

M.Phil (Chemistry) Programme

M.Phil (Chemistry) 2-years programme is held on semester system comprising of two semesters of course work in first year. The Scheme of study, Syllabi and Courses of Reading for M.Phil 1st and 2nd semesters are given below:

M.Phil (CHEMISTRY) SEMESTER SYSTEM (2 YEARS PROGRAM)

A. Two types of courses (major and minor) of each of the following subjects shall be prepared:

- (a) Physical Chemistry
- (b) Inorganic Chemistry
- (c) Organic Chemistry
- (d) Analytical Chemistry
- (e) Applied Chemistry
- (f) Biochemistry

B. The Major course will be of 4 credits (which will be further divided into two papers) and the Minor course will be of 2 credits.

C. In 1st semester, a student will opt and study the following courses:

- | | |
|---|-----------|
| i). Two major courses of a certain subject (2 credits each) | 4 credits |
| ii). One minor course of the same subject as of major | 2 credits |
| iii). One minor course of other than the major subject | 2 credits |
| iv). Practical | 4 credits |
| v). Mathematics / Statistics | 2 credits |
| vi). Seminar / Special Problems | 1 credit |

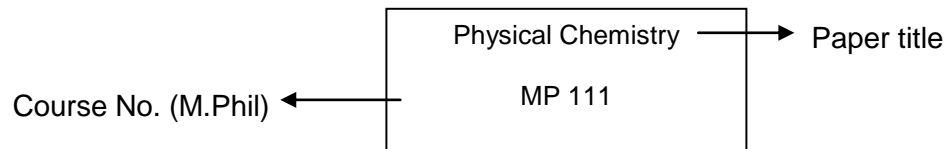
Total Credit Hours 15

D. In the 2nd semester the student will study the same subjects of same weight age as he/she studied in 1st semester.

E. In the 3rd and 4th semesters research work will be conducted.

M.Phil (CHEMISTRY) SEMESTER SYSTEM (2 YEARS PROGRAM)

Semester #	Major Paper-I (2 Credits)	Major Paper-II (2 Credits)	**Minor Paper (Same as major paper) (2 Credits)	Practical (4 Credits)	Minor Paper (Other than major paper) (2 Credits)	Compulsory Course (2 Credits)	Seminar (1 Credit)	Total Credit Hours
I	Physical Chemistry MP 111	Physical Chemistry MP 112	Physical Chemistry MP 113	Physical Chemistry MP 114	** Course number given in their respective papers	Mathematics MP 110	Seminar / Special Problems MP 120	15
	Inorganic Chemistry MP 121	Inorganic Chemistry MP 122	Inorganic Chemistry MP 123	Inorganic Chemistry MP 124				
	Organic Chemistry MP 131	Organic Chemistry MP 132	Organic Chemistry MP 133	Organic Chemistry MP 134				
	Analytical Chemistry MP 141	Analytical Chemistry MP 142	Analytical Chemistry MP 143	Analytical Chemistry MP 144				
	Applied Chemistry MP 151	Applied Chemistry MP 152	Applied Chemistry MP 153	Applied Chemistry MP 154				
	Biochemistry MP 161	Biochemistry MP 162	Biochemistry MP 163	Biochemistry MP 164				
II	Physical Chemistry MP 211	Physical Chemistry MP 212	Physical Chemistry MP 213	Physical Chemistry MP 214	**Course number given in their respective papers	Statistics MP 210	Seminar / Special Problems MP 220	15
	Inorganic Chemistry MP 221	Inorganic Chemistry MP 222	Inorganic Chemistry MP 223	Inorganic Chemistry MP 224				
	Organic Chemistry MP 231	Organic Chemistry MP 232	Organic Chemistry MP 233	Organic Chemistry MP 234				
	Analytical Chemistry MP 241	Analytical Chemistry MP 242	Analytical Chemistry MP 243	Analytical Chemistry MP 244				
	Applied Chemistry MP 251	Applied Chemistry MP 252	Applied Chemistry MP 253	Applied Chemistry MP 254				
	Biochemistry MP 261	Biochemistry MP 262	Biochemistry MP 263	Biochemistry MP 264				
III	Research MP 300							6
IV	Research MP 400							6
Total Credit Hours for M.Phil (Chemistry) 2 Year Program								42



(Credit hours required for earning the degree are 30)

PHYSICAL CHEMISTRY (M.Phil 1st Semester)

Module Code:	MP 111
Module title:	Physical Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**Physical Chemistry of High Polymers (Cr. 2):**

Polymer interactions: Molecular forces and chemical bonding in polymers; **Molecular weights of polymers:** Molecular size measurement. Techniques for measuring: number-average; weight-average; z-average and viscosity-average molecular mass; universal curve. **Spectroscopic analysis:** UV, FTIR and NMR techniques. Thermal analysis: TGA; DSC; DMA; glass transition temperature. Morphology: Amorphous and crystalline structures; semicrystalline nature; viscoelasticity; models and predictions; time-temperature dependency; polymer rheology; electrical and magnetic properties of polymers.

RECOMMENDED BOOKS:

1. Ravve, Principles of Polymer Chemistry, 2nd ed., Plenum Publishers, New York (2000).
2. F.W. Billmeyer, Jr., Textbook of Polymer Science, John Wiley & sons, New York (1994).
3. J.R. Fried, Polymer Science and Technology, Prentice Hall/PTR (1995).
4. C.E. Carraher, Seymour/Carraher's Polymer Rheology, Marcel Dekker, New York (2003).
5. J. Furnkaw, Physical Chemistry of Polymer Rheology, Springer-Verlag, Berlin (2003).

Module Code:	MP 112
Module title:	Physical Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Electrochemistry(Cr.2):

Overview of electrode processes: Kinetics of electrode reactions. Mass transfer by migration and diffusion. **Electroanalytical techniques:** potential step and potential sweep methods. **Electrochemical impedance spectroscopy:** Effects of solution resistance and double layer capacitance. Electrode reactions with coupled homogeneous chemical reactions. **Industrial electrochemistry:** Corrosion study: detection, measurement, monitoring and remedial. **Energy conversion systems:** fuel cells and batteries. Semi-conductor electrochemistry.

RECOMMENDED BOOKS:

1. A.J. Bard and L.R Faulkner, Electroanalytical Chemistry, Marcel Dekker(1993).
2. D. Pletcher and F.C. Walsh, Industrial Electrochemistry, 2nd ed., Blackie Academic & Publisher (1993).
3. J.O'M. Bockriss, A.K.N. Reddy, and M.F. Gomboa, Modern Electrochemistry: Electrodes in Chemistry, Engineering, Biology and Environmental Science, ed., Springer (2000).
4. M. Mohammad and M. Amjad, Principles of Electrode Kinetics, Rooha Printers, Lahore (2000).
5. P.H. Reiger, Electrochemistry, Chapman and Hall, New York (1994).

Module Code:	MP 113
Module title:	Physical Chemistry (Minor Paper)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Physical Chemistry of Environment (Cr.2):

Environment and its resources: Resource depletion and environmental pollution; green house effect; green house gases; mechanism of reactions causing pollution; interaction of pollutants with materials; noxious emission from industrial processes; aerosol production.

Chemistry of pollutants: Nuclear waste and its management. Kinetic and thermodynamic aspects of atmospheric phenomena. Clean energy for future.

Experimental techniques for environmental monitoring.

RECOMMENDED BOOKS:

1. W.W. Eckenfelder, Jr., Industrial Water Pollution control, McGraw-Hill International Edition (2000).
2. M. Bockris, Environmental Chemistry, Plenum Press, New York (1992).

