

# Forman Christian College



Estd 1864

**MPhil Program**

**Policies and Student's Guide**

**2011**

**Department of Chemistry**

**Forman Christian College (A Chartered University); Ferozpur  
Road, Lahore**

## **1- Admission Policies:**

Forman Christian College offers MPhil degree program in chemistry with the following majors of specialization; Applied Chemistry, Inorganic-Analytical Chemistry, Organic-Biochemistry and Physical Chemistry. A candidate may select any one of the above fields of chemistry as his/her major.

### **Admission requirements:**

- 4-year baccalaureate degree from a HEC recognized local or foreign university, with major in Chemistry or a related field and a minimum of 2.5CGPA. Or
- Conventional MSc in chemistry or a related field with a minimum 60% marks or 2.5 GPA.
- Graduate Assessment Test ( GAT).
- FC College Aptitude Test in Chemistry (FATC).
- Provisional admission can be sought by students awaiting final results. Such candidates must also meet all other eligibility conditions.
- Applicants with a strong background in mathematics or research experience or relevant service experience will be preferred.

## **2- Admission Procedure:**

Admission procedure starts with appearance of advertisement in newspapers and/or on website of Forman Christian College.

- A candidate can seek admission in only one field of specialization; anyhow, if he/she intends to apply in two or three disciplines, separate admission forms for each discipline must be submitted.
- A candidate has to pass the FC College test in that given field of specialization.
- Field of specialization cannot be changed after completion of admission procedure in any one of the fields.

### **3- Major and Minor Courses:**

Chemistry Department offers 4 major fields of specialization.

- After admission in a chosen major, a candidate is required to choose a minor field of study as well.
- Minor field once selected, is not changed, a course within the minor field can be changed after necessary changes in record in the academic office.
- A student must complete all requirements of the major field as given in the program structure in M.Phil Brochure.
- All major course credits must be completed/passed prior to taking the comprehensive examination.
- Minor requirement is six credits from the offered courses. Minor course registration will be approved by the department. Once selected minor course can be changed within the specified period but strictly according to the policies of the department.
- After the specified period any selected/registered course can be dropped but its alternate cannot be registered in that semester.

### **4- Research Project and thesis:**

Research is a full one year project assigned and approved by the department.

- Research project will be decided and approved by the concerned section.
- During research period each student will present two research seminars of one credit each. The objective is to evaluate research progress by the concerned section.
- Research project should be completed within the specified time and research thesis should be submitted to the department for evaluation and defense.
- Research thesis will be accepted only if it meets formatting and writing standards of the department.
- Research thesis will be evaluated by the external examiner appointed by the department with the approval of Rector.

## **5- Registration Procedure:**

Registration of the semester courses is conducted for each semester by the academic office. Registration forms filling instructions and help are available from the advisor assigned by the department.

- Registration forms can be obtained from the academic office and after filling can be get signed from the advisor. In case of absence of the advisor, this form can be get signed by the chairman of chemistry department.

## **6- Fee Structure and Procedure:**

Fee structure is available on Forman Christian College University website ([www.fccollege.edu.pk](http://www.fccollege.edu.pk)). Dues are submitted for full academic year and installment plans are also available.

## **7- Courses Repeat Procedure:**

Courses can be repeated in the following situations:

- If a student fails in a certain course or he/she drops a course during a semester.
- If CGPA of a student is less than the minimum CGPA criteria (2.5) for research.
- Course can be repeated only when it is being offered by the department for that semester.
- Repeating a course involves new registration through the academic office and payment of necessary dues.
- Department of chemistry allows only one chance to repeat course/s in which he/she failed.
- In case of CGPA below 2.5 a student can repeat one or two courses to improve his/her CGPA.

## 8- Course Details:

### **CHEM 500 Advanced Environmental Chemistry**

#### **Course Module Credits: 3**

Global change, Energy flows and supplies, Energy utilization and storage: Environmental radiation and radioactivity, nuclear energy and waste disposal, Biogeochemical cycling of chemicals, sewage and fertilizers, radiation and molecules.

### **CHEM 502 Materials Chemistry I**

#### **Course Module Credits: 3**

Materials selection and development: the problems, the three families of materials, metals, ceramics, polymers, the structure of materials, bonding forces in different materials, Solid phase transformation in metals, Effect of addition of other elements on the structure of pure metals, solid solutions, new phases, intermediate phases, super alloys, processing, specification, and applications of ceramics, plastics (high polymers): structures, polymerization types, processing methods, properties and applications of plastics; corrosion of materials: Ceramics and plastics. Economic, Environmental and Social Issues in Environmental Science and Engineering.

### **CHEM 503 Material Chemistry II**

#### **Course Module Credits: 3**

Electrical properties of materials, Magnetic properties of materials, Optical and thermal properties of materials, semiconductors, super conductors, thin films, Introduction to Nanotechnology, Properties of individual nano particles, metal nano clusters, semi conducting nano particles, Rare Gas and molecular clusters, methods of synthesis.

