

CHEMISTRY

CHM-101: CHEMISTRY OF ELEMENTS (3 credits, 36 hrs)

	No. of Lectures
1. Periodicity	2
2. Main group chemistry	10
3. Transition metal chemistry	8
4. Stereochemistry	2
5. Functional groups and transformation	8
6. Natural products	2
7. Drugs	2
8. Polymers	2

CHM-102: BONDING, STRUCTURE AND SYMMETRY (3 credits, 36 hrs)

	No of Lectures
1. Types of chemical bonds, strong and weak	4
2. Hydrogen atom and the concept of orbitals	4
3. Many-electron atoms, shell structure and periodicity	2
4. Chemical bonding: MO and VB theories of diatomic molecules: Ground and excited electronic states	8
5. Polyatomic molecules	8
6. Qualitative aspects of symmetry in structure, spectra and reactivity	10

IDC-201: CHEMICAL BIOLOGY (3 credits, 36 hrs)

	No. of Lectures
1. Molecules of life: amino acids and proteins, carbohydrates, polysaccharides, lipids, steroids, cell-membranes, nucleic acids and oligonucleotides Bio- and chemical synthesis	4
2. Techniques for structure determination of biomolecules	4
3. Chirality of biomolecules: biosynthesis of polypeptides, polyketides, polynucleotides	4
4. Structure and function: protein structure, Ramachandran : plot – protein folding : DNA/RNA structures, various forms (a,b,c,z) of DNA, t-RNA structure	6
5. Enzyme kinetics, inhibition, drug action (selected examples)	5
6. Ligand – receptor interactions	2

7. Carbohydrates and cell surface, glycoproteins	3
8. Lipids, membranes, liposomes, drug delivery	3
9. Vitamins/coenzymes, hormones (proteins, steroids, fatty acids)	3

CHM-202: SPECTROSCOPIC AND OTHER PHYSICAL METHODS FOR MOLECULES AND SOLIDS (3 credits, 36 hrs)

	No of Lectures
1. Interaction of radiation and matter	1
2. Rotational spectroscopy	4
3. Vibrational spectroscopy - interaction of rotation and vibration	6
4. Raman spectroscopy	2
5. Electronic spectroscopy	7
6. Photoelectron spectroscopy and ESCA	1
7. Magnetic resonance spectroscopy	6
8. Diffraction methods	4
9. Microscopy	3

CHM-203: CHEMICAL REACTIONS: ENERGETICS AND DYNAMICS (3 credits, 36h)

	No of Lectures
1. Enthalpy, entropy, free energy and chemical potential. Equilibrium constant and its dependence on temperature and pressure	6
2. Rates of reactions – rate laws for reactions of various orders – experimental determination of rate – temperature dependence of rate. Concept of transition state	8
3. Theories of reaction rate: Collision theory activated complex theory. Thermodynamical aspects of rates	5
4. Types of reactions: Photochemical, chain and oscillatory reactions	6
5. Electron transfer processes	3
6. Catalysis: Homogeneous and Heterogeneous. Enzyme Catalysis	6
7. Electrochemical processes	2

Chemistry: Third year course titles

Semester-V		Semester-VI	
Subject	Credits	Subject	Credits

Quantum Chemistry	3	Symmetry in Chemistry	3
Physical Organic Chemistry	3	Organic Synthesis	3
Main Group Chemistry	3	Transition Metal Chemistry	3
Deptt. Elective. I	3	Deptt. Elective. II	3
Non-Deptt. Elective. I	3	Non-Deptt. Elective. II	3
Chemistry Lab. I	6	Chemistry Lab. II	6
Total Credits	24	Total Credits	24

Chemistry: Fourth year course titles

<i>Semester-VII</i>		<i>Semester-VIII</i>	
Subject	Credits	Subject	Credits
Molecular Spectroscopy	3	Chemistry of Materials	3
Equilibrium and Non-Equilibrium	3	Analytical Chemistry (Instrumental Methods)	3
Statistical Mechanics			
Deptt. Elective III	3	Deptt. Elective –V	3
Deptt. Elective IV	3	Deptt/Non-Deptt. Elective-IV	3
Non-Deptt. Elective III	3	Non-Deptt. Elective –V	3
Research Project	4	Research Project	6
Seminar	2		
Total Credits	24	Total Credits	24

Chemistry: Fifth year program

Research/ training Project work for both semesters of the 5th year with two supplementary and/or optional courses each semester. Students will be required to write a Project Thesis. Total No. of Credits in the 5th Year is 48.