Module Code:	MP 114
Module title:	Physical Chemistry (Practical)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Lab. Projects shall be designed according to the facilities available.

PHYSICAL CHEMISTRY (M.Phil 2nd Semester)

Module Code:	MP 211
Module title:	Physical Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**Advanced Nuclear and Radiation Chemistry (Cr.2):**

Basic principles: Sources of nuclear radiation, radioactivity, nuclear-structure, models and stability, nuclear reactions. **Nuclear track detectors:** Kinetics and mechanism of track etching, tracers. **Nuclear waste and its management:** Nuclear hazards and benefits, transuranium elements and nuclear series, theoretical aspects of reactions, sources, absorption of radiations. **Applications:** Nuclear chemistry, radiobiology, analytical uses of radiation absorption.

RECOMMENDED BOOKS:

1. G. Choppin, J. Liljenzin and J. Rydberg, Radiochemistry and Nuclear Chemistry, 3rd ed., BH Publishers (2000).
2. K.H. Lieser, Nuclear and Radiochemistry, 2nd revised ed., Willey-VCH(2001)
3. G. Friedlander and J.W. Kennedy, Nuclear and Radiochemistry, 3rd ed., Wiley, New York (1981).
4. W.J. Cooper, R.D. Curry and K.E. O'shea (Eds.), Environmental Applications of Ionizing Radiations, Wiley-IEEE (1998).
5. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th ed., Wiley Eastern Ltd., New Delhi (1995).
6. Vertes and S. Nagy, Handbook of Nuclear Chemistry, Springer Verlag, Berlin (2003).
7. F. Aziz and M.A.J. Rodges, Radiation Chemistry, VCH, Weinheim (1987).
8. J.W.T. Spinks and R.J. Woods, An Introduction to Radiation Chemistry, 2nd ed., John Wiley, New York (1976)
9. R.J. Woods and A.K Pikaev, Applied Radiation Chemistry: Radiation Processing, Willey-IEEE (1993).

Module Code:	MP 212
Module title:	Physical Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Chemistry of Advanced Composite Materials (Cr.3):

Introduction: Definitions and classification; natural composites; property enhancement by reinforcement and orientation; matrix interface; synthetic fibers; processing of composites. **Examples:** Metallic; ceramic and polymeric matrices; interface reactions.

Properties: Mechanical and thermal properties of composite materials; stress relaxation and creep studies; dynamical mechanical properties, toughening mechanisms and mechanical failure in polymeric composites.

RECOMMENDED BOOKS:

1. F.L. Mathews and R.D. Rawlings, Composite Materials; Engineering and Science, Chapman and Hall (1994).
2. R.E Shalin, Polymer Matrix Composites, Chapman and Hall (1995).
3. R.S. Scifullon, Physical Chemistry of Inorganic Polymeric and Composite Materials, Ellis Harwood (1992).

Module Code:	MP 213
Module title:	Physical Chemistry (Minor Paper)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Advanced Techniques in Physical Chemistry(Cr.2):

Magnetic resonance spectroscopy: Nuclear magnetic resonance (NMR) in solid state, measurement of scalar couplings, measurement of dipolar couplings, measurement of “residual dipolar couplings”.

Diffraction methods: Introduction, single crystal X-ray diffraction (XRD) of small molecules and macromolecules including natural systems; powder X-ray diffraction (XRD) of small molecules and macromolecules, measurement of lattice parameters, measurement of B-values, determination of space group, calculation of electron density map.

Electron microscopy: Introduction, scanning electron microscopy (SEM), transmission electron microscopy (TEM), measurement of I/Q values, single particle 3-D reconstruction.

RECOMMENDED BOOKS:

1. E.M. Haacke, R.W. Brown, M.L. Thompson and R. Venkatesan, Magnetic Resonance Imaging: Physical Principles and Sequence Design, John Wiley, New York (1999).
2. M.J.Duer, Introduction to Solid-State NMR Spectroscopy, Blackwell Publishing (2004).
3. J.P. Glusker, M. Lewis and M. Rossi, Crystal Structure Analysis for Chemists and Biologists, VCH Publishers, New York (1994).
4. J.Kuo, Electron Spectroscopy: Methods and protocols, Humana Press (2007)
5. Sharma and S.G. Schulman, Introduction to Fluorescence Spectroscopy, Wiley Interscience (1999).

Module Code:	MP 214
Module title:	Physical Chemistry (Practical)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Lab. Projects shall be designed according to the facilities available.

INORGANIC CHEMISTRY (M.Phil 1st Semester)

Module Code:	MP 121
Module title:	Inorganic Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**1. Electrode potential and its application:**

Electrode potential of an electrode, Oxidation or reduction electrode potential, standard electrode potential, Positive and negative values of standard electrode potential, Oxidation-reduction electrode, Construct a galvanic cell for a given redox reaction, Applications of E_o , values, feasibility of metal-metal displacement reactions (Redox reactions), Metal-metal displacement reactions in the electrochemical series, Metal-hydrogen displacement reactions in electrochemical series, Electropositive and electronegative character of elements.

2. Non-Redox Metalloenzymes:

Introduction, Biological Lewis Acids, Apoenzymes, Metal-ion catalysed reactions, comparison of a metal catalysed reactions and enzymatic reactions, Lewis Acid catalysis, carboxypeptidase, Models for carboxypeptidase, carbonic-anhydrase, models for carbonicanhydrase, biochemistry of iron, Enzyme: its structure and function, Inhibition and poisoning, role of metal ions in biological system, Biochemistry of nonmetals, medicinal chemistry, problems in biological system, Role of metal ions in environment.

RECOMMENDED BOOKS:

1. J H Huheey, Inorganic Chemistry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (2008)
2. J. D. Lee, Concise Inorganic Chemistry, Elbs with Chapman and Hall, London
3. Advanced Inorganic Chemistry F.A. Cotton and G.Wilkinson 6th Ed. 2001, Interscience, Publishers, London.
4. Cullen Dolphin and James, Biological aspects of Inorganic Chemistry, 2005
5. Williams, An Introduction to Bioinorganic Chemistry, 2003

Module Code:	MP 122
Module title:	Inorganic Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Photochemistry and Activated Molecules:

Electronic States and Term Symbols, electronic states for diatomic molecules and their consequences, electronic states for octahedral complexes, tanabe-sugano diagrams and spectra of d-block complexes, luminescence, lasers, and spin-orbit coupling, photochemically assisted substitution and redox processes, chlorophyll and photosynthesis, biochemical oxygen transport and activation, biochemical nitrogen activation.

2. Metal Carbenes and Carbynes:

Metal carbenes, metal carbynes, Synthesis, Chemical Reactions, bridging carbenes and carbynes, metathesis, oligomerization and polymerization reactions of Alkenes.

RECOMMENDED BOOKS:

1. Organotransition metal Chemistry by Akin Yamamoto, 1996, A. Wiley Interscience Publication London
2. J H Huheey, Inorganic Chemistry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (2008)
3. Instrumental analysis by Gary D. Christian and James E.O., Reilly, 2007, Allyn and Bacon Inc., London.

Module Code:	MP 123
Module title:	Inorganic Chemistry (Minor Paper)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Organometallic compounds:

(a) **Synthetic aspects of organometallic compounds:**

Organometallic compounds as stoichiometric and catalytic reagents, Transition metal organometallics as catalysts and synthetic reagents. Metal Alkyls, Metal Hydrides, Protection and deprotection, Coupling reactions, nucleophilic attack on a ligand, Directed and asymmetric catalysis.

