

# **INTERNATIONAL COLLEGE FOR GIRLS**

**SFS, GURUKUL MARG, MANSAROVAR, JAIPUR**

**DEPARTMENT OF CHEMISTRY**

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**CREDIT TEMPLATE  
AND  
OUTLINES OF THE SYLLABI  
FOR  
M.Phil.  
CHEMISTRY EXAMINATION**

**Department of Chemistry**  
**Curriculum and Credit Template**  
**M.Phil. Chemistry**

**Semester I**

Paper Code	Title	Contact Hrs.				Credit
		Per semester	Per week			
			L*	C*	P*	
CHY 141	Advanced Inorganic Chemistry	90	4	2	-	6
CHY 142	Advanced Organic Chemistry	90	4	2	-	6
CHY 143	Advanced Physical Chemistry	90	4	2	-	6
CHY 144	Research Methods and Methodologies	90	4	2	-	6
CHY 145	Advanced Laboratory Techniques	90	-	-	6	3
CHY 146	Communication Skills	45	3	-	-	3
CHY 147	Dissertation: Literature Survey and Synopsis Presentation	45	-	3	-	3
<b>Total Credits for I Semester</b>						<b>33</b>

**Semester II**

Paper Code	Title	Contact Hrs.				Credit
		Per semester	Per week			
			L*	C*	P*	
CHY 241 to CHY 247	Recent Advances in Chemical Research - elective papers I to VII (the list of elective paper is provided below from which the student can select any two)	45	1	2	-	3
		45	1	2	-	3
CHY 248	Dissertation	450	-	-	30	30
<b>Total Credits for II Semester</b>						<b>36</b>

**Elective Courses**

**The following elective papers are available**

Elective Paper I	CHY 241	Polymer Chemistry
Elective Paper II	CHY 242	Textile Chemistry
Elective Paper III	CHY 243	Pharmaceutical Chemistry
Elective Paper IV	CHY 244	Environmental Chemistry
Elective Paper V	CHY 245	Bio-inorganic and Superamolecular Chemistry
Elective Paper VI	CHY 246	Nuclear and Radiation Chemistry
Elective Paper VII	CHY 247	Industrial Chemistry

\* L – Lectures, C-Counselling Sessions, P-Practical

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## **DEPARTMENT OF CHEMISTRY**

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**SCHEME OF EXAMINATION**

**FOR**

**M.Phil. CHEMISTRY EXAMINATION**

**I Semester Examination November 2008**

**II Semester Examination April 2009**

**INTERNATIONAL COLLEGE FOR GIRLS**  
**M.Phil. Chemistry**  
**Scheme of Examination**

Semester	Paper code	Credits	Time duration per week	Maximum Marks	Minimum Marks	Continuous Assessment (30 %)	Semester End Exam (70 %)
<b>I</b>	CHY – 141	6	6	100	50	30	70
	CHY – 142	6	6	100	50	30	70
	CHY – 143	6	6	100	50	30	70
	CHY – 144	6	6	100	50	30	70
	CHY – 145	3	6	100	50	30	70
	CHY – 146	3	3	100	50	30	70
	CHY – 147	3	3	-	-	-	-
<b>II</b>	CHY – 241	3	3	100	50	30	70
	to	3	3	100	50	30	70
	CHY – 247						
	CHY – 248	30	30	100	50	30	70

<b>Scheme of Evaluation for Continuous Assessment (Theory)</b>					
Test	Quiz	Teacher Interaction	Attendance	Total	Reduced To
40 mks	20 mks	20mks	10 mks	90 mks	30 mks

**Note :**

- Time duration of Internal tests will be one and half hours
- Time duration of SEE will be three hours
- Passing percentage in continuous assessment and semester end exam is 50 % individually in each paper

# **INTERNATIONAL COLLEGE FOR GIRLS**

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**DEPARTMENT OF CHEMISTRY**

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**COURSES OF STUDY**

**FOR**

**M.Phil. CHEMISTRY EXAMINATION**

**I Semester Examination November 2008**

**II Semester Examination April 2009**

Syllabus applicable for the students seeking admission to the M.Phil. Chemistry Course in the academic year 2008-09.

## Semester I

### Paper I CHY- 141 Advanced Inorganic Chemistry

60 Hrs (L) + 30 hrs (C)  
4 hrs/week(L) + 2 hrs/week(C)

#### **Objective:**

*To learn the importance of coordination chemistry in present scenario. Also to learn basics of photochemistry and X-ray methods as applicable in inorganic chemistry.*

#### **I Structure and Mechanisms in Coordination Compounds 12 Hrs**

*Pre requisite: Mechanism of substitution in octahedral complexes*

Synthesis of coordination compounds, compounds of first transition series elements with respect to their electronic spectra, magnetic & thermal properties (DTA, TGA)

##### **Stereo chemical aspects of substitution reaction of Octahedral Complexes-**

Stereochemical changes in dissociation ( $SN_2$ ) and displacement ( $SN_2$ ) mechanism through various geometries of coordination compounds. Isomerization and racemization reactions in octahedral complexes.