For selected students, the program in the fifth year may initiate research work towards a subsequent Ph D degree.

PRACTICALS

Chemistry- Semester I – 15 turns

CHM-121: Analytical Chemistry

1	Standardization of pipette, burette, graduated flask, thermometers, use of balance, SI units, concepts of accuracy, precision and standard deviation	2
2	Preparation of solutions and standardization - succinic acid, NaOH	1
3	Semimicro Inorganic Qualitative Analysis (2 anions + 2 cations)	7
4.	a. Purification of organic compounds (distillation and crystallization)	4
	b. Organic analysis – functional groups with mp/bp - aldehydes, acetones, acids, phenols, alcohols, amines, hydrocarbons	
5.	Molecular weights of polymers using viscosity measurements	1
6.	Gravimetric analysis; Ba (II) as BaSO ₄	1

Chemistry- Semester 2 – 15 turns

CHM-122: Estimations and computational chemistry

1.	Volumetric Analysis	
	a) acid/base titrations	2
	b) redox – KMnO ₄ / K ₂ Cr ₂ O ₇	2
	c) iodometric – Cu(II)	1
2.	Organic Estimation (a) aniline (b) phenol (c) acetone (d) acid	2
3	Thermochemistry a) Heat of solution of benzoic acid/salicylic acid b) Heat of neutralization of acid/base	2
4.	Computational Chemistry Lab -	6
	Atomic orbitals and charge density	
	Hydrogen atom and concepts of hybridized orbitals	
	Handling of chemical models	
	MO calculations of diatomic and polyatomic	
	Molecules – visualization of MO and electron	
	Densities, Huckel's theory and Walsh diagram	

Chemistry- Semester 3 - 15 turns

CHM-221: Spectroscopy and chemical biology – 15 turns

(a) Spectroscopy		
1	Verification of Beer-Lambert's Law	1
2	Photometric titrations –(i) One ion (ii) two ions together	2
3	Polarimetry – (i) Optical activity of sucrose/glucose, mutarotation (ii) Kinetics of inversion of sucrose	2
4	Spectrophotometer (i) pK value of indicator (ii) pH of given buffer	2
5	Visits to advanced instrumental facilities	2

(b) Chemical Biology		
6	Enzyme kinetics	1
7	Computational Chemistry Lab – protein structure	1
8	Analysis of food stuffs (i) glucose content (ii) oils – acid, saponification and iodine values	3
9	Non-aqueous titrations – (i) glycine (ii) drug like m-bendazole/diazepam	1

Chemistry-Semester 4– 15 turns

CHM-222: Kinetics and electrochemistry

1	Order of reaction (determination of rate, order, graphs using computer) (a) First order – acidic hydrolysis of methyl acetate (b) Second order – equal conc. and unequal conc $K_2S_2O_8 + KI / H_2O_2 + KI / KBrO_3 + KI$ (any one) (c) Zero order	3
2	Thermodynamic activation parameters for two reactions given above	2
3	Conductometer (i) acid/base titrations, (ii) Kinetics of saponification of ethyl acetate	2
4	pH meter: (i) acid/base titrations, (ii) acidic and basic dissociation constants of glycine and its isoelectric point	2
5	Potentiometer (i) acid/base titrations, (ii) mixture of halides vs. $AgNO_3$	2
6	Polarograph (i) Zn (II) / Cd (II) conc.(ii) $E_{1/2}$ of Zn (II) / Cd (II)	2
7	Demonstration of oscillatory, electron transfer homogeneous and heterogeneous catalysis	2