(b) **Biological applications and Environmental aspects of organometallic compounds:**

Introduction, Organometallics in medicine, organometallic compounds in agriculture and horticulture, Organometallics in industry, Environmental aspects of organometallic compounds.

2. Nuclear Chemistry:

Nuclear stability, Neutron-to-proton ratio. Mass defect, Binding energy of a nucleus and its calculation, Binding energy per nucleon, nuclear reactions, capture reactions, particle-particle reactions, Spallation reactions, Endo ergic and exo ergic nuclear reactions, Bohr's theory of nuclear reactions, Nuclear fission, Bohr yield curve, nuclear fission of U-235 by liquid drop model, Chain reaction, Fission Reaction, Nuclear atomic reactor, Nuclear power plant, Fusion reaction, solar energy, Proton-proton cycle, carbon-nitrogen cycle, hydrogen bomb.

RECOMMENDED BOOKS:

1. J H Huheey, Inorganic Chemistry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (2008)
2. J. D. Lee, Concise Inorganic Chemistry, Elbs with Chapman and Hall, London
3. Advanced Inorganic Chemistry F.A. Cotton and G.Wilkinson 6th Ed. 2001, Interscience, Publishers, London.
4. Cullen Dolphin and James, Biological aspects of Inorganic Chemistry, 2005
5. Williams, An Introduction to Bioinorganic Chemistry, 2003.

Module Code:	MP 124
Module title:	Inorganic Chemistry (Practical)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Lab projects related to the theory course work.

RECOMMENDED BOOKS:

1. J. Bassett, R. C. Denny, G. H. Jeffery and J. Mendham, Vogel's Text Book of qualitative Inorganic Analysis, the English Language Book Society and Longman, New York, (2008)
2. Quantitative Analysis Chemistry, James S. Pritz, George H. Sehenk, 2001 Alby and Becon Inc. London.
3. Theory and practice of chromatography by Prof. Dr. Javed Iqbal (2002).
4. Instrumental analysis by Gary D. Christian and James E.O., Reilly, 2007, Allyn and bacon Inc., London.
5. Hand Book of Organic reagents in Inorganic Analysis by ZAVIX Holzbecher and other 1976 Ellis Hurwod Limited, London.
6. Experimental Inorganic Chemistry - W. G. Palmer, 2005.
7. The analysis of minerals and ores of the rarer elements – W. R. Schoeller, and A. R. Powell, Charles, Griffin and Company Limited, 2004.

INORGANIC CHEMISTRY (M.Phil 2nd Semester)

Module Code:	MP 221
Module title:	Inorganic Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**1. Electronic Absorption Spectra:**

Spectra of Octahedral and Tetrahedral complexes (d1 and d9) systems, Energy level diagrams d2-d8, spectrochemical series, remarks on intensities and line widths of charge transfer spectra. Optical activity; Basic principles and definitions, applications and circular Dichrome. Structural and Thermodynamic consequences of partially filled d-shells; Ionic radii, John-Teller effects, Thermodynamic effect of d-orbital splitting; Formation constants of complexes octahedral vs Tetrahedral coordination.

2. Magneto Chemistry:

Definition and Electronic configurations of Transition metals, magnetic properties, Diamagnetisms and Paramagnetism , magnetic susceptibility, magnetic moments and various methods for there measurement, commenton Theoretical and Experimental value sof magnetic moments for various transition metal ions. Thermal energy, Ferromegnatisma and Antiferromegnatism.

RECOMMENDED BOOKS:

1. Advanced Inorganic Chemistry F.A. Cotton and G.Wilkinson 6th Ed. 2001, Interscience, Publishers, London.
2. Coordination Compounds by S.F.A. Kettle, 1971, Nelson , (Nairobi Kenya).
3. Valency and Molecular Structure by Cotton and Fowles, 1970, London
4. The Chemical electrons by R.E. Pease 1969 Longmans, Green LES London.
5. J H Huheey, Inorganic Chemistry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (2008)

Module Code:	MP 222
Module title:	Inorganic Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Solid state chemistry:

X-ray powder diffraction, High temperature X-ray powder diffraction, Single crystal X-ray diffraction, Electron diffraction, Neutron diffraction, Band structure of inorganic solids, Colour in inorganic solids

2. Stability of Complexes:

Stability, stepwise formation of complexes, kinetic vs. thermodynamic stability, labile and inert complexes, experimental determination of stability constant and composition of a complex.

3. Organometallic Compounds:

Metal Hydrogen exchange reactions, Hydrometalations, Orthometalations, Halometalations (Applied Aspects), Reactions of transition metal organometallic compounds. Association Reactions, Ligand protonation substitution reactions, Addition and decarbonylation, Oxidative-Addition Reactions, Stereochemistry of Oxidative Addition Reactions, Influence of central metal and ligands on oxidative-addition reactions, stability of metal-carbon bonds, Rearrangement reactions, , Catalysis involving Organometallic compounds, Olefin hydrogenation, The Wacker's process (Schmidt Reaction) Polymerization, oligomerization, Olefin isomerization, polymer-bound Catalysis

RECOMMENDED BOOKS:

1. Organotransition metal Chemistry by Akin Yamamoto, 1996, A. Wiley Interscience Publication London.
2. Mechanisms of Inorganic reactions in solution by Benson, 1969 McGraw Hill, London
3. Inorganic Chemistry by James E. Huheey 1983 Harper International London.
4. Theoretical Principles of Inorganic Chemistry by Manku, G.S. 1980 McGraw Hill.
5. Mechanisms of Inorganic reactions in solution by Benson, 1969 McGraw Hill, London

Module Code:	MP 223
Module title:	Inorganic Chemistry (Minor Paper)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Clusters and Metal – Metal Bond:

Structure, the isolobal analogy, synthesis reactions, metal-nitrogen multiple bonds, Nitrido and Imido complexes, Metal oxo complexes, preparation, reactions and applications.

2. (a) Fundamental concepts for transition metal complexes:

The language of coordination chemistry, Russel-Saunders's Coupling scheme, Determination of the ground state terms of free atoms or ions, atomic configurations Atomic terms and their applications.

(b) Electron transfer in coordination complexes:

Mechanism of one electron transfer reactions, Direct electron transfer reactions, sphere mechanism, Factors affecting the rates of direct transfer reactions, complimentary electron transfer reactions and mechanism.

RECOMMENDED BOOKS:

1. Structural Inorganic Chemistry by Wells, A.F. 1975, Charenden Press, London.
2. Stereochemistry and bonding in Inorganic Chemistry by J.E. Ferguson 1974, Prentice Hall, New Jersey.
3. J H Huheey, Inorganic Chemistry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (2008)

Module Code:	MP 224
Module title:	Inorganic Chemistry (Practical)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Lab projects related to the theory course work.

RECOMMENDED BOOKS:

1. J. Bassett, R. C. Denny, G. H. Jeffery and J. Mendham, Vogel's Text Book of qualitative Inorganic Analysis, the English Language Book Society and Longman, New York, (2008)
2. Quantitative Analysis Chemistry, James S. Pritz, George H. Sehenk, 2001 Alby and Becon Inc. London.
3. Theory and practice of chromatography by Prof. Dr. Javed Iqbal (2002).
4. Instrumental analysis by Gary D. Christian and James E.O., Reilly, 2007, Allyn and bacon Inc., London.
5. Hand Book of Organic reagents in Inorganic Analysis by ZAVIX Holzbecher and other 1976 Ellis Hurwod Limited, London.
6. Experimental Inorganic Chemistry - W. G. Palmer, 2005.
7. The analysis of minerals and ores of the rarer elements – W. R. Schoeller, and A. R. Powell, Charles, Griffin and Company Limited, 2004.