#### **II Organometallic Compounds 12 hrs**

Stereochemical aspects in organometallic compounds, carboranes and metallocarboranes, Cluster chemistry, bimetallic and cluster complexes, structure and applications in catalysis. Electron transfer properties of metal complexes. Molecular recognition. Asymmetric catalysis.

#### **III Role of Metal Ions in Biology 12 hrs**

Proteins and enzymes of V, Mn, Fe, Co, Ni, Cu, Zn and Mo. Structural and functional models. Transport and storage of metal ions. Bio-inorganic reaction mechanisms.

#### **IV Photochemistry 12 hrs**

Characteristics of the electronically excited states of inorganic compounds. Photoelectrochemistry of excited state redox reactions. Photosensitization. Photochemical reactions, substitution, decomposition and fragmentation, rearrangement, and redox reactions.

#### **V X-ray Methods 12 Hrs**

Fundamentals of x-ray diffraction, theory of x-ray diffraction, diffraction of x-rays by crystals, determination of crystal structure (powder as well as single crystals), instrumentation, determination of lattice parameters, production of X-ray spectra, X-ray absorption methods, X-ray fluorescence methods, auger emission spectroscopy (AES), electron spectroscopy for chemical analysis (ESCA), x-ray intensity calculations and application of x-rays

***Text/References:***

1. Advanced Inorganic Chemistry, VI Ed., F.A. Cotton, G. Wilkinson, C.A. Murillo and M. Bochmann, Wiley Eastern/John Wiley, 1999.
2. Concise Inorganic Chemistry, IV Ed., J.D. Lee, ELBS, 1991.
3. Inorganic Chemistry; III Edition; D.F. Shriver and P.W. Atkins; Oxford University Press, New York, 1999.
4. Organometallic Chemistry, G.O. Spessard, G.L. Miessler, Prentice Hall, 1997.
5. Inorganic and Organometallic Photochemistry, M.S. Wrighton, ACS Publications, 1978.
6. Principles of Bioinorganic Chemistry, S.J. Lippard & J.M. Berg, University Science Books, Mill Valley, 1994.
7. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books, Mill Valley, 1994.
8. Photochemistry of Co-ordination Compounds, V. Balzani and V. Carasiti, Academic Press, 1970.
9. Solid State Chemistry, I Ed.; D.K. Chakrabarty; New Age International Publishers, New Delhi, 2005.
10. Principles of Solid State, I Ed.; H.V. Keer; New Age International Publishers, New Delhi, 2002.

## Semester I

### Paper II CHY- 142 Advanced Organic Chemistry

60 Hrs (L) + 30 hrs (C)  
4 hrs/week(L) + 2 hrs/week(C)

#### **Objectives:**

*To learn the advancements in the field of mechanistic organic chemistry.*

- I Organic reactivity and mechanisms – An overview I 12 hrs**  
Classification and investigation of reaction mechanisms, theoretical principles of chemical reactivity. Perturbation theory, Frontier orbitals and rules governing their interactions. Qualitative valence bond theory. Potential Energy Surfaces. Isotope effects. Conformational analysis. Linear free energy relationships.
- II Organic reactivity and mechanisms – An overview II 12 hrs**  
Solvents and solvation effects. Empirical solvent polarity scales. Extended  $pK_a$  scales. HSAB principle. Acid and base catalysis. Transition state stabilization and enzyme catalytic principles. Nucleophilic and Electrophilic reactivity and mechanisms. Pericyclic mechanisms and reactivity, Free radical reactivity.
- III Disconnection approach and Protecting Groups 14 hrs**  
An introduction to Synthons and synthetic equivalents, disconnection approach, functional group interconversions. One group C-X and two group disconnections in 1,2,1,3-, 1,4- & 1,5- difunctional compounds, Retro- synthesis of alkene, acetylenes, aliphatic nitro, alcohols, carbonyl compounds and amines, the importance of the order of events in organic synthesis, chemoselectivity, regioselectivity. Diels Alder reaction, Michael addition and Robinson annulation. Retro- synthesis of aromatic Heterocycles and 3, 4, 5 and 6 membered carbocyclic and heterocyclic rings. Reversal of polarity (Umpolung).
- Self Study:** Protecting Groups: Principle of protection of alcohol, amine, carbonyl and carboxyl groups
- IV Synthetic reagents and reactions 12 hrs**  
Complex metal hydrides, lithium dialkyl cuprate, lithium diisopropylamide (LDA), dicyclohexylcarbodiimide (DCC), trimethyl silyl iodide, tributyltin hydride, peracids, lead tetra acetate, PPA, diazomethane, ozone phase transfer catalyst, woodward-prevost hydroxylation, Barton and Shapiro reaction, Hoffmann – Löffler-Fretag, Miyamura, Stille, Negishi, Kamada Peterson synthesis, selenium dioxide, crown ethers, DDQ, Dess-Martin periodinane, periodic acid and iodoisobenzyl diacetate.
- V Newer methods of stereoselective synthesis 10 hrs**  
Introduction and stereoselective and stereospecific reactions, enantioselective synthesis (chiral approach), reactions with hydride donors, hydroboration, catalytic hydrogenation via chiral hydrazones and oxazolines. Sharpless epoxidation. Diels Alder selective synthesis, use of calculations of optical purity and enantiomeric excess ORD and CD, Octant rule and axial haloketone rule, determination of configuration.



