**C H E M I S T R Y 3**

**C O U R S E O U T L I N E**

**2019**

**CHEMISTRY 3** is divided into two courses:

**CHE301** - lectured from February to June and **examined in June** by **two 3-hour papers**, and

**CHE302** - lectured from July to October and **examined in November** by **two 3-hour papers**.

Normally a student will register for both courses at the beginning of the year, but one course could be taken alone.

Each week there are 5 lectures and 4 practical hours. Practical and theory tests and tutorial assignments may be set.

**MINIMUM ENTRY REQUIREMENT:**

To register for either CHE301 or CHE302, credits for both CHE201 and CHE202 (or an ACR (aggregated credit) for CHEMISTRY 2 are required.

**MID-SEMESTER DEPARTMENTAL TESTS** **& MID-TERM DEPARTMENTAL TESTS**:

The Mid-semester test will be in the same format as the end-of-semester examination. It will be held in:

**Barratt Lecture Theatre 1** at **7:00 pm** on

**Wednesday 17th April and Wednesday 4th September 2019**.

(Any changes to the mid-term test dates, times and venues may be announced later.)

The marks for these tests will be included in the Final Mark as detailed below.

**FINAL MARK:** for each semester course comprises:

60% from the combined marks for the two theory papers.

10% from the mark for the mid-semester/mid-term Departmental tests

10% from the combined coursework continuous assessment tasks marks.

20% from the marks for the practical course modules, as follows:

**CHE301** 10% from the Physical practical course marks; and

10% from the Organic practical course marks.

**CHE302**  10% from the Inorganic practical course marks; and

10% from the Research Internship Project marks.

**CREDITS:**

To obtain a credit in either course the **OVERALL** mark for that course must be **AT LEAST 50%** with **AT LEAST 40%** subminimum in the combined **THEORY** papers.

In addition, credits must have been obtained in any **TWO** ancillary subjects from Physics: (e.g. 101, 102), Mathematics, Computer Science, or Statistics.

An Aggregated Credit (**ACR**) will be awarded for **CHEMISTRY 3** - if the total combined marks for CHE301 and CHE302 are **AT LEAST 50%** with **AT LEAST 40%** subminimum for ***each of*** CHE301 **THEORY** and CHE302 **THEORY**.

Progression to **HONOURS** in Chemistry normally requires an overall mark of at least 60% in Chemistry 3.

**NOTE:** Aggregation is only permitted for semester courses written in the ***same*** calendar year.

There are **no** Supplementary Examinations in either CHE301 or CHE302.

**DULY PERFORMED (DP) CERTIFICATES** (Rule G19 in the University Calendar)

A DP Certificate is required before a student is permitted to write the course examination. To obtain a DP Certificate for either of the **CHE301** or **CHE302 Examinations** a student must have attended at least **80%** of all lectures and performed and submitted ***all*** assigned tutorials, ***all*** essays and ***all*** practical work to a satisfactory level. Absences ***must*** be explained ***in writing*** with a Leave of Absence form which can be obtained through the Departmental administrator in room F40.

**TEXTBOOKS:**

(i) P.W. Atkins, *Physical Chemistry*, O.U.P., 6th (or earlier) Ed., paperback.

(ii) J. McMurry, *Organic Chemistry*, 5th (or earlier) Ed, Brooks/Cole. **Or**

Clayden, Greeves, Warren and Wothers, *Organic Chemistry*, **Or**

Solomon, Fryhle and Snyder, *Organic Chemistry*

(iii) B. Douglas, D. McDaniel, J. Alexander, *Concepts and Models of Inorganic Chemistry*, 3rd Ed, Wiley.

(iv) D.A. Skoog, D.M. West and F.J. Holler, *Fundamentals of Analytical Chemistry*, 7th (or earlier) Ed, Saunders College.

**LECTURES:**(Periods 1-2-3-4-5) start on first **Monday of term** in **Sociology B (near Barratt Lecture theatre complex)** at **7:45 am** **(1st period)**.

**PRACTICALS:** **CHE301:** **Fridays : 12:20 to 5:30 p.m**. commencing in **first week** of lectures. Depending on the class size **CHE302:** (**Fridays: 1:00 to 6:00 p.m)** Inorganic practicals may also be run on **Wednesday** (check your allocated day).

*Attendance is expected at* ***all*** *practicals. If you have a problem, discuss it with the lecturer-in-charge preferably* ***before*** *the practical. Practical reports not handed in by due date will score 0 marks.*

A non-refundable fee of **R350** per semester is charged to cover accidental breakage of equipment, laboratory notes, lecture handouts, laboratory safely and protection equipment and other course material.

