**Revised curricular of the New Undergraduate Degree program**

# Bachelor of Science Honours in Applied Chemistry

**Department of Chemistry**

**University of Kelaniya**

**(Approved by the UGC December 2020)**

# 1. Introduction

At present, the Department of Chemistry offers Chemistry and Biochemistry as subjects for the B.Sc. program. The B.Sc. Degree programmes having chemistry as a subject teach the basic concepts of chemistry in the first two years of the programme. A selected group of few students read for the Honors Degree in Chemistry. These students are exposed to higher concepts and applications in Chemistry and are trained in carrying out independent research and scientifically presenting data.

However, most of the honors degree students (almost >80%) secure placements in foreign universities, mainly in the USA, for their post-graduate studies and opts not to return to Sri Lanka. Thus, Sri Lanka is deprived of making use of their training for national development.

The department offers compulsory and optional courses for the students who follow the Bachelor's degree, in the third year. However, in the existing courses, there is little emphasis on independent learning methods. Students are not given the opportunity to conduct case studies, research projects and to do presentations.

Most graduates with a Bachelor's degree secure employment as chemists in various industries and in government institutions. Whilst their background in concepts in Chemistry is quite strong, they lack training in certain soft skills which stifles their successful progress in their careers. The current program in Chemistry does not offer opportunities for students to get exposed to soft skills development, management capabilities, and problem-solving capacity. These are the most sought-after skills an employer is looking for in a prospective employee.

In realizing the above situation that is prevailing in Sri Lanka in the Bachelors Degree programs, the Department of Chemistry at the University of Kelaniya, wish to introduce the new degree program to undergraduates in addition to the present B.Sc. (General) Degree programme that offers chemistry as a subject. The new program will cater to the requirement of the local industries and institutions, both governmental and private, which are in need of personals with appropriate skills, attitudes and knowledge to work in chemistry related areas.

The Faculty of Science, University of Kelaniya intends to conduct a new B.Sc. Degree programme in Applied Chemistry from the 2020/2021 academic year. The degree programme is designed to provide knowledge and adequate skills in the area of Applied Chemistry. The programme is targeted to train graduates who will be able to work confidently in the modern industrial world. Sri Lanka is rich in natural resources. However, to harness the economic benefits of these resources, value addition methods have to be developed. To ensure food safety and security, and to provide good quality safe agricultural products, the country needs the services of competent individuals with a strong background in Chemistry. The program will train graduates who are capable of addressing these human resource needs of Sri Lanka.

The Department of Chemistry, Faculty of Science is the main Department of study involved with the programme. Other Departments in the Faculty (especially Departments of Industrial Management, Microbiology, Physics & Electronics, Statistics & Computer Science, and Zoology& Environmental Management) will also contribute to the programme. The course unit on industrial training of students will be carried out by affiliation to the National Institute of Technical Assistance (NAITA).

## 2. Objectives of the degree programme

Objectives of the Degree programme in Applied Chemistry are

- To provide students with a knowledge and understanding of the fundamental principles of chemistry and its applications, basic knowledge in concepts in chemical engineering, skills in analytical techniques used in laboratories, advanced knowledge in industrial-related areas of chemistry, diversifying the undergraduate degree programmes in relation to the national and global needs, so that the employability of the graduates to increase.
- To encourage students to engage in independent learning
- To improve technical and soft skills such as personality, communication, information technology, problem-solving, teamwork and management skills that are required by both scientific and non-scientific employers.
- To demonstrate interest and enthusiasm in conducting scientific investigations and integrate in to and work in any culture.
- To enhance the ability to work in chemistry related industries and institutions and contribute to the growth of the Chemical industry through innovations
- To increase the enrollment of G.C.E. (Advanced level) qualified students in the biological and physical science streams of the University.

## 3. Title of the degree to be awarded and the duration of the course of study

B.Sc. Honours Degree in Applied Chemistry

## 4. Entry requirements and eligibility criteria

The selection is to be carried out by the University Grants Commission of Sri Lanka, as a direct intake, based on the z score on applicants who have passed the GCE (Advanced Level) examination with Chemistry, Physics, and Biology or Combined Mathematics or Agriculture as subjects.