***Text/References:***

1. Physical Organic Chemistry; II Edition, Neil Issac; Longman Press, New Delhi; 1998.
2. Designing Organic Synthesis; I Edition; S. Warren; John Wiley and Sons, Great Britain, 2002.
3. Modern Methods of Organic Synthesis, III Edition; W. Carruthers; Cambridge University Press; U.K. 1996.
4. Principles of Organic Synthesis; III Edition; R.O.C. Norman and J.M. Coxon; Nelson Thornes, United Kingdom, 2003.
5. Organic Synthesis- Concepts, Methods and Starting Materials; J. Fuhrhop and G.Penzillin; Verlage VCH.
6. Advanced Organic Chemistry Part A & B; IV Edition; Francis A. Carey and Richard J. Sundberg; Kluwer Academic/Plenum Publishers, New York, 2000.
7. Stereochemistry: Conformation and Mechanism; IV Edition; P.S. Kalsi; New Age International Publishers Pvt. Ltd, New Delhi, 1999. E.L.
8. Stereochemistry of organic compounds; II Edition, D. Nasipuri; New Age International, New Delhi; 1993.
9. Advanced Organic Chemistry; IV Edition, Jerry March; Wiley India, New Delhi; 2005.
10. Molecular Reactions and Photochemistry; II Edition, Charles H. DePuy and Orville L. Chapman; Prentice-Hall of India, New Delhi, 1988.
11. Theory and Physical Principles of Organic Reactivity; A. Pross; John Wiley, 1995
12. Mechanism and Theory in Organic Chemistry; T.H. Lowry and K.H. Richardson; Harper and Row, 1976.

## Semester I

### Paper III CHY- 143 Advanced Physical Chemistry

60 Hrs (L) + 30 hrs (C)  
4 hrs/week(L) + 2 hrs/week(C)

#### *Objective*

To expose the students about some advance topics of physical chemistry.

- I Principles of Reactivity** **12 hrs**  
Mechanistic significance of entropy, enthalpy and Gibb's free energy. Arrhenius equation. Transition state theory. Uses of activation parameters, Hammond's postulate, Bell-Evans-Polanyi Principle. Potential energy surface model. Marcus theory of electron transfer. Reactivity and selectivity principles.
- II Conversion and Storage of Electrochemical Energy** **12 hrs**  
**Present status of energy consumption**  
Pollution problem, Direct energy conversion by electrochemical means. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkane fuel cell, Phosphoric acid fuel cell, direct NaOH fuel cells, applications of fuel cells.
- III Kinetics of Electrode Process** **12 hrs**  
Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant ( $K_0$ ) and Transfer coefficient ( $\alpha$ ), Exchange Current. **Irreversible Electrode processes** : Criteria of irreversibility, information from irreversible wave.
- IV Electrocatalysis** **12 hrs**  
Chemical catalysts and Electrochemical catalysts with special reference to porphyrins, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions involving adsorbed species. Influence of various parameters.
- V Potential Sweep Method** **12 hrs**  
Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cyclic voltammetry. Controlled current microelectrode techniques : comparison with controlled potentials methods, chronopotentiometry, theory and applications.

#### *Text/References:*

1. Physical Organic Chemistry; II Edition; N.S. Isaac, ELBS/Longman
2. Modern Electrochemistry Vol. I, IIA, Vol. IIB J.O.M. Bockris and A.K.N. Reddy, Plenum Publication, New York, 1998.
3. Polarographic Techniques; II Edition; L. Meites, Interscience Publication, 1965.
4. Fuel Cells : Their electrochemistry; McGraw Hill Book Company, New York.
5. Modern Polarographic Methods; A.M. Bond, Marcell Dekker.
6. Polarography and allied techniques; K. Zutshi, New age International publication. New Delhi.

7. Electroanalytical Chemistry; Basil H. Vessor & Galen W.; Wiley Interscience.
8. Topics in Pure and Applied Chemistry; Ed. S. K. Rangrajan, SAEST Publication, Karaikudi (India).
9. Physical Chemistry; VI Edition; P.W. Atkins; Oxford University Press, 1998.
10. Chemical Kinetics; III Edition; Keith J. Laidler; Pearson Education, 2004
11. An Introduction to Electrochemistry; S. Glasstone; Lancaster Press, 1956.
12. Electrochemistry, Principles, Methods and Applications; Brepp and Brepp.

## Semester I

**Paper IV CHY-144 Research Methods and Methodology 60 Hrs (L) + 30 hrs (C)  
4 hrs/week(L) + 2 hrs/week(C)**

### **Objective**

*To familiarize students with research methodology and modern instrumentation methods of analysis.*

### **I Research Methods 10 hrs**

Problem selection; literature survey; familiarity with ideas and concepts of investigation; acquiring technical skills ; drawing inferences from data; qualitative and quantitative analysis; assessing the problems; results and conclusions; presenting a scientific seminar; publication of research paper; art of writing a thesis.