ORGANIC CHEMISTRY (M.Phil 1st Semester)

Module Code:	MP 131
Module title:	Organic Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**1. Asymmetric synthesis:**

Introduction, Chiral auxiliaries, Alkylation of chiral enolates, Enantiomeric excess, Chiral reagents and chiral catalysts, Asymmetric hydrogenation, Asymmetric epoxidation, Asymmetric dihydroxylation.

2. Organic Name reactions:

Horner-Wadsworth Emmons reaction, Julia-Lythgoe olefination, Nef reaction, Suzuki coupling, Mitsunobu reaction, Pauson-Khand reaction, Sharpless epoxidation, Oppenauer oxidation, Simmons Smith reaction.

RECOMMENDED BOOKS:

1. Asymmetric synthesis by Robert Alan Aitken, S. Nicholas Kilényi, Blackie Academic Professional, (Chapman & Hall), 1994.
2. Principles of Asymmetric Synthesis, R. E. Gawley and J. Aub, Elsevier, 1996.
3. Name reactions: a collection of detailed reaction mechanisms. 3rd Ed. By Jie Jack Li, Springer-Verlag, Berlin Heidelberg, 2006.
4. Name Reactions and Reagents in Organic Synthesis, 2nd Ed. Bradford P. Mundy, Michael G. Ellerd, Frank G. Favaloro, Jr., Wiley, 2005.
5. Organic Syntheses Based on Name Reactions (2nd Ed.) by A. Hassner, C. Stumer, Elsevier, 2002.
6. Organic Chemistry by Jonathan Clayden, Nick Greeves, Stuart Warren, Oxford University Press 2000

Module Code:	MP 132
Module title:	Organic Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Designing Organic Synthesis:

Retro synthesis: Introduction to Disconnections, Good Disconnections, one-group disconnections, two-group disconnections, "illogical" two-group disconnections, Functional group interconversion. Strategies for synthesis.

2. Advance Heterocyclic Chemistry:

Introduction of polynuclear heterocyclics, synthesis and structure elucidation of Quinoline, isoquinoline, flavonoids, coumarins, chromones, acridine. Industrial applications.

RECOMMENDED BOOKS:

1. Work book for Organic Synthesis, The disconnection approach, Stuart Warren, John Willey and Sons, 1994,.
2. Organic Synthesis, The disconnection approach, Stuart Warren, 1993, John Willey and Sons 1993.
3. Designing Organic Synthesis, A Programmed Introduction to synthon approach, S. Warren, John Willey and Son, 1992.
4. Guide book to Organic Syntheses, R. K. Mackie, D. M. Smith, 1982, Longman Group Limited.
5. Organic Chemistry, Volume I (6th Ed.) & II (5th Ed.) by I.L. Finar, Pearson Education (singapore) Pte Ltd, 2008.
6. Heterocyclic Chemistry, 4th Ed. by J. A. Joule, K. Mills, Blackwell Publishing, 2000.
7. Heterocyclic Chemistry, 3rd Ed. by T.L. Gilchrist, Longman, 1997.
8. Principles in Organic Synthesis by R.O.C Norman & J. M. Coxon, 1993, Chapman and Hall, 1993.
9. Organic Chemistry by Jonathan Clayden, Nick Greeves, Stuart Warren, Oxford University Press 2000.

Module Code:	MP 133
Module title:	Organic Chemistry (Minor Paper)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Spectroscopic Techniques:

Recent techniques as applied to the structure elucidation of organic compounds
NMR (Nuclear Magnetic Resonance; 1 – D and 2 – D), 1H and 13C-NMR
ESR (Electron Spin Resonance).

RECOMMENDED BOOKS:

1. Spectroscopic Methods in Organic Chemistry 6th ed. by D. Williams and I. Fleming. Wiley-VCH, 1991
2. Spectrometric identification of Organic Compounds 6th ed. by R. M. Silverstein and F. X. Webster, Wiley, 2007.
3. Organic Spectroscopy and Chromatography by M Younas, ILMI, Pakistan, 2007.
4. Spectroscopy by Pavia, Lampman, Kriz, 2nd ed., Harcourt Brace College Publishers, 1996.
5. Electron spin resonance spectroscopy of organic radicals by Fabian Gerson, Walter Huber, Wiley-VCH Verlag GmbH &Co. KGaA Weinheim, 2003.

Module Code:	MP 134
Module title:	Organic Chemistry (Practical)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:**Project based on:**

- (i) Determination of the mechanism of a known reaction by recording its kinetic and spectroscopic data.
- (ii) Isolation of cholesterol; Purification of the cholesterol through bromination followed by debromination, Oxidative degradation of the cholesterol and identification of various products thus obtained,
- (iii) Synthesis of a peptide by protecting the amino group and activating the carboxylic group.
- (iv) Multistep synthesis of organic compounds.

RECOMMENDED BOOKS:

1. Practical Organic Chemistry by F. G. Mann and B. C. Saunders, Longman, UK, 1978.
2. Vogel's Textbook of Practical Organic Chemistry (5th ed.) by A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Longman UK, 1989.
3. Advanced Practical Organic Chemistry, by J. Leonard, B. Lygo, G. Procter, CRC, 1994.
4. Advanced Practical Organic Chemistry (2nd ed.) by N. K. Vishnoi, Vikas Publishing House Pvt Ltd, India, 1996.
5. Natural products: a laboratory guide by Raphael Ikan, Academic Press, 1991

ORGANIC CHEMISTRY (M.Phil 2nd Semester)

Module Code:	MP 231
Module title:	Organic Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Natural products:

Introduction, Biosynthesis of Terpenes, Steroids, Alkaloids, Coumarins, and Flavonoids.

RECOMMENDED BOOKS:

1. Biosynthesis of Natural Products, Paolo Manito, John Wiley & Sons, 1980.
2. Chemistry of natural Products, S.V. Bhat, B. A. Nagasampagi, M. Sivakumar, Springer, Narosa Publishing House. 2006.
3. Organic Chemistry, Volume II by I.L. Finar; 5th ed. Longman scientific, 1975.

Module Code:	MP 232
Module title:	Organic Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Chemistry of Sulphur Phosphorus, and silicon Compounds:

Introduction, preparation and properties of sulfur, phosphorus and silicon containing compounds. Application in organic synthesis. Industrial and pharmaceutical applications.

2. Colour and Constitution:

Dye – Chemistry: Synthesis and applications of azo, anthraquinones, phthalocyanines, vat, indigo polymethine and nitro dyes, High technology applications.

RECOMMENDED BOOKS:

1. Principles in Organic Synthesis by R.O.C Norman & J. M. Coxon, Chapman and Hall, 1993.
2. Organic Chemistry by Jonathan Clayden, Nick Greeves, Stuart Warren, Oxford University Press, 2000.
3. Color Chemistry by H. Zollinger, VCH, 1987
4. Industrial Dyes by Klaus Hunger, Wiley VCH, 2003.