**RESEARCH INTERNSHIP PROJECT** Interns are allocated to work in a research group. These are equivalent to one terms practical course, and are run over either 1st or 2nd semester; the marks are allocated to **CHE302**

**TIMETABLE CHEMISTRY 3 2016**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Topic*** | ***Lecturer*** | ***No of Lects*** | ***EXAM PAPER*** |
| **CHE301** | Introduction | RWK | 1 |  |
|  | Organic Synthesis | RWK | 9 | **A** |
|  | Retrosynthesis | RWK | 9 | **A** |
|  | Green Chemistry | RWK | 7 | **A** |
|  | Linear Free Energy | KAL | 6 | **A** |
|  | Molecular Modelling and | KAL | 14 | **B** |
|  | Quantum Mechanics |
|  | Photochemistry and PDT | JM | 6 | **B** |
|  | Nanotechnology | JB | 6 | **B** |
|  | Introduction to industrial chemistry | Guest lecturer | 3 | **-** |
|  |  |  |  |  |
|  | Transition Metal Chemistry | GMW | 19 | **A** |
| **CHE302** | Crystallography & Solid State Chemistry | VS | 10 | **A** |
|  | Bioinorganic Chemistry | }TBA | 19 | **B** |
|  | Organometallic Chemistry |
|  | Statistical Kinetics and Energetics | MSK | 15 | **B** |

**Key to Lecturers:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***INITIALS*** | ***NAME*** | ***Room No*** | ***INITIALS*** | ***NAME*** | ***Room No*** |
| RK | Prof R. Klein | S35 | VS | Dr V. Smith | S36 |
| KAL | Prof K. A. Lobb | S39 | TBA | To be announced |  |
| JB | Dr J. Britton | F44 | GMW | Prof G.M. Watkins | S2 |
| RWK | Prof R.W.M. Krause | F41 | MSK | Prof S. Khene | S38 |
| JM | Dr J. Mack | G29 |  |  |  |

**C H E 3 0 1**

Lectured from February to June.

Examined in June by two 3-hour theory papers (Paper A and Paper B)

Contents of the papers are as follows (number of lectures is indicated in the Timetable above):

**P A P E R A**

**Biologically-active organic compounds**

***Synthesis***:

Carbonyl chemistry: fundamentals, nucleophilic addition and substitution, enolate chemistry, condensation reactions, α,ß-unsaturated carbonyls. Miscellaneous reactions of carbonyl compounds: Haloform, Wittig, Mannich, Aldol, Claisen, Michael reductions.

Retrosynthesis: introduction to retrosynthetic analysis. Disconnections of various functional groups.

**Green Chemistry**

Introduction to the development of environmentally friendly chemical processes.

**Linear Free Energy**

The Hammett equation, substituent constant *σx*, reaction constant ρ; Hammett plots, calculations of **K** and **k**; steric parameters *Es*, δ; Taft equation; effect of solvents on δ.

**P A P E R B**

**Molecular Modelling**

Introduction to computational methods: Quantum mechanics and molecular mechanics approaches; application to the modelling of organic compounds.

**Quantum Mechanics**

Particles and waves, wave functions and wave equations; boundary conditions and quantum numbers. The electromagnetic spectrum, rotational, vibrational and electronic spectroscopy: spectroscopy as a tool for determining molecular structure. The hydrogen atom. Orbitals. Approximate methods for multielectron atoms. Hückel approximation.

**Nanotechnology**

Introduction to the chemical and physical behaviour of nanomaterials.

**Photochemistry**

Fluorescence and phosphorescence; intersystem crossing and internal conversion. Principles of laser action; some useful lasers; medical applications of lasers (photodynamic therapy).

**C H E 3 0 2**

Lectured from July to October

Examined in November by two 3-hour theory papers (Paper A and Paper B)

Contents of the papers are as follows (number of lectures is indicated in the Timetable above):

**P A P E R A**

**Transition Metal Chemistry**

***Coordination chemistry:*** Nomenclature, isomerism, stability of complexes.

***Shape, structure and properties of compounds:*** Comparison of valence bond, molecular orbital, crystal field and ligand field theoretical models. Spectroscopic and magnetic properties related to electronic structure.

**Crystallography & Solid State Chemistry**

The lattice, unit cells, Miller indices, simple close-packed structures in metals; X-ray diffraction, neutron and electron diffraction; applications of . X-ray diffraction.

**P A P E R B**

**Organometallic Chemistry**

Definition and scope of organometallic chemistry, nomenclature. The metal-carbon bond. Main group organometallic compounds. *d*-block organometallic compounds. Reaction mechanisms of organometallic compounds and their role in synthesis.

**Bioinorganic Chemistry**

Essential elements and trace elements in biological systems. Biological function related to general properties of the elements. Examples of metal-containing proteins and metallo-enzymes : haemoglobin, myoglobin, cobalamin (vitamin B12) etc. The role of metal complexes in medicine.

**Statistical Kinetics and Energetics**

***Statistical Kinetics:*** Advancing technology has allowed experiments on individual molecules to open up new approach to our understanding of the molecular world. The aim of this course is to provide an introduction to a growing field kinetics at a single molecular level.

***Statistical Thermodynamics:*** This course aims to introduce chemical thermodynamics with insight derived from what chemical equilibrium means on a molecular and statistical level.