### **II Data Handling 10 hrs**

Reliability of analytical data; errors in chemical analysis – classification of errors, accuracy and precision, determining the accuracy of methods, improving the accuracy of analysis, statistical analysis, rejection of results and presentation of data; sampling in analysis – definition, theory and techniques of sampling, statistical criteria of good sampling, stratified sampling v/s random sampling, minimization of variance in stratified sampling, transmission and storage of samples.

### **III Separation Techniques 15 hrs**

*Pre requisite: Purification of solids and liquids – simple crystallization, sublimation; distillation, fractional distillation, distillation under reduce pressure.*

Basic principles, classification–adsorption and partition chromatography.

*Column chromatography:* adsorbents, preparation of column, adsorption, elution, recovery of substance, factors affecting column efficiency

*Thin layer chromatography:* general procedure, essential requirements, methods for production of thin layer on plates, choice of adsorbent and solvent, detecting reagents, development and detection, preparation of chromatogram.

*Paper Chromatography:* principles and techniques, preparation of sample, choice of paper, location of spots and measurement of  $R_f$  value, factors affecting  $R_f$  value.

*Ion exchange chromatography:* principles and techniques, ion exchange resins, action of resins, separation factor, factors affecting separation factors.

*Gas chromatography:* carrier gas, injection port, columns – solid inert support, stationary liquid phase, column thermostetting, detectors.

*High pressure liquid chromatography:* principles, comparison with GC and TLC, experimental techniques, instrumentation.

### **IV Spectrometric Techniques 15 hrs**

*Mass Spectrometry:* Sample flow in a mass spectrometer, inlet sample systems, ionization methods in mass spectrometry, mass analyzers, ion- collection systems, data handling, Isotope-radiospectrometry, correlation of mass spectra with molecular structure.

*Fourier Transform Spectroscopy:* Enhancement of spectra, computer averaging; principle of FT-IR, FT-NMR, FT-mass spectrometry.

*Combined techniques:* sample identification using multiple spectrometric technique data; GC – mass spectrometry; GC- IR Spectrometry; liquid chromatography – mass spectrometry

## V Optical Methods of Analysis

10 hrs

**Pre requisite:** Lambert and Beer law, verification, derivation, signification of  $\lambda_{max}$  and molar absorptivity, theory of fluorescence and phosphorescence.

*Spectrophotocolorimetry:* single beam and double beam spectrophotometers, functions of the components, applications.

*Fluorescence and phosphorescence spectrophotometry:* variables that affects fluorescence and phosphorescence, measurement of fluorescence, application in quantitative analysis, comparison of luminiscence and UV visible absorption methods.

*Atomic absorption spectroscopy:* principle, method of calibration, comparison of atomic absorption and flame emission spectroscopy, atomic fluorescence, applications in quantitative analysis (analysis of  $Zn^{2+}$ ,  $Cu^{2+}$  and  $Pb^{2+}$ ).

*Flame photometry:* principle, flames and flame spectra, flame source, atomisers, optical and electronic system, photo sensitive detectors, calibration curve, interferences in flame photometry, applications in quantitative analysis (determination of sodium in samples).

### Text/References:

1. Thesis and Assignment Writing; J. Anderson, B.H. Dursten and M. Poole; Wiley Eastern, 1977.
2. A Handbook of Methodology of Research; P. Rajammal and P. Devadoss; R.M.M. Vidya Press, 1976.
3. Instrumental Methods of Analysis; VII Edition; H.H Willard, L.L Merritt, J.A. Dean, F.A Settle; CBS Publishers and Distribution , New Delhi,1986.
4. Chemical Analysis\_-An Instrumental Approach; III Revised Edition ; A.K Srivastava and P.C jain; S.Chand and Company, New Delhi,1997.
5. Mass Spectrometry-Techniques and Application ; G.W.A Miline; Wiley interscience , London.
6. Fundamentals of Analytical Chemistry; VII Edition ;D.A Skoog, D.M Westt and F.J. Holler; Saunders College Publishing ,Philadelphia ,1991.
7. Vogel's Text book of Quantitative Chemical Analysis, VI Edition, J. Mendham, R.C Denny, G.H, Jaffery; Pearson Education, Singapore,2004.
8. Handbook of Instrumental Techniques for Analytical Chemistry; F.Settle; Prentice –Hall, Inc. United States of America,1997.
9. Basic Concepts of Analytical Chemistry Second Edition; S.M. Khopkar; New Age International Publisher, New Delhi, 2000.