Module Code:	MP 233
Module title:	Organic Chemistry (Minor Paper)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

MS (Mass Spectroscopy, EI / CI and HRMS)
HPLC (High Performance Liquid Chromatography)
GC – MS (Gas Chromatography)

RECOMMENDED BOOKS:

1. Spectroscopic Methods in Organic Chemistry 6th ed., by D.Williams and I. Fleming, Wiley-VCH, 1991
2. Spectrometric identification of Organic Compounds by R. M. Silverstein; 6th ed., Wiley, 2007.
3. Organic Spectroscopy and Chromatography by M Younas, ILMI, Pakistan
4. Spectroscopy by Pavia, Lampman, Kriz, 2nd ed., Harcourt Brace College Publishers, 1996.
5. High performance liquid chromatography by Sandie Lindsay, John Barnes, John Wiley & Sons Ltd., 1992.
6. Mass spectrometry: principles and applications, 3rd ed., by Edmond de Hoffmann, Vincent Stroobant, John Wiley & Sons Ltd. 2007.

Module Code:	MP 234
Module title:	Organic Chemistry (Practical)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

- 1. Advance Organic Synthesis:**
Five, and six membered hetrocyclic compounds.
- 2. Extraction on any two of the following:**
Essential oils from indigenous fragrant plant
Lycopene from tomatoes
 β -carotene from carrots
Pigments from carrots
- 3. Analysis of commercial products:**
(a) Pharmaceutical and Antimicrobial Assays
- 4. Physical and chemical testing of raw industrial materials:**
(a) Oils and fats (b) resins (c) Pigments

RECOMMENDED BOOKS:

- Analytical Chemistry, Theory and Practice, 3rd ed.. R.M. Verma, CBS Publishers, India, 1997.
- Practical Heterocyclic Chemistry, by A. O. Fitton and R. K. Smalley, Academic Press, 1968.
- Natural products: a laboratory guide by Raphael Ikan, Academic Press, 1991.
- Bioassay Techniques for Drug Development by Atta-ur Rahman, M. I. Choudhary, W. Thompson, Informa Healthcare, 2001.

ANALYTICAL CHEMISTRY (M.Phil 1st Semester)

Module Code:	MP 141
Module title:	Analytical Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**Theoretical Atomic Spectroscopy:**

Theoretical background of atomic spectroscopy; origin of atomic lines, Natural width of atomic line, factors responsible for broadening the line, structural of hydrogen & hydrogen like atoms;

Quantum numbers and term symbols, Hyperfine structure, Intensities of emissions and absorption lines, origin of atomic spectra;

Dopper broadening, Pressure broadening; Resonance broadening; stark and Zeeman broadening, self reversal broadening.

Neutron Activation Analysis:

Principle of Neutron Activation Analysis, Irradiation with neutrons; qualitative and quantitative analysis, sample preparation; Applications.

Radio limmino Assay:

Definitions, Principle of Radio Immino Assay, Protocol and methodology, Applications of Radio Immino Assay.

RECOMMENDED BOOKS:

1. Analytical Chemistry by J.D. Dick, McGraw Hill, 1973, N.Y. also available in International students edition McGraw Hill, Mogakusha, 1973.
2. Instrumental Methods by W. Ewing, Mc Graw Hill Book Co. N.Y. (Third/Fourth Edition) also available in international students edition.
3. New Instrumental Methods in ElectroChemistry by Faul-Delabay, Inter Science Publisher, London, N.Y.
4. Neutron Activation Analysis by William R. Corliss, Science, U.S. Atomic Energy Commission, Division of Technical Information.
5. Radioimmunoassay: methodology and applications in physiology and in clinical studies : commemorative issue for Solomon A. Berson, Thieme publisher.

Module Code:	MP 142
Module title:	Analytical Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Advance Nuclear Magnetic Resonance Spectroscopy:

Continue-wave NMR spectrometer, Pulsed Fourier Transform NMR spectrometer (FT-NMR),
NMR process elucidation of NMR Spectra, Carbon-13 NMR, Quantitative analysis and integration,
NMR imaging in medicine and analytical applications of NMR Spectroscopy.

Advance Mass Spectrometry:

Comparison of usefulness MS with UV-IR and NMR spectroscopy
Interpretation of MS spectra congestion U.V., I.R., NMR

RECOMMENDED BOOKS:

1. Mass Spectrometry textbook by Jurgen H Gross, Springer-Verlag Berlin Heidelberg.
2. Nuclear Magnetic Resonance Spectroscopy by G.A Webb, RSC publishing.

Module Code:	MP 143
Module title:	Analytical Chemistry (Minor Paper)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Introduction / Assessment of Analytical Data

Introduction and scope of Analytical Chemistry: Analytical problems and their solutions; The nature of analytical methods; trends in analytical methods; Different units of concentration and their conversion; Definition and basic concepts: nature and origin of errors, Classification of errors; Accuracy and Precision; Limits of detection, Confidence limits; Deviation, Standard deviation, Application of statistical tests; Rounding off analytical data; Quality control charts; Computation of analytical data. Significance of sampling, weighing and measuring in Analytical chemistry.

2. Basic Chromatography Techniques

Classifications of Chromatographic Techniques, Paper and Thin Layer Chromatographic Techniques; their instrumentation, applications and limitations, Column Adsorption Chromatography.

3. Ion Exchange Chromatography:

Cation Exchange resin, Anion Exchange resin, Cross-linkage, Effect of pH-separation of Amino Acids, Separation of metal ions on Anions Exchange Columns, Applications of ion Exchange Chromatography.

RECOMMENDED BOOKS:

1. Fundamental of Analytical Chemistry by Douglas Skoog and Donald M. W. West, Holt Reinhart and Inc, London.
2. Chromatography by R.K Sharma , Gogel publishing home Meerret.
3. Introduction to chromatography by Nasir-ud-din, Published by author.
4. Paper chromatography by Dr.Friedrich Cramer, London Macmillan and Co Ltd.
5. Thin- layer chromatography by Marini, Elsevier publisher.
6. Modern analytical chemistry by David Harvey, Roohani-art press, Islamabad.
7. Principle and Practice of analytical chemistry by Fillfield, Blackwell Science Ltd.
8. Chromatographic Methods of Analysis by Stock & Rice, Elsevier Co. Amsterdam.

Module Code:	MP 144
Module title:	Analytical Chemistry (Practical)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Potentiometric Measurements:

Potentiometric Determination of Fluoride in Drinking Water Using a Fluoride Ion-Selective Electrode.

Spectrometric Measurements:

Spectrophotometric Determination of Inorganic Phosphorus in Human Serum or Urine.

Chromatography:

Anion Ion Exchange Chromatography Separation of Cobalt and Nickel Followed by EDTA Titration of the Metals Using Back-Titration.

Determination of Sulfate in Urine by Precipitation Titration Following Ion Exchange Separation.

Titrimetry:

Determination of carbon dioxide in air soft drinks etc.

Determination of TDO (total oxygen dissolved) in polluted water samples.

Determination of COD (chemical oxygen demand) in industrial waste water.

Determination of bicarbonate content in blood samples.

RECOMMENDED BOOKS:

1. Vogels, text book of Quantitative chemical analysis by J. Mendham, R. C. Denny, J. D. Barnes, M. J. K. Thomas, Pearson Education Ltd.
2. Vogels, a text book of quantitative inorganic analysis by J. Bassett. The English Language Book Society and Longman.

ANALYTICAL CHEMISTRY (M.Phil 2nd Semester)

Module Code:	MP 241
Module title:	Analytical Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**Advance Chromatographic Techniques-I:**

Gas chromatography; Concept of theoretical plates, Van-Deemter Equation, Instrumentation and Advancements in Gas chromatography including GC-MS, Ion-exchange chromatography, Ion Chromatography;

Advance Chromatographic Techniques-II:

High Performance Liquid Chromatography, Electrophoresis and its various types, supercritical fluid chromatography, Gel permeation chromatography; Affinity chromatography.

