecular complexes, Macro-cycles and macro-polycycles, Catenands and dendrimers, Self-assembly of organic and hybrid inorganic-organic systems, Supramolecular catalysis, Molecular machines, molecular and supramolelcular devices.

CHM 662 **CHEMISTRY OF NATURAL PRODUCTS** **[Prereq. CHM 402]**

L-T-P-D-[C]
3-0-0-0-[4]

The isolation, structure and reactions of natural products will be discussed.

CHM 664 **MODERN PHYSICAL METHODS IN CHEMISTRY** **[Prereq. CHM 422]**

L-T-P-D-[C]
3-0-0-0-[4]

Applications of spectroscopic methods, dipole moments, magnetism, magnetic resonance, and other methods in analysis and elucidation of molecular structure will be discussed.

CHM 668 **ADVANCED MAIN GROUP CHEMISTRY** **[Prereq. CHM 441]**

L-T-P-D-[C]
3-0-0-0-[4]

General Introduction to main group chemistry, Homo and Heteroclusters of main

group elements, chemistry of main group homo and heterocycles, polymers of main group elements, main group organometallic Chemistry.

CHM 670 **SCIENTIFIC INSTRUMENTATION**

L-T-P-D-[C]
3-0-0-0-[4]

Network theorems, Resonance Circuits, BJT and FET devices, Amplifier basics, Operational Amplifiers, Power Supplies, Basic digital gates, Bistable, Monostable, and Astable multi-vibrators, A/D and D/A convertors. 8-bit Microprocessor basics. Electronics in scientific instrumentation. Examples of scientific instruments.

CHM 679 **INTRODUCTION TO BIONANOTECHNOLOGY**

L-T-P-D-[C]
3-0-0-0-[4]

CHM 679 **MOLECULAR REACTION DYNAMICS**

L-T-P-D-[C]
3-0-0-0-[4]

Molecular reaction dynamics and chemical reaction cross-section, rate constant and activation energy, reactive scattering using molecular beams, potential energy surfaces, probing the transition state, unimolecular reactions, state-selective photochemistry.

CHM 681 **BASIC BIOLOGICAL CHEMISTRY** **[Prereq. CHM 481]**

L-T-P-D-[C]
3-0-0-0-[4]

Purine and pyrimidine bases. Watson-Crick and Hoogsteen hydrogen bonds. DNA double helix, RNA folding, Nucleic acid synthesis. Genetic code and gene expression, Transcription. Post-transcriptional modification of RNA, Reverse transcription: HIV-I replication cycle. Amino acids and proteins. Ribosomal translation. DNA triple helical motifs, Triplexes in biological context, Triplexes for targeted delivery of drugs , DNA superstructures. Polymerase chain reactions, In vitro mutagenesis, DNA sequencing. RNA self-splicing, Group I and group II introns, Ribozymes: Catalytic mechanism, and applications, Artifical evolution. Antisense oligonucleotides: Mechanism and control of gene expression. Molecular basis of carcinogenesis, Prions, Genetic diseases. Approaches in drug design and discovery, Drug metabolism.

CHM 685 **MOLECULE-RADIATION INTERACTION**

L-T-P-D-[C]
3-0-0-0-[4]

Electromagnetic fields and their quantization, quantum mechanics of interaction radiation and atoms, optical activity, Raman scattering, Rayleigh scattering, spontaneous emission.

CHM 687 **CHEMISTRY OF POLYHEDRAL CLUSTERS AND METAL-METAL MULTIPL BONDED COMPOUNDS** **[Prereq. CHM 442]**

L-T-P-D-[C]
3-0-0-0-[4]

Non-transition element polyhedral compounds, Transition metal clusters (structure and bonding). Synthesis of transition metal carbonyl clusters, Ligand substitution reactions, Cluster assigned ligand transformation, Polyhedral rearrangements, Fragmentation reactions, Clusters in homogeneous catalysis, Metal metal multiple bonds.