## Semester I

### Paper V CHY-145 Advanced Laboratory Techniques

90 Hrs (6 hrs/week)

1. Safety Methods and Measures in laboratories dealing with chemical science
2. First Aid tools and techniques
3. Glass-bowling, high vacuum and temperature control techniques. Various types of glass vessels and standard apparatus used in lab.
4. Instrumentation and operation of some equipments through the following experiments – a list of experiment is given below. Students are required to perform six to eight experiments.
  - a. Analysis of water (any three)
    - i. Determination of BOD/COD value of given water sample
    - ii. Determination of nitrate and phosphate ion in the given water sample
    - iii. Determination of sodium and potassium ions in the given water sample.
    - iv. Colorimetric estimation of fluoride ions in the given water sample.
  - b. Analysis of drug (any one)
    - i. Determination of amount of Vitamin C in different commercial samples.
    - ii. Analysis of aspirin in different commercial samples.
    - iii. Analysis of sulpha drugs in different commercial samples.
  - c. Instrumental techniques (any two)
    - i. Determination of ferrous and ceric ions potentiometrically.
    - ii. Determination of halides in given mixture argentometrically.
    - iii. Determination of dissociation constant of weak acid / phosphoric acid pH metrically
    - iv. Determination of cobalt and nickel using ion exchange / paper chromatography
  - d. Organic synthesis (any one)  
Comparative study of a product obtained from microwave technique and conventional method.
5. Field Visit

## Semester I

### Paper VI CHY-146 Communication Skills

45 Hrs (3 hrs/week)

#### *Needs of the Learners:*

1. Presentations (Writing and Speaking)
2. Participation in Seminars/Conferences
3. Participation in Group Discussion
4. Writing Reports (for Academic Purposes, on Projects / Experiments, etc.)
5. Teaching.

#### **Language-skills required:**

1. Reading
2. Writing
3. Speaking

<b>I</b>	<b>Grammar</b> Conditionals Relative Clauses Subject – Verb Agreement Passive Voice	<b>9 hrs</b>
<b>II</b>	<b>Written Communication – I</b> Discuss a topic of general interest, but related to science in about 300 words. (Analyse, Comment, Argue, Reflect, Persuade, etc.) (can also be used for an oral presentation, followed by discussion)	<b>9 hrs</b>
<b>III</b>	<b>Written Communication – II</b> Writing a Report on a project undertaken or an experiment conducted (Theory + Practice)	<b>9 hrs</b>
<b>IV</b>	<b>Oral Communication I</b> (a) Consulting a dictionary for correct pronunciation (familiarity with Phonemic Symbols and Stress-marks only) <b>(6 hrs)</b> (b) Making a Presentation (Powerpoint) <b>(3 hrs)</b>	<b>9 hrs</b>
<b>V</b>	<b>Oral Communication – II</b> (a) Group Discussion <b>(6 hrs)</b> (b) Interviews <b>(3 hrs)</b>	<b>9 hrs</b>

#### *Text/References:*

1. Advanced English Usage; Quirk & Greenbaum; Pearson Education.
2. Developing Communication Skills; Banerjee Meera & Mohan Krishna; Macmillan Publications, 1990.
3. Business Communication; Chaturvedi, P.D.; Pearson Publications.
4. Business Communication; Mathew, M.J.; RBSA Publications, 2005.
5. Communication of Business; Taylor, Shirley; Pearson Publications.

## Assessment – Pattern

- **30 Marks**
  - 10 – Written Test (On Grammar)
  - 10 – Teacher Interaction
  - 10 – Attendance
- **70 Marks**
  - 30 –Powerpoint Presentation
  - 20 – Group Discussion
  - 20 – Viva-Voce



## Semester II

### Recent Advances in Chemical Research

Elective Paper I CHY-241 Polymer Chemistry

45 hrs  
1Hr/Week(L) + 2Hrs/Week(C)

**Objective:**

*To learn the basic concepts of polymer science for inculcating the research aptitude and to expose the students with the industrial use of commercial polymers.*

**I Polymer Characterization**

**9 hrs**

Average molecular weight, number-average and weight-average molecular weights; sedimentation and viscosity average molecular weights, polydispersity and molecular weight distribution; practical significance of molecular weight; measurement of molecular weights – end-group, viscosity, light scattering, osmotic and ultra centrifugation methods; analysis and testing of polymers – chemical analysis of polymers, spectroscopic methods, X-ray diffraction study, microscopy, thermal analysis and physical testing – tensile strength, fatigue, impact, tear resistance, hardness and abrasion resistance.

**II Structure and Properties**

**9 hrs**

Morphology and order in crystalline polymers – configuration of polymer chains, crystal structure of polymers, morphology of crystalline polymers, strain - induced morphology, crystallization and melting; polymer structure and physical properties – crystalline melting point  $T_m$  (melting point of homogenous series, effect of chain flexibility and other steric factors, entropy and heat of fusion), the glass transition temperature  $T_g$ , relation between  $T_m$  and  $T_g$ , effects of molecular weight, diluents, chemical structure, chain topology; property requirements and polymer utilization.

**III Polymer Processing**

**9 hrs**

Plastics, elastomers and fibres, compounding, processing techniques- calendaring, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

**IV Commercial Polymers**

**9 hrs**

Structure, properties and applications of -  
Natural rubber and other polyisoprenes, rubber copolymers, rubber derived from butadiene, cellulosic polymers, phenolic and amino resins.  
Polymer based on phosphorous – polyphosphates, phosphorous sulphide cages  
Polymer based on sulphur – tetrasulphur tetranitride and related compounds.