Number of students to be admitted per academic year would be sixty (60).

## 5. Assessment criteria

### 5.1 Assessment Procedure

Student performance at a course unit is generally assessed through assignments, reports, presentations and end of course examinations. The method of assessment will be announced by the relevant Department at the commencement of a course unit. The research projects of the BSc Hons Degree Programme are assessed by a dissertation and an oral presentation. Supervision, monitoring and assessing the industrial training to be carried out by the academic staff in the department of Chemistry and senior staff member of the relevant industry together with monitoring by NAITA.

### 5.2 Attendance

Students are strongly advised to attend and actively participate in their academic activities regularly, as it has proven that there is a highly significant relationship with the grades obtained for a particular course unit and attendance.

For all theory course units, 100% of the marks are assigned based on the assessments (including continuous assessments).
If the attendance of a student at a laboratory course unit is between 50% - 79% the best grade obtainable by a student for that course unit will be "C" and if the attendance of a student at a laboratory course unit is less than 50%, the best grade obtainable by the student will be "D".

### 5.3 Grading System

Marks obtained in respect of a course unit will be graded according to the following grading system. A grade point value as indicated below is assigned to each grade.

| Range of Marks | Grade | Grade Point Value |
|---|---|---|
| 85-100 | $A^+$ | 4.0 |
| 70-84 | A | 4.0 |
| 65-69 | $A^-$ | 3.7 |
| 60-64 | $B^+$ | 3.3 |
| 55-59 | B | 3.0 |
| 50-54 | $B^-$ | 2.7 |
| 45-49 | $C^+$ | 2.3 |
| 40-44 | C | 2.0 |
| 35-39 | $C^-$ | 1.7 |
| 30-34 | $D^+$ | 1.3 |
| 25-29 | D | 1.0 |
| 00-24 | E | 0.0 |

Students should complete all course units that they are registered for and if they fail to complete a particular course unit, it will be indicated in the transcript as “absent” and a zero (0.0) grade point value will be assigned to it.

### 5.4 Repeating a Course Unit Examination

A student who does not obtain a grade of C or better in a particular course unit may re-sit the examination of that course unit in the following academic year for the purpose of improving the grade. The best grade obtainable by a student in this instance would be C. In the event a student obtains a lower grade while attempting to better the grade, he/she will be entitled to the previous grade.

### 5.5 Grade Point Average

Grade Point Average (GPA) is the credit-weighted arithmetic mean of the Grade Point values, which is determined by dividing the total credit-weighted Grade Point Value by the total number of credits. GPA shall be computed to the second decimal place.
Example: A student who has completed one course unit with two credits, three course units each of three credits and two course units each of 1 credit with grades A, C, B, D, $C^+$ and $A^+$ respectively would have the GPA of 2.48 as calculated below.

$$\frac{(2\times4.0)+(3\times2.0)+(3\times3.0)+(3\times1.0)+(1\times2.3)+(1\times4.0)}{2+3+3+3+1+1} = \frac{32.3}{13} = 2.4846$$

Grade Point Average = 2.48

**Grade point values and credit values of all registered course units in a study programme of a student shall be considered in calculating the final GPA, unless stated otherwise.**

## 6.1 Eligibility for the Award of the B.Sc. Honours Degree in Applied Chemistry

To be eligible for the B.Sc. Honours Degree a student must

(i) accumulate grades of D or better in course units, aggregating to at least 60 credits during the first two academic years, and aggregating to at least 120 credits during the entire four academic year period, including the stream compulsory units where applicable, of which at least 30 credits must be from each academic year,

(ii) obtain grades of C or better in course units totaling to at least 96 credits with at least D grades for the remaining course units, and

(iii) obtain grades of C or better in compulsory course units totaling to at least 84 credits with at least D grades for the remaining compulsory course units,

(iv) obtain a minimum GPA of 2.00, and

(v) complete the relevant requirements within a period of 6 academic years

## 6.2 Award of Classes

### 6.2.1 First Class

A student who is eligible for the B.Sc. Honours Degree in APCH may be awarded a First Class provided he/ she,

(i) obtains grades of C or better in course units aggregating to at least 120 credits, considered under 6.1 (i),

(ii) obtains grades of A or better in level 3 and level 4 course units aggregating to at least half the number of credits accumulated in such course units.