CHM 689 **NUCLEAR MAGNETIC RESONANCE**

L-T-P-D-[C]
3-0-0-0-[4]

Physical basis of NMR spectroscopy; Chemical shift; Indirect spin-spin coupling; Computer simulation of NMR spectra; Double Resonance experiments; relaxation; Multipulse experiments; Nuclear Overhauser effect and NOESY experiments; Applications, Chemical and Biochemical; Dynamic NMR, Theory and Applications; Application to Solids, NMR Imaging.

CHM 691 **FRONTIERS IN INORGANIC CHEMISTRY** **[Prereq. CHM 442]**

L-T-P-D-[C]
3-0-0-0-[4]

Developing facets of inorganic chemistry: i) Oxidative generation of the O-O bond from water during photosynthesis and its importance from the standpoint of non-conventional energy research and ii) reductive cleavage of the dioxygen O-O bond and the chemistry thereof (various novel organic transformations including methane to methanol of biotechnological importance), performed by a large number of metalloenzymes and synthetic catalysts. The course is intended to be attractive not only to the students having aptitude for inorganic chemistry but also to those who are interested in chemistry of relevance to biology and industry.

CHM 693 **CHEMICAL SYNTHETIC STRATEGY OF ADVANCED MATERIALS**

L-T-P-D-[C]
3-0-0-0-[4]

Chemical methods of synthesis play a crucial role in designing materials, discovering novel materials, metastable phases, nanomaterials and provide less cumbersome routes for the known materials. Chemical ingenuity is important for the synthesis of solid materials with desired structure and properties. Keeping in mind the multidisciplinary nature of the subject, a rational approach to the synthesis of materials is evolved. Indeed, soft chemistry routes/techniques are pursued with greater vigour. These include precursor technique, sol-gel, hydrothermal, non-aqueous liquid phase reactions, polymer pyrolysis, gas phase reactions, plasma reactions, electron beam evaporation, freeze drying, spray drying, topochemical reactions, intercalation, electrochemical methods, CVD laser ablation, arc-method, molten salt method, intergrown structures. Solid state reactivity, working knowledge of characterization techniques and conventional techniques.

CHM 695 MOLECULAR MODELLING IN CHEMISTRY

L-T-P-D-[C]
3-0-0-0-[4]

Basic principles of quantum mechanics of atoms and molecules, potential energy surfaces, modeling of water and small organic molecules, molecular modeling of macromolecules, simple applications of molecular modeling, study of an assembly of atoms or molecules.

CHM 696 QUANTUM COMPUTING

L-T-P-D-[C]
3-0-0-0-[4]

The main objective of this course is to provide an overview of the interdisciplinary field of quantum Computing and demystify the concept of quantum while linking it to computation and information science. It is aimed to bring out the concepts of quantum mechanics through linear algebra and matrix manipulation, which connects it to conventional computer science. The main advantages of quantum computing are demonstrated through reversibility and parallel processing while the difficulties in implementation and alghorithm development are treated with care.

CHM 698 CHEMISTRY OF DRUG DESIGN AND METABOLISM

L-T-P-D-[C] **[Prereq.CHM 481]**
3-0-0-0-[4]

Physicochemical principles of drug action, principles of drug design, neuroactive drugs, anticancer, antiviral, antimalarial and cardiovascular drugs, biopharmaceuticals, drug delivery and drug metabolism, induction and inhibition of drug metabolism.

CHM 699 LASERS IN CHEMISTRY AND BIOLOGY 3-2-3-5

L-T-P-D-[C]
3-2-3-0-[5]

Fundamentals of Lasers, laser-induced fluorescence and multiphoton ionization processes of molelcules, probing IVR and dynamics of chemical reactions in liquid and molecular beam, spectroscopy of single molecule, probing of proton dynamics, optical trapping and manipulations of biological macromolecules and organelles, confocal microscopy and fluorescence correlation spectroscopy, applications to diagnostics and biotechnology.

CHM 700 (M.Sc. 2-yr), 0-0-12-0-12

CHM 700 (M.Sc. Integ.) 0-0-8-0-8 (IX semester), 0-0-12-0-12 (X Semester)

CHM 800 GENERAL SEMINAR

CHM 801 GRADUATE SEMINAR