**V Bio Medical Polymers**

**9 hrs**

Introduction, contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

***Text/References:***

1. Textbook of Polymer Science, III Edition; Fred. W. Billmeyer; John Wiley & Sons, Singapore, 2002.
2. Polymer Science, I Edition; V.R. Gowariker, N.V. Viswanathan, Jayadev Sreedhar; New Age International Pvt. Ltd., New Delhi, 2000.
3. Principles of Polymer Science, I Edition; P. Bahadur and N.V. Sastry; Narosa Publishing House, New Delhi, 2003.
4. Polymer Science, First Edition; M.G. Arora, M. Singh, K. Naran; Anmol Publications Pvt. Ltd., New Delhi, 1994.
5. A Textbook of Inorganic Polymers; A.K. Bhagi and G.R. Chatwal; Himalaya Publishing House, Bombay, 2001



**Semester II**  
**Recent Advances in Chemical Research**

**Elective Paper-III CHY-243 Environmental Chemistry** **45 hrs**  
**1Hr/Week(L) + 2Hrs/Week(C)**

**Objective:**

*To be more aware about the environment*

- I Atmosphere and pollution** **10 Hrs**  
Atmosphere composition and structure of atmosphere , particles ions, radicals , and aerosols present in the atmosphere, temperature inversions  
Air pollution-Air pollutants like carbon monoxide , nitrogen oxides, sulphur oxides, effect of pollutants, automobile pollution, ozone depletion, photochemical smog, acid rains, green house effect
- II Hydrosphere** **7 Hrs**  
Water resources- chemical composition of water bodies, water chemistry( physical properties, precipitation reaction, acid-base reaction alkalinity, hardness, buffer solution)
- III Water parameters** **10 Hrs**  
Oxidation –reduction chemistry in natural water dissolved oxygen, oxygen demand, BOD, COD, anaerobic decomposition of organic matter  
Water quality and standard ,sources of water pollution , impact of water pollution , control and treatment of water pollution
- IV Hazardous and municipal waste** **9 Hrs**  
Introduction, classification , sources and effects, hazardous waste in geosphere, hydrosphere, atmosphere and biosphere.  
Reduction treatment and disposal of Hazardous waste-waste reduction and minimization, physical and chemical and thermal treatment, composting, in situ treatment
- V Toxicology and Green Chemistry-** **9 Hrs**  
Toxic organic chemicals, pesticides, dioxins, PCB, furans, organophosphates, carbamates, insecticides.  
Toxic heavy metals-introduction and toxic effects of mercury, lead , cadmium, arsenic and chromium.  
Elementary idea about Green Chemistry, Need of green chemistry , solvent free reactions ( microwave associated synthesis- role of ionic liquid in green chemistry)

**Text/ Reference**

1. Environmental Chemistry, VI Edition, Stanley .E. Manahan ; Lewis publishers, Boston
2. Environmental Chemistry, I Edition; Colin Baird: W.H. Freeman and company, New York, 1998.
3. Environmental Chemistry, IV Edition, A.K.D; New Age International Pvt. Ltd., New Delhi,2003.
4. Environmental Chemistry, I Edition; Soumitro Ghosh; Dominant Publisher and Distributors, New Delhi, 2003.

5. Environmental Chemistry , P.S. Sindhu; New Age International(p) Ltd. Publishers, New Delhi, 1998.
6. Chemistry of the Environment , II Edition, Thomas G.Spiro & William M. Stigliani; Prentice-Hall of India Pvt. Ltd., New Delhi, 2002.
7. Environmental Chemistry , A Global Perspective; Gary W. Vanloon & Stephen J. Duffy; Oxford University Press , New York, 2000.
8. Green Chemistry, Environmental Friendly Alternatives; Rashmi Sanghi and Srivastava, M.M.; Narosa Publishing House, 2006.

**Semester II**  
**Recent Advances in Chemical Research**

**Elective Paper IV CHY-244 Bioinorganic and Supramolecular Chemistry 45 hrs**  
**1Hr/Week(L) + 2Hrs/Week(C)**

**Objectives:**

To learn the importance of metalloenzymes used in biosystems and metals in medicine and to understand the importance of co-ordination compounds in the emerging field of supramolecular chemistry.

- I Iron and Calcium in Biological Systems 9 hrs**  
*Metal Storage and Transport:* Ferritin, Transferrin, Siderophores.  
*Calcium in Biological Systems:* calcium in living cells, transport and regulation of  $\text{Ca}^{2+}$  ions in higher organisms, molecular aspects of intramolecular processes, extracellular binding proteins.
- II Metalloenzymes 10 hrs**  
Zinc enzymes-carboxypeptidase and carbonic anhydrase; iron enzymes – catalase, peroxidase and cytochrome P-450; copper enzymes – superoxide dismutase; vitamin B<sub>12</sub> and B<sub>12</sub> coenzymes.
- III Medicinal Inorganic Chemistry and Metal-Nucleic acid Interactions 10 hrs**  
*Metals in medicine:* metal deficiency and disease, toxic effects of metals, metals used for diagnosis, chemotherapy with special reference to anticancer drugs.  
*Metal-nucleic acid interactions:* basics- nucleic acid structure, fundamental interactions and reactions with nucleic acids, applications of different metal complexes that binds nucleic acids, conformational probes, metal-nucleic acid interactions with special references to zinc finger protein.
- IV Supramolecular Chemistry-I 8 hrs**  
*Molecular recognition:* molecular receptors for different types of molecules including arisonic substrates, design and synthesis of coreceptor molecules and multiple recognition; supramolecular reactivity and catalysis.
- V Supramolecular Chemistry-II 8 hrs**  
**Pre requisite:** *Essential and trace elements in biology, basic concepts of nucleic acid.*  
Transport processes and carrier design, supramolecular devices- supramolecular photochemistry, supramolecular electronic, ionic and switching device.