Clinical / Drug Analysis:

Common pathological tests; blood and urine analysis; collection and preservation of samples; radio immunoassay; physiological significance of clinical tests; enzymes in diagnosis; trace elements in human body; classification and analysis of narcotics and toxic drugs, automation in clinical analysis.

Electron Spin Resonance Spectroscopy:

Electron behaviour; essential features of ESR spectrometer; interpretation of ESR spectra; hyperfine interaction; the g-factor, Line widths; Spin-label ENDOR and ELDOR, quantitative analysis by ESR.

RECOMMENDED BOOKS:

1. Analytical Chemistry by J.D. Dick, McGraw Hill, 1973, N.Y. also available in International students edition McGraw Hill, Mogakusha, 1973.
2. Instrumental Methods by W. Ewing, Mc Graw Hill Book Co. N.Y. (Third/Fourth Edition) also available in international students edition.
3. New Instrumental Methods in ElectroChemistry by Faul-Delabay, Inter Science Publisher, London, N.Y.
4. Acid bases in Analytical Chemistry by I.M. Koithoff and Burucken stein, Inter Science Publishers Inc. N.Y. London.

Module Code:	MP 242
Module title:	Analytical Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

X-ray Spectroscopy-I:

Nature and Production X-rays, Origin of Spectra; Moseley's Law; Equipment for generation and detection of X-rays; Applications of X-ray emission and absorption methods for chemical analysis;

X-ray Spectroscopy-II:

X-ray fluorescence analysis; Diffraction studies; single crystal analysis; powder method of X-ray diffraction, structural applications of X-ray analysis

RECOMMENDED BOOKS:

1. X-rays and electrons: an outline of recent X-ray theory By Arthur Holly Compton, Van Nostrand company.
2. Analytical Chemistry by J.D. Dick, McGraw Hill, 1973, N.Y. also available in International students edition McGraw Hill, Mogakusha, 1973.
3. Instrumental Methods by W. Ewing, Mc Graw Hill Book Co. N.Y. (Third/Fourth Edition) also available in international students edition.
4. New Instrumental Methods in ElectroChemistry by Faul-Delabay, Inter Science Publisher, London, N.Y.

Module Code:	MP 243
Module title:	Analytical Chemistry (Minor Paper)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Solvent Extraction:

Basic principle of solvent extraction, The Distribution Coefficient, The Distribution Ratio, The Percent Extracted Solvent Extraction of Metals, Analytical Separations, Multiple Batch Extractions, Countercurrent Distribution, Solid-Phase Extraction, Solvent Extraction by Flow Injection Analysis.

2. Electrophoresis:

Capillary Zone Electrophoresis, Application of traditional Electrophoresis
Gel Chromatography.

3. Flame Emission:

Basic principle of atomic spectroscopy; Use of atomic spectra for detection and determination of elements; flame as a source of atomization and excitation; Instrumentation involved in FES; applications and limitations.

4. Atomic Absorption Spectroscopy:

Basic Principle of AAS; Flameless AA spectroscopy including graphite furnace and hydride generation.

RECOMMENDED BOOKS:

1. Vogels, text book of Quantitative chemical analysis by J. Mendham, R. C. Denny, J. D. Barnes, M. J. K. Thomas, Pearson Education Ltd.
2. Advances in electrophoresis by Andrea Chrmambach, Wiley-VCH.
3. Ion-Exchange Chromatography by Helfferich, McGraw Hill Book Co., Inc. N.Y. London.
4. Solvent Extraction by Gorge H. & Morrison Hener, John Wiley and sons, London, N.Y.
5. Chromatographic Methods of Analysis by Stock & Rice, Elsevier Co. Amsterdam.
6. Flow injection analysis by Ruzicke Hassen, Wiley Interscience.

Module Code:	MP 244
Module title:	Analytical Chemistry (Practical)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Advanced Chromatography/Spectrometric Techniques:

Analysis of some drug samples by HPLC.

Determination of sodium by HPLC.

Determination of phosphate by spectrophotometric techniques.

Determination of chloride by spectrophotometric method.

Determination of Ni using DMG: spectrophotometrically.

Estimation of the purity of some organic aromatic compounds by HPLC technique.

Gas Chromatographic Analysis of a Tertiary Mixture.

Qualitative and Quantitative Analysis of Fruit Juices for Vitamin C using High-Performance Liquid Chromatography.

Analysis of Analgesics Using High-Performance Liquid Chromatography.

RECOMMENDED BOOKS:

1. Vogel's, s text book of quantitative inorganic analysis by J. Bassett. The English language book Society and Longman
2. Modern Analytical Chemistry by David Harvey, McGraw-Hill, International Edition.

APPLIED CHEMISTRY (M.Phil 1st Semester)

Module Code:	MP 151
Module title:	Applied Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Material Science:

Introduction to composite material, advantages & applications especially

- (a) Fiber glass:
Forms & types of fiber glass, fiber glass for non woven, fiber glass yarn manufacturing & physical properties
- (b) Aramid fibers:
Chemistry of aramid fibers application, types i.e. Kevlar, Nomex
- (c) Carbon & Graphite fiber:
Buckyballs, diamond and graphite, chemistry of carbon fiber, fiber for textile, carbon-carbon composite

BOOKS RECOMMENDED:

1. Recent Developments in Chemistry, Physics, Material Science and Device Applications, Liming Dai.
2. Nano Chemistry, G.B. Segeer.

Module Code:	MP 152
Module title:	Applied Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Industrial Quality control:

Electromagnetic radiation, nature, absorption & emission, luminescence phenomena, light scattering, instruments of spectroscopy.

- (a) Infrared spectroscopy:
Theory sample preparation, spectra interpretation, applications
- (b) UV / Vis spectroscopy:
Introduction, theory, applications
- (c) Flame photometry / Atomic absorption:
Atomization, flames burners, non flame atomization, applications of emission & absorption.

BOOKS RECOMMENDED:

1. Introduction to Instrumental Analysis, Braun, Mc Graw Hill Book Company, 1987.
2. Instrumental Analysis, Gary D. Cristian, 1978.
3. Organic Spectroscopy, Dr. Younas.

Module Code:	MP 153
Module title:	Applied Chemistry (Minor Paper)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Environmental Impact of chemical industries:

The environment & human interaction, sources of pollution, control and treatment of pollution and wastes from industrial sites, control of atmospheric, aquatic and disposal of solid waste, health and safety at work and hazards of the chemical industry especially toxicity and exposed to chemicals.

BOOKS RECOMMENDED:

1. Environmental Chemistry, Stanely E. Manahan.
2. Environmental Pollution and Control in Chemical Process Industries, S. C. Bhatia, Khanna Publishers, 2005.

Module Code:	MP 154
Module title:	Applied Chemistry (Practical)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Preparations

Paper pulp; Pressure sensitive adhesive tapes: Wax Emulsions

Atomic absorption spectroscopy

Determination of magnesium in tap water, food, leaves etc.

Determination of manganese and selenium in tea leaves.

Titrimetry

Determination of silver ions in waste residues of photographic developers by potentiometry.

Calculation of the basicity of an unknown acid by conductometry

Calculation of the strength of acid by potentiometric titration

Spectrophotometry

Simultaneous determination of manganese and chromium in the given sample of steel by spectrophotometry.

Verification of deviations from Beer-Lambert's law.

Assay of pharmaceutical products like aspirin, paracetamol, and chloramphenicol using spectroscopic techniques.

Determination of sucrose in sugar cane juice using plorimetry.