## **CHEM 505 Industrial Chemistry**

### **Course Module Credits: 3**

Industrial carbon, characteristics and their applications, Petroleum and petrochemicals, Essential oils, distillation of Essential oils, Factors affecting efficiency of distillation, perfumery and attars, Medicinal plants, extraction of medicinal plants, emerging opportunities, Biocides, Allelochemicals, New chemicals, storage and preservations, value addition, eco technology, natural oil, fats and waxes.

## **CHEM 507 Environmental Management**

### **Course Module Credits: 3**

Environment management strategies, legal issues, laws and by laws, law enforcing agencies, Impact Assessment.

## **CHEM 520 Thermal Methods of Analysis**

### **Course Module Credits: 3**

The scope of thermal methods, Applications of thermal analysis, Instrumentation and techniques of thermogravimetry, Thermogravimetric curves and their interpretation, Nature and instrumentation of differential thermal analysis and differential scanning calorimetry, Practical procedure and applications of DTA and DSC, Applications of DTA and TGA in cement, Clay, Minerals, Drugs and Polymers etc.

## **CHEM 524 Inorganic Electronic Spectroscopy**

### **Course Module Credits: 3**

Brief introduction of Group Theory ,Term symbols, Russel Saunders coupling scheme, development of correlation and Tanabe-Sugano diagrams, Crystal field and Ligand field diagrams.Energy level calculations; Selection rules, Band Intensities and Band assignments. Interpretation of Crystal Field and Charge Transfer spectra. Spectra of low symmetry complexes. Application of group theory to vibrational spectra of simple and coordination compounds.

### **CHEM 525 Bio-Inorganic Chemistry**

#### **Course Module Credits: 3**

Development and importance of Bio-inorganic chemistry, Introduction to metals and nonmetals and their biological importance, Functions of metals in enzyme catalysis. Dioxygen Carriers and Dioxygen reactions, Metal ions and Chelating agents for medicinal purposes. , Nitrogen fixation; vitamin B6 and B12. Pumps and Transport proteins.

### **CHEM 526 Analytical Techniques**

#### **Course Module Credits: 2+1**

Separation techniques, Gas chromatography, High performance liquid chromatography, Capillary electrophoresis, 2) Polarography and advanced voltammetric techniques, 3) Fluorescence Spectroscopy

### **CHEM 527 Chemistry of Non Aqueous Solvents**

#### **Course Module Credits: 3**

Classification of solvents , Physical and chemical properties and reactions in the following non aqueous solvents:Liquid ammonia , Acetic acid , Sulphuric acid ,

Fluorosulphuric acid , Bromine trifluoride and hydrofluoric acid . Reactions in molten salt systems, Scope of non-aqueous solvents

### **CHEM 528 Mechanisms of Inorganic Reactions in Solution**

#### **Course Module Credits: 3**

Introduction, Substitution reactions of metal octahedral, square planar and tetrahedral complexes, Oxidation-reactions of metal ions, Outer sphere and inner sphere reactions , Inorganic and organic bridging , Groups in inner sphere reactions , Reactions of various metals such as Thallium , Uranium , Plutonium,etc, Metal ions catalysed reactions , Reactions of oxoanions: reactions of Hypobromite and Hypochlorite , Oxygen exchangers of bromate , chlorate , Iodate , Periodate with water.

### **CHEM 530 Frontiers In Inorganic / Analytical Chemistry**

#### **Course Module Credits: 1**

Topics under recent investigation and of current interest (the choice will depend upon the interests of the teacher giving this course).

### **CHEM 540 Advanced Heterocyclic Chemistry**

#### **Course Module Credits: 3**

A detailed chemistry of heterocyclic compounds containing one or more hetero atoms, their reactivity, synthesis, and applications, stereochemistry and spectroscopy; fused ring systems, heterocyclic compounds with seven membered rings; a review of naturally occurring heterocyclic compounds.

### **CHEM 541 Chemistry of Isoprenoids and Polyphenols**

**Course Module Credits: 3**

Study of isoprenoids and polyphenols as typical natural products: Distribution of terpenoids and polyphenols in living organisms; structure, reactivity/ reactions and physiological activities of terpenoids and flavonoids; biosynthesis of natural products with special reference to terpenoids and flavonoids; synthesis of some monoterpenoids and flavonoids; medicinal applications; isolation and separation techniques, detection and structural elucidation of terpenoids and polyphenols.

### **CHEM 542 Advanced Spectroscopy of Organic Compounds**

**Course Module Credits: 3**

Structural elucidation using Mass spectrometry and NMR spectroscopy. Electron impact and chemical ionization, field ionization, field desorption, higher resolution mass spectrometry (HRMS); fast atom bombardment (FAB), Fragmentation pattern of common functional groups; Structure elucidation using mass spectrometry in conjunction with other spectroscopic techniques.

1D and 2D NMR spectroscopy: chemical shift, spin-spin coupling; homo- and heteronuclear 2D shift-correlated spectroscopy and Application of NMR to structure determination, stereochemistry and dynamic studies.