**Text/References:**

1. Principles of Bioinorganic Chemistry; I Edition; S. J. Lippard, J.M. Berg; Panima Publishing Corporation, New Delhi, 2005.
2. Bioinorganic Chemistry; I Edition; I.Bertini, H.B.Gray, S.J.Lippard, J.S.Valentine; Viva Books Pvt Ltd., New Delhi, 1998.
3. Bioinorganic Chemistry; I Edition; M.Satake, Y.Mido; Discovery Publishing House, New Delhi, 2003.

4. Supramolecular Chemistry, I Edition; Concepts and Perspectives; J.M. Lehn; VCH, Verlagsgesellschaft, Germany, 1995.
5. Inorganic Chemistry; III Edition; D.F. Shriver and P.W. Atkins; Oxford University Press, New York, 1999.
6. Inorganic Chemistry, Principles of Structure and Reactivity; IV Edition; J.E. Hueey, E.A. Keiter and R.L. Keiter; Addison-Wesley Publishing Company, New York, 1993.
7. Inorganic Chemistry; III Edition; Gary L. Miessler and Donald A. Tarr; Pearson Education Inc. Singapore, 2005.

**Semester II**  
**Recent Advances in Chemical Research**

**Elective Paper V CHY 245 Nuclear and Radiation Chemistry** **45 hrs**  
**1Hr/Week(L) + 2Hrs/Week(C)**

**Objective:**

To learn about nuclear chemistry and to equip students for future career in nuclear industry.

**I Atomic Nucleus** **9 hrs**  
Sub-nucleons, classification of nuclides, nuclear stability, binding energy, nuclear radius, orbital, spin and total angular momentum of nucleons, electric quadrupole moment of nuclides; nuclear models – liquid drop model, fermi gas model, optical model, shell model.

**II Radioactivity** **10 hrs**

*Pre requisite: Properties of  $\alpha$ ,  $\beta$  and  $\gamma$  rays.*

Decay scheme, decay kinetics, parent-daughter decay growth relationship, branching decay, alpha emission, beta emission – type of beta decay, electron capture, neutrino, double beta decay, nuclear deexcitation – gamma emission, gamma transition, internal conversion, auger effect; artificial radioactivity, counters – Geiger counter, scintillation counter, proportional counter, semi conductor detector.

**III Nuclear Reactions** **10 hrs**

*Pre requisite: Nuclear fission and fusion.*

Types, special nuclear reaction – evaporation, spallation, fission, fragmentation; reaction cross section; compound nucleus mechanism for nuclear reaction, high energy, photo and thermo nuclear reaction; fission – process and product, fission energy, theory of nuclear fission, nuclear reactor, breeder reactor in India, fusion and its scope.

**IV Elements of Radiation Chemistry** **7 hrs**  
Interaction of radiation with matter, radiolysis of water, chemical and biological effect of radiation, units for measuring radiation absorption.

**V Applications of Radio Nuclides** **8 hrs**

*Pre requisite: Radioisotopes*

Tracer method, isotope dilution analysis, activation analysis, diffusion studies, structure determination, reaction mechanism, radio pharmaceuticals, dating techniques, neutron activation analysis.



***Text/References:***

1. Essentials of Nuclear Chemistry, IV Edition; H.J. Arnikar; New Age International (P) Ltd., New Delhi, 1995.
2. Source book on Atomic Energy II Edition; S. Glasstone; Van Nostrand Co. Inc., New Jersey.
3. Nuclear Chemistry for B.Sc. and M.Sc. Students of Indian Universities, I Edition; C.V. Shekhar; Dominant Publishers and Distributors, New Delhi, 2003.

**Semester II**  
**Recent Advances in Chemical Research**

**Elective Paper VI CHY-246 Industrial Chemistry**

**45 hrs**

**1Hr/Week(L) + 2Hrs/Week(C)**

**Objective:**

*To develop awareness in students for chemistry in industrial sector*

**I Fuels**

**9Hrs**

Classification of fuels, Calorific values, Characteristic of fuels, Comparison between solid, liquid and gaseous fuels. Bomb calorimeter, Boy's calorimeter, Analysis of coal.

**II Explosives and Petrochemicals**

**9Hrs**

Explosives: characteristics of explosives, classification of explosives- primary and secondary explosives, preparation and application of some commercial explosives.  
Petrochemicals: Introduction, Classification of Petrochemicals, Manufacture of some common Petrochemicals

**III Cement**

**9Hrs**

Types and composition of cements, raw material, manufacturing, Chemistry of setting of cement, various additive used. Reinforced cement concrete.