BOOKS RECOMMENDED:

1. Applied Chemistry Theory and Practice, O.P. Vermani & A.K. Narula, Wiley Eastern Limited (1989).
2. T. B. of Quantitative Inorganic Analysis, Vogel's Ed-4th, Longman Group Limited (1978).
3. Practical Statistics for the Analytical Scientist, A Bench Guide, RSC Publishing, LGC Ltd 2009.

APPLIED CHEMISTRY (M.Phil 2nd Semester)

Module Code:	MP 251
Module title:	Applied Chemistry (Major Paper-I)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Fuel Technology & Renewable Energy Sources:

Introduction, sources of fuel and energy, solid fuels as coal and other, liquid fuels petroleum and other, gaseous fuels natural gas, producer gas, LPG etc., Renewable energy sources as solar energy, geothermal energy, water and wind energy sources.

BOOKS RECOMMENDED:

1. Industrial chemistry, B. K. Sharma, Krishna Prakashan Media (P) Ltd., Ed-15 (2006).
2. Shereve's Chemical Process Industries, 5th Ed.1975, G.T.Austin, McGraw Hill Book Co. New York.
3. Petroleum Refining Technology, Ram Parsad (2002)
4. The Chemistry and Technology of Petroleum, James G. Speight (1991).

Module Code:	MP 252
Module title:	Applied Chemistry (Major Paper-II)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

1. Nano Chemistry and Technology:

Introduction to nano-material science; synthesis of nano-materials and fabrication of nanoscale materials. Concept of nano-junction and design material with target properties. Nano technology for molecular organized assemblies.

2. Rubber Industry:

Historical background, general classification of rubber; Properties and manufacturing of natural rubber, synthetic rubber. Rubber fabrication and rubber compounding. Latex compounds and rubber derivatives.

BOOKS RECOMMENDED:

1. Recent Developments in Chemistry, Physics, Material Science and Device Applications, Liming Dai.
2. Nano Chemistry, G.B. Segeer.
3. A Chemical Approach to Nanotechnology, Geoffrey A Ozin, Andre'C Arsecnault.
4. Rubber Chemistry, J. A. Brydson, Applied Science Publishers, 1978.
5. Development in Rubber Technology, A. Whelam and K. S. Lee, Applied Science Publishers, 1979.

Module Code:	MP 253
Module title:	Applied Chemistry (Minor Paper)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Water and Industrial Effluent Treatment:

Water for industry, water as a solvent, quality characteristic of water, softening of water by classical methods, demineralization of water, industrial water treatment modern methods as reverse osmosis, magnetic treatment, electro dialysis etc. disadvantages of scale formation in boiler and their removal.

Problems of industrial waste, types of wastes, treatment of wastes or effluents with organic & inorganic impurities, effluent purification and their treatment methods.

BOOKS RECOMMENDED:

1. Environmental Chemistry, Stanely E. Manahan.
2. Environmental Pollution and Control in Chemical Process Industries, S. C. Bhatia, Khanna Publishers, 2005.
3. Environmental Chemistry, B. K. Sharma.

Module Code:	MP 254
Module title:	Applied Chemistry (Practical)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

Preparations

Paris green(insecticide); β -naphthol: Thermo and Thermosetting Resins, Urea Formaldehyde

High pressure liquid chromatography

Assay of analgesics

Qualitative and quantitative analysis of different fruit juices for vitamin-C.

Dying of the cellulose fabric and development of shades of different depth.

Determination of cetane number of the diesel fuel by aniline point.

Determination of the flash and fire point in the liquid fuel.

ICP Analysis

Quantitative analysis of heavy metals in Blood, Urine, and various plants at low levels by ICP.

Spectrophotometry

Determination the pK value of methyl orange and methyl red by spectrometry

Verification of Beer Lambert Law

Miscellaneous

Extraction of oils from cloves, rose, orange peels by steam distillation

Recovery of Chromium from tannery wastewater.

BOOKS RECOMMENDED:

1. Applied Chemistry Theory and Practice, O.P. Vermani & A.K. Narula, Wiley Eastern Limited (1989).
2. T. B. of Quantitative Inorganic Analysis, Vogel's Ed-4th, Longman Group Limited (1978).
3. Practical Statistics for the Analytical Scientist, A Bench Guide, RSC Publishing, LGC Ltd 2009.

BIOCHEMISTRY (M.Phil 1st Semester)

Module Code:	MP 161
Module title:	Biochemistry (Major Paper-I)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:**Inborn Errors of Metabolism:**

Genetic Disease involving disorders of metabolism i.e. inherited metabolic diseases. Disorders of carbohydrate metabolism e.g. Glycogen storage disease. Disorders of amino acid metabolism e.g. Phenylketonuria, maple syrup urine disease, glutaric acidemia type 1. Disorders of organic acid metabolism e.g. alcaptonuria. Disorders of fatty acid oxidation e.g. medium chain acyl dehydrogenase deficiency (glutaric acidemia type 2). Disorders of Purine/pyrimidine metabolism e.g. Lesch-Nyhan syndrome. Disorders of steroid metabolism e.g. congenital adrenal hyperplasia. Disorders of mitochondrial function e.g. Kearns-Sayre syndrome. Lysosomal storage disorders e.g. Gauchers disease and Niemann Pick disease.

RECOMMENDED BOOKS:

1. Inborn error of Metabolism (2009), Archbald E. Garred Pub: Bibliolife, USA.
2. Inborn errors of Development (2003), Charles J. Epstein, Robert P. Erickson, Anthony Wynshaw-baris Pub: Oxford University Press.
3. Biochemistry (200), Alexander C. Brownie, John C, Kernohan, Pub: Churchill Livingstone.
4. Human Biochemistry (2001), James M. Orten, Otto, W. Neuhauis, Pub: Molsby.
5. Hoffmann, G. F; Nayhan, W. L; Zschocke, J; Kahler, S. G; Mayatepek, E. (2001) " Inherited Metabolic Diseases". Lippincott Williams and Wilkins.
6. Fernandes, J; Saudubray, J. M; van den Berghe, G; Walter, J. H. (2006) " Inborn Metabolic Diseases: Diagnosis and traetment (4th ed) Springer.
7. Murray J. Favus "Primer on the Metabolic Bone Diseases And Disorders of Mineral Metabolism" 2006, ed: 6th Publisher; Amer. Society for Bone & Mineral

Module Code:	MP 162
Module title:	Biochemistry (Major Paper-II)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Food and Nutrition:

Food composition and analysis. Role of minerals in animal body e.g. Calcium, Phosphorous, Magnesium, Potassium, Sodium and Iodine. The disorders associated with their excess or deficiencies such as; Hypophosphatemia, Osteomalacia, Ricketts, Rhabdomyolysis, Hyperparathyroidism, Hypothyroidism, Obesity. Assessment of nutritional status in Pakistan. Wastage of food components in cooking and processing, Preservation of food. Food infections and natural toxins of food. Thermogenic effects of food. Disorders of nutrition. Food microbiology and enzymology. . Malnutrition and its assessment

RECOMMENDED BOOKS:

1. Human Nutrition and Diabetics (1998) J.S. Garron, W.P.T James, Pub: Churchill Livingstone.

Module Code:	MP 163
Module title:	Biochemistry (Minor Paper)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Cell structure and function:

Organization of cells. Structural features of prokaryotic and eukaryotic cells. Study of cellular components. Chemistry of mono, oligo and polysaccharides. Glycoproteins and proteoglycans. Amino acid chemistry, classification and properties. Proteins, classification and organization levels. Lipid chemistry and classification. Biological significance of Carbohydrates. Proteins and lipids.