(iii) obtains a GPA of 3.70 or greater**,** and

(iv) completes the relevant requirements within four academic years.

**Note:** A student who obtains grades of D/D+/C- aggregating to not more than 6 credits in level 3 and level 4 course units but fulfils all the other requirements stipulated under 6.2.1 may be considered by the Board of Examiners for the award of Second Class (Upper Division) Honours.

### 6.2.2 Second Class (Upper Division)

A student who is eligible for the B.Sc. Honours Degree in APCH may be awarded a Second Class (Upper Division) provided he/ she,

(i) obtains grades of C or better in course units aggregating to at least 110 credits and grades of D or better in the remaining course units, considered under 6.1(ii),

(ii) obtains grades of B or better in level 3 and level 4 course units aggregating to at least half the number of credits accumulated in such course units.

(iii) obtains a GPA of 3.30 or greater, and

(iv) completes the relevant requirements within four academic years.

**Note:** A student who obtains grades of D/D+/C- aggregating to not more than 6 credits in level 3 and level 4 course units but fulfils all the other requirements stipulated under 6.2.2 may be considered by the Board of Examiners for the award of Second Class (Lower Division) Honours.

### 6.2.3 Second Class (lower Division)

A student who is eligible for the B.Sc. Honours Degree in APCH may be awarded a Second Class (Lower Division) provided he/ she,

(i) obtains grades of C or better in course units aggregating to at least 110 credits and grades of at least D in the remaining course units, considered under 6.1 (ii),
(ii) obtains grades of B or better in level 3 and level 4 course units aggregating to at least half the number of credits accumulated in such course units.
(iii) obtains a GPA of 3.00 or greater, and
(iv) completes the relevant requirements within four academic years.

The Medium of Instruction will be English and Internet based and computer assisted learning will be practiced.

The letters in the codes used to identify the course units indicate the academic disciplines and are as follows

| | |
|---|---|
| Chemistry | CHEM |
| Applied Chemistry | APCH |
| Management & Computer Studies | MACS |
| Electronics | ELEC |
| Department of English Language Teaching | DELT |
| Microbiology | MIBI |
| Environmental conservation and management | ENCM |

## Course structure for B.Sc. Honours Degree in Applied Chemistry

**Year 1**

| Course code | Title | Number of credits | Course status |
|---|---|---|---|
| **1st semester** | | | |
| CHEM 11601 | Calculations in Chemistry[1] | 1 | C |
| CHEM 11612 | Atomic Structure, Periodic Table and Chemical Bonding | 2 | C |
| CHEM 11622 | General Chemistry | 2 | C |
| CHEM 11631 | Basic Chemical Analysis Laboratory | 1 | C |
| APCH 11612 | Computer Skills for Chemists | 2 | C |
| DELT 11552 | English for Applied Chemistry | 2 | C |
| ELEC 11134 | Basic Electronics | 4 | C |
| ELEC 11141 | Basic Electronics laboratory | 1 | C |
| MACS 11512 | Management Theory and Practices | 2 | C |
| MACS 11521 | Introduction to Intellectual Property Rights | 1 | C |
| **2nd semester** | | | |
| CHEM 12642 | Physical Chemistry I | 2 | C |
| CHEM 12652 | Stereochemistry and Reaction Mechanisms in Organic Chemistry | 2 | C |
| CHEM 12661 | Basic Organic Chemistry Laboratory | 1 | C |
| MACS 12532 | Principles of Accounting and Costing | 2 | C |
| APCH 12622 | Basic Statistical Methods | 2 | C |
| APCH 12632 | Biomolecules[#] | 2 | C |
| MIBI 12532 | Introductory Microbiology[#] | 2 | C |
| | Total No. of credits in the 1st year | **31** | |