**IV Refractories, Glasses and Ceramics**

**9Hrs**

Refractories: Introduction, Properties, Manufacturing and Common refractive bricks.  
Glass and Ceramics: Manufacturing techniques, Classification of glass and uses, plasticity of clays, white pottery, glazing, Earthenware and stoneware.

**V Corrosion Science and Protective Coatings**

**9Hrs**

Corrosion, Theories of Corrosion, Kinetics of corrosion, Evan's diagram, Thermodynamics of corrosion-Pourbaix diagram, forms of Corrosion.  
Corrosion prevention: Modification of materials, Corrosion inhibitors, cathodic and anodic protection.  
Pigments- characterization and types, properties, Paints- Classification, properties and applications of paints. Manufacture of paints.

**Text/ Reference:-**

1. Engineering Chemistry; Menaria, K.L., Goyal Praveen; Genius Publication, 2007.
2. Engineering Chemistry; Krishnamurthy, N., Vaillinayagan ; Prentice Hall of India Pvt. Ltd., 2006.
3. Engineering Chemistry; Jain, P.C., Jain, Monika; Dhanpat Rai & Co. Pvt. Ltd, 2007.
4. Engineering Chemistry; Nair, Rekha; College Book Centre, 2007.
5. Theory and Practical of Engineering Chemistry; Chawla, Shashi; Dhanpat Rai & Co., 2007

**Semester II**  
**Recent Advances in Chemical Research**

**Elective Paper VII CHY-247 Textile Chemistry**

**45 hrs**  
**1Hr/Week(L) + 2Hrs/Week(T)**

**Objectives:**

1. To acquaint the students about the polymers of the textile fibres.
2. To understand the chemistry, production and fundamental properties of natural and synthetic fibres.
3. To familiarize with the chemical processing from desizing to finishing of textiles and their principles.

- I Polymer Chemistry: 8Hrs**  
Polymers and methods of polymerization, Classification of Polymers, Degree of polymerization, Molecular weight of polymer and its determination, Orientation and Crystallinity of Polymer and their influence on fibre properties.
- II Chemistry of Cellulosic Fibres: 12Hrs**  
Chemical composition, molecular structure, physical and chemical properties of cotton fibre, Regenerated cellulosic fibres – viscose, cupra ammonium rayon, cellulose acetate-their manufacture, properties and uses.
- III Chemistry of Protein Fibres – Wool and Silk. 6Hrs**  
Chemical composition, Molecular structure, Physical and chemical properties, Felting in wool, Degumming and Weighting of silk.
- IV Chemistry of Synthetic Fibre - Polyester, Polyamides, Acrylonirile 9Hrs**  
Chemistry of fibres–raw material and manufacturing process, Physical and chemical properties of all the fibres and their uses.
- V Textile Finishing: 10Hrs**  
Definition and importance of finishing, Classification of Finishes.  
a) Mechanical Finishes.  
b) Chemical Finishes – Mercerisation, Parchmentisation, Durable Press, Wash and Wear, Wrinkle Recovery.  
c) Functional Finishes – Flame retardant, Water Repellent, Antistatic, Moth Proofing.  
d) Special Purpose Finishes.

**Text/References:**

1. Technology of Textile Processing; Vol.-IX; Shenai, V.A. (1984):, Sevak Publication.
2. Hand Book of Textile Fibres; Cook, J. Gordon; Man-Made Fibres Merrow Publishing co. Ltd. England.
3. Manmade Fibres; Moncrief: R.W.; John Willey & Sons New York.
4. Dyeing and Chemical Technology of Textile Fibres; Trotman, E.R.; Charles Griffino Company Ltd., London, 1975.
5. An Introduction to Textile Finishing; Marsh, J.T.; B.I., Publications, 1979
6. An Introduction to the Chemistry of Dyestuffs; Shenai, V.A.; Sevak Prakashan, 1991

## Semester II

**CHY-248 Dissertation**

**450 hrs (30 hrs/week)**

### **Dissertation: Literature Survey and Synopsis Presentation**

This has been incorporated in semester I, with the aim that a candidate does extensive literature survey on a topic of choice and further take up dissertation on the same topic in the subsequent semester.

### **Dissertation**

To give an exposure of research to candidates, dissertation has been introduced in semester II. Candidate is required to carry out minor research project on any topic of choice (based on Semester I Literature Survey Article) under the supervision of an allotted guide or faculty.

The marking scheme of dissertation is as follows:

**Total Marks            100**

#### **Internal (30 %)**

Synopsis	Attendance	Total
<b>20 marks</b>	<b>10 marks</b>	<b>30 marks</b>

#### **External (70 %)**

Objective	Methodology	Review and bibliography	Results	Presentation	Viva	Total
<b>10 marks</b>	<b>10 marks</b>	<b>10 marks</b>	<b>15 marks</b>	<b>10 marks</b>	<b>15 marks</b>	<b>70 marks</b>