RECOMMENDED BOOKS:

1. Principles of Biochemistry by Lehninger AL, Nelson DL and Cox MN, 2000 Pub: worth Publishers.
2. Biology by Campbell. N. A and Reece. J. B. 7th ed. 2004 Pub; Benjamin- Cummings Publishing Co.
3. Biology: The Unity and Diversity of Life by Cecie Starr and Ralph Taggart 11th ed. 2005 Pub: Brooks Cole.

Module Code:	MP 164
Module title:	Biochemistry (Practical)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

1. Experiments will be designed to use, Polyacrylamide gel electrophoresis including SDS PAGE. Southern, Northern and Western Blot analysis.
2. Every student will be assigned a project to isolate, purify and characterize an enzyme or protein from a plant/ animal source. Students will be required to submit the report in the format of thesis.

RECOMMENDED BOOKS:

1. An introduction of Practical Biochemistry, (1987), D.T. Plummer, Pub: McGraw Hill.
2. The Basic Protein and Peptide Protocol (1994), J.M. Walker, Pub: Humana Press.
3. Handbook of Molecular and Cellular Methods in Biology and Medicine P.B. Kaufmann, w.Wu.L.J. Greke (1995) Pub: CRC Press.
4. Protein Method, D.M. Bolleg, M.D. Rozycki, S.J. Edelstein (1996), Pub: Wiley-Liss.
5. Methods of Protein Analysis (1994),
6. R.A. Copeland, Pub: Chapman and Hall.

BIOCHEMISTRY (M.Phil 2nd Semester)

Module Code:	MP 261
Module title:	Biochemistry (Major Paper-I)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Carcinogenesis:

Oncogenesis. Tumor cell morphology and behaviour. Types of tumour cells. Viruses and tumor. Chemical and other toxic carcinogens. Mechanism of Carcinogenesis. Environmental carcinogens. Genetic Carcinogenesis. Biochemistry of Malignant cells. Invasiveness and metastasis. Growth of cancer. Chemotherapeutic agents, cytotoxic agents, Antimetabolites, Antagonists as purine antagonists etc, and Antibiotics.

RECOMMENDED BOOKS:

1. Medical Biochemistry (1992), N.N. Bhagwan, Pub: Jones and Bartlett. Boston.
2. Principles of cell and Molecular Biology (1995), L.J. Kleinsmith, V.M. Keish, Pub: Herpe Collis.
3. Current Literature.

Module Code:	MP 262
Module title:	Biochemistry (Major Paper-II)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Current topics in Biochemistry:

This course will be offering a comprehensive knowledge on the current research topics going on in biochemistry with special reference to the recent advancements in molecular biology, as recombinant DNA technology, Isolation and manipulation of gene, gene therapy etc.

RECOMMENDED BOOKS:

1. Current Literature available on websites.
2. Molecular Cell Biology (2000) Lodish H. Berk et al, Pub: W.H. Freeman and company.
3. Applied Molecular Genetics (1999), R.L. Miesfield. Pub: Wiley Liss.
4. Principles of Cell and Molecular Biology (1995), L.J.Kleinsmith, V.M. Kish, Pub: Haper Collins.
5. Gene expression in Recombinant Microorganisms (1995), A.Smith, Pub: Marcel Dekkar, NewYork.
6. Molecular Biology, Robert F. Weaver (2007) Pub: McGraw Hill Science.

Module Code:	MP 263
Module title:	Biochemistry (Minor Paper)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Membrane Structure –Functions:

Membrane structure and functions. Fluid mosaic model, membrane proteins. Electrical properties of membranes. Movements of molecules/ions through membrane channels and pores. Passive and active mediated transport phenomenon. Ionophores, biosignalling.

RECOMMENDED BOOKS:

1. Transport and Receptor Proteins: Molecular Structure and function (1992), Clarkson DT and Cook DT Pub: Plencum Press.
2. Membrane Structure and Functions, John Thornborough (1995), Pub: McGraw Hill.

Module Code:	MP 264
Module title:	Biochemistry (Practical)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	4 credits

SYLLABUS OUTLINE:

1. Practicals will be designed to involve techniques like Elisa, immuno-dotblot, immunoprecipitation technique. Radioimmunoassay. Antibody production
2. Every student will be given a research project and they will be required to prepare a research review . They will submit there review report and give an oral presentation of it.

RECOMMENDED BOOKS:

1. A Biological guide to Principles and Techniques of Practical Biochemistry (1991), K.Wilson, K.H. Goulding Pub: ELBs.
2. Consultation pf recent literature.

MATHEMATICS (M.Phil 1st Semester)

Module Code:	MP 110
Module title:	Mathematics (Theory)
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Concept of Function, Rate of change, Rate of change by definition, Differentiation and their techniques, Power rule, Chain rule, Derivatives of trigonometric, exponential and logarithmic functions, Implicit and explicit differentiation, Applications of derivatives, Introduction to indefinite integral, Techniques of integration. Applications of integration, Partial Derivatives, Introduction to 1st order differential equations, Solutions of ordinary differential equations with initial and boundary conditions, Applications of linear differential equations.

BOOKS RECOMMENDED:

1. Thomas Calculus, 11th Edition Wesley publishing company, 2005.
2. H. Anton, I. Bevens, S. Davis, Calculus 8th Edition, Jhon Willey & Sons Inc. 2005.
3. Frank A. Jr. Elliott Meldelson, Calculus, Schaum's Outline series, 4th Edition 1999.
4. Differential Equations with Boundary value problems, 3rd Edition, Dennis G.Zill.
5. Erwin Kresyzig, Advanced Engineering Mathematics, John Wiley Sons, 2004.

STATISTICS (M.Phil 2nd Semester)

Module Code:	MP 210
Module title:	Statistics (Theory)
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	2 credits

SYLLABUS OUTLINE:

Introduction to Statistics, Application of statistics in various fields of Chemistry, Variables, their types and level of measurements, Introduction to SPSS, Creating SPSS files for data entry, Editing and Manipulating SPSS files, Data Exploration Techniques, Descriptive statistics, Sampling issues in laboratory experiments, Testing of hypothesis, Regression analysis, Correlation analysis, The One-factor between subjects experiment (ANOVA).

BOOKS RECOMMENDED:

1. Statistical Analysis Methods for Chemists: A software Based Approach by William P. Gardiner. ISBN: 987-0-85404-549-5.
2. Statistics and Chemometrics for Analytical Chemistry, 4/E by James Miller, Prentice Hall.
3. Statistical Methods in Analytical Chemistry, 2nd Ed. by P. C. Meier and R. E. Zünd ISBN: 978-0-471-29363-7.
4. Statistical Treatment of Analytical Data by Alfassi, Zeev. CRC Press. ISBN: 084932436X.
5. Chemometrics: Statistics and Computer application in Analytical Chemistry, John Wiley, ISBN: 352729628X.

SEMINAR / SPECIAL PROBLEMS (M.Phil 1st Semester)

Module Code:	MP 120
Module title:	Seminar / Special Problems
Name of Scheme:	M.Phil 1st Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	1 credit

SYLLABUS OUTLINE:

Seminar / Special Problems will be conducted as per the criteria decided.

SEMINAR / SPECIAL PROBLEMS (M.Phil 2nd Semester)

Module Code:	MP 220
Module title:	Seminar / Special Problems
Name of Scheme:	M.Phil 2nd Semester
Department:	Institute of Chemistry
Faculty:	Science
Module Type:	Compulsory
Module Rating:	1 credit

SYLLABUS OUTLINE:

Seminar / Special Problems will be conducted as per the criteria decided.