### **CHEM 545 Advanced Biochemistry I**

**Course Module Credits: 3**

Advanced Enzymology; mechanism and kinetics of enzyme catalysis, types of enzymatic catalysis, cofactor and co-enzymes, role and chemistry of NADH and FADH<sub>2</sub>, substrate folding, squalene and oxidosqualene cyclases, enzyme

inhibition and regulation, Transport of oxygen and carbon dioxide, buffer solutions and regulation of blood pH.

### **CHEM 546 Advanced Biochemistry II**

#### **Course Module Credits: 3**

Concepts and pathways in metabolism, interconnection of metabolic pathways, metabolic profile of organs, metabolic changes by food intake and starvation, effect of ethanol on metabolic processes in liver; Glycogen break down, phosphorylation, Epinephrine and glycogen signals, Pathway of glycogen synthesis and regulation of glycogen metabolism. Amino acids biosynthesis and regulation.

### **CHEM- 563 Mathematics for Chemists**

#### **Course Module Credits: 3**

#### **Course Description:**

The course begins with a review of the basic mathematical and statistical tools, as covered in the required prerequisites (*two semesters of single variable calculus, introductory linear algebra and introductory statistics*). It continues with the introduction of advanced tools particularly suited to chemical applications. These include first and second order ordinary differential equations, with elementary analytical methods for exact solutions and common numerical methods for approximate solutions, the basics of multivariate calculus with partial differentiation and multiple integration, techniques for solving partial differential equations, either exactly or approximately, differential equation based dynamical systems and operator based methods for their solution, basic probability distributions and their use in constructing error estimates and simulations, and the use of linear transformations, including the determination of eigenvalues and eigenvectors.

## Physical Chemistry Courses

### **CHEM 560 Surface Chemistry**

#### **Course Module Credits: 3**

Physical and chemical properties of solid surfaces; thermodynamics and kinetics of gas chemisorption; chemical bonding at surfaces; applications to catalysis and electronic materials, differentiation between physical absorption and chemisorption. Adsorption of gases on solids and influence of temperature and pressure on gaseous adsorption. Types of van der waals adsorption, BET adsorption isotherm and its interpretation . Other industrial applications of adsorption of gases and solutions on solids (such as gas masks and silica gel as drying agents etc.) Adsorption isotherm of dilute solution of solids. Gibbs equation, its verification, Gibbs isotherm and the interpretation of adsorption data. Ionic and non-ionic surfactants, flotation reagents, and their mechanism for the removal of dirt particles from fabrics. Surfactants, flocculating and dispersing agents.

### **CHEM- 561 Spectroscopy-I**

#### **Course Module Credits: 3**

Basic theory of interaction of molecules with the electromagnetic field, microwave, chemiluminescence, fluorescence, phosphorescence, light scattering and refractometry, radiationless processes and photochemical transformations, Rotational, vibrational, and electronic spectra of molecules; multiphoton spectroscopy, elements of lasers.

## **CHEM- 562 Electron Microscopy**

### **Course Module Credits: 3**

A survey of advanced methods of characterization including SEM, TEM, AES, STM, AFM and ESCA.

## **CHEM- 564 - Advanced Chemical Kinetics**

### **Course Module Credits: 3**

Rate laws and mechanism of elementary steps of polymerization reactions, thermodynamic interpretation of reaction rates, fast reactions and their methods of study, catalyzed reactions, detailed concept of potential energy surfaces, Rice-Herzfeld chain reaction, explosion of hydrogen and oxygen reaction, mechanism of photochemical and radiochemical reactions, statistical theories of kinetics, study of reactions in electrical discharges, chemical action of high energy radiations, investigating the mechanism and kinetics of reactions by tracers of elements.

## **CHEM- 565 Advanced Quantum Chemistry.**

### **Course Module Credits: 3**

Wave equations, amplitude equation, physical meaning of wave functions, free particle motion, schrodinger wave equation, one electron atom , two electron atom, solution of the problem of an atom (Ion) . Atom (ion) with electrons, atom (ion) with large number of electrons. Systematic atomic state: multiplet structure of atomic turns. Atom(ion ) with one outer electron, terms of atoms with any number of electrons, intensity of spectral lines, atomic spectra & their applications.

## **CHEM- 566 Advanced Topics in Physical Chemistry**

### **Course Module Credits: 3**

Chemistry of the solid state; electron spin resonance; lasers and nonlinear spectroscopy; molecular dynamics; molecular quantum mechanics; microwave, NMR and ESR spectroscopy, quantum theory of angular momentum, group theory, tensor operators, time-dependent perturbation theory, variational methods, degenerate and nondegenerate perturbation theory, and molecular orbital theory, particle and photon scattering: photophysics and photochemistry; radiation and nuclear chemistry; theory of gas phase kinetics.

## **CHEM- 580 Research Thesis**

### **Course Module Credits: 14**

A research project for two semesters.

## **CHEM-581 Research Seminars.**

### **Course Module Credits: 2**

Two research seminars for one semester each during the research period.