#### **School of Chemical and Material Sciences**

## **Courses List**

| Course Code    | Course Title                       | Credit Structure |   |   |   |
|----------------|------------------------------------|------------------|---|---|---|
|                |                                    | L                | Т | Р | С |
| CH801/CH802    | Trends in Chemistry                | 3                | 0 | 0 | 6 |
| CHS801/CHS802  | Graduate Seminar                   | 2                | 0 | 0 | 4 |
| CHL801/CHL802  | Analytical Techniques Laboratory   | 2                | 0 | 4 | 8 |
| CH 811/CH 812  | Advanced Inorganic Chemistry       | 3                | 0 | 0 | 6 |
| CH 813/ CH 814 | Advanced Organometallic Chemistry  | 3                | 0 | 0 | 6 |
| CH 841/ CH 842 | Application of spectroscopy        | 3                | 0 | 0 | 6 |
| CH 843/ CH 844 | Methods in Organic Synthesis       | 3                | 0 | 0 | 6 |
| CH 845/ CH 846 | Stereochemistry and Asymmetric     | 3                | 0 | 0 | 6 |
|                | Synthesis                          |                  |   |   |   |
| CH 871/ CH 872 | Quantum chemistry                  | 3                | 0 | 0 | 6 |
| CH 873/ CH 874 | Light matter interaction           | 3                | 0 | 0 | 6 |
| CH 875/ CH 876 | Statistical thermodynamics and its | 3                | 0 | 0 | 6 |
|                | applications to chemical systems   |                  |   |   |   |

# CH801/CH802 Trends in Chemistry 3-0-0-6

The contents for this course will be decided by the respective instructors. The course will be covering different aspect of chemistry and introduce the students towards modern scientific research happening across the globe.

## CHL801/CHL802 Analytical Techniques Laboratory 2-4-0-8

Safety methods in chemistry laboratories, Schlenk technique; Modern instrumentation and operation of UV-vis, IR spectrophotometers, fluorescence spectrometer, HPLC-MS, Thermogravimetry, Cyclic Voltammetry (or any other techniques). Data handling and interpretation of selected techniques.

CHS 801/ CHS 802 Graduate Seminar 2-0-0-4

Structure and bonding, molecular orbital theory emphasizing general concepts and group theory; ligand field theory; angular overlap methods; application of physical methods to predict the geometry, magnetism, and electronic spectra of transition metal complexes; reaction and mechanism of metal complexes; chemistry of selected transition metals.

### CH 813/ CH 814 Advanced Organometallic Chemistry 3-0-0-6

Structure and bonding, 18 electron rule, MO theory, different classes of ligands in organometallic compounds (N2, O2, H2, CO, NHC, Cp, NO, C2H4, C2H2 etc.), general reactions and mechanism, applications of organometallic compounds in catalysis, biology and optics. Special topics from recent developments.

### CH 841/ CH 842 Application of spectroscopy 3-0-0-6

Organic spectroscopy: NMR spectroscopy for structural elucidation of organic compounds (Basic principles, 1D-NMR, 2D-NMR), Mass Spectroscopic techniques (Principle, Instrumentation and Data Analysis), Infra-red and UV spectroscopy of organic compounds (Characteristic absorptions of functional groups), Structural elucidation using combination of spectral data

Inorganic spectroscopy: Optical spectroscopy of coordination compounds, infrared spectroscopy of coordination compounds, multinuclear NMR with hereto atoms, VT NMR and reaction monitoring, Mass spectroscopy of coordination compounds. Special topics from recent developments.

#### CH 843/ CH 844 Methods in Organic Synthesis 3-0-0-6

Different types of Olefination reactions (Wittig, HWE, Peterson, Julia, McMurry), Olefin Metathesis, Cross-Coupling reactions (Suzuki, Buchwald-Hartwig, Heck, Sonogashira, Negishi, Hiyama etc.), Cycloaddition reactions (Diels Alder, Dipolar, 2+2+2 etc.), Application of classical reactions in Natural and Non-natural product synthesis, Asymmetric Catalysis (Metal-chiral ligand, organocatalysis), Synergistic Catalysis, C-H Functionalization Methods, Modern photochemical methods

#### CH 845/ CH 846 Stereochemistry and Asymmetric Synthesis 3-0-0-6

Stereochemical principles (Stereo-isomerism, Optical isomerism, diastereoisomers, torsional isomerism, atropisomers, determination of absolute configuration, conformational analysis and impact on reactivity), Asymmetric Catalysis (Need, biological relevance, modern methods such as metal-chiral ligand complexes, organocatalsis etc., modes of stereoinduction, stereochemical models)

Need for quantum theory, Postulates in Quantum chemistry, Uncertainty principle, Exactly solvable models in Quantum chemistry: particle in a box, Harmonic oscillator, Rigid rotor, Hydrogenic systems. Approximate methods: Variation theorem and perturbation theory, Multi electron atoms, Bonding in diatomic molecules, time dependent perturbation theory.

### CH 873/ CH 874 Light matter interaction

3-0-0-6

Introduction to spectral energy domains and measurement of spectra, Implications of discrete energy levels, Population of States – Boltzmann Distribution, Time dependent perturbation theory, Selection rules, Atomic spectra, Rotational and vibrational spectroscopy of molecules. Raman spectroscopy. Electronic spectroscopy of molecules in their ground and excited states. Impact of group theory on spectroscopy. Mechanism of spin relaxation and their impact on NMR spectroscopy of simple systems.

# CH 875/ CH 876 Statistical thermodynamics and its applications to chemical systems 3-0-0-6

Concepts of distribution, thermodynamic probability and most probable distributions. Thermodynamic ensembles. Partition functions. Applications of statistical thermodynamics to Ideal gases, Electrolytes in solutions, Theories of reaction rates in gases and solutions, Polymers.