[1] Credits not counted for the GPA calculation

**Year 2**

| Course code | Title | Number of credits | Course status |
|---|---|---|---|
| **1st Semester** | | | |
| CHEM 21682 | Physical Chemistry II | 2 | C |
| CHEM 21691 | Physical Chemistry Laboratory | 1 | C |
| APCH 21642 | Principles of Analytical Chemistry | 2 | C |
| APCH 21652 | Soil Chemistry, Terrestrial Pollution & Management of Solid and Hazardous Waste | 2 | C |
| APCH 21663 | Atmospheric Chemistry, Aquatic Chemistry and Pollution & Treatment | 3 | C |
| APCH 21672 | Polymer Chemistry | 2 | C |
| APCH 21682 | Scientific Communication Skills | 2 | C |
| **2nd Semester** | | | |
| CHEM 22702 | Inorganic Chemistry | 2 | C |
| CHEM 22712 | Organic Synthesis, Spectroscopy and Aromaticity | 2 | C |
| CHEM 22721 | Analytical Chemistry Laboratory | 1 | C |
| APCH 22692 | Sample Preparation and Chemometrics | 2 | C |
| APCH 22702 | Case study I (Environmental) | 2 | C |
| APCH 22712 | Polymer technology | 2 | C |
| APCH 22721 | Environmental Chemistry Laboratory | 1 | C |
| APCH 22732 | Environmental Toxicology, Green Chemistry and Cleaner Production | 2 | C |
| MACS 22563 | Introduction to Marketing and International Trade | 3 | **C** |
| | Total No. of credits in the 2nd year | **31** | |

**Year 3**

| Course code | Title | Number of credits | Course status |
|---|---|---|---|
| 1st semester | | | |
| CHEM 31731 | Organic & Inorganic Synthesis, Analysis & Natural Product Chemistry Laboratory | 1 | C |
| APCH 31742 | Food Chemistry | 2 | C |
| APCH 31752 | Food Technology | 2 | C |
| APCH 31761 | Food Chemistry Laboratory | 1 | C |
| APCH 31772 | Solid State Chemistry | 2 | C |
| APCH 31782 | Laboratory Safety, Occupational Health, Safety Managemer and Laboratory Quality Systems | 2 | **C** |
| ENCM 31022 | Environmental Policies and Legislations | 2 | C |
| ENCM 31073 | Environmental Impact Assessment and Environmental Monitoring | 3 | C |
| **2nd semester** | | | |
| APCH 32793 | Advanced Analytical Chemistry | 3 | C |
| APCH 32802 | Case Study II (Industry) | 2 | C |
| APCH 32812 | Chemical Industries in Sri Lanka I (minerals, petroleum, metals, packaging, leather) | 2 | C |
| APCH 32821 | Industrial Chemistry Laboratory | 1 | C |
| APCH 32832 | Chemical Technology I | 2 | C |
| MACS 32603 | Principles of Human Resource Management and Leadership | 3 | C |
| APCH 32842 | Chemical Industries II (plantation crops) | 2 | C |
| | Total No. of credits in the 3rd year | **30** | |

**Year 4**

| Course code | Title | Number of credits | Course status |
|---|---|---|---|
| **1st Semester** | | | |
| APCH 43853 | Industrial Training (2-3 months) | 3 | C |
| APCH 41862 | Molecular biology | 2 | C |
| APCH 41872 | Productivity and Quality Management | 3 | C |
| **2nd semester** | | | |
| APCH 42882 | Chemical Technology II | 2 | C |
| APCH 42893 | Ethanopharmacology and Health Products# | 3 | C |
| APCH 42903 | Metabolism and Clinical Chemistry# | 3 | C |
| APCH 42912 | Agrochemicals and Chemical Ecology | 2 | O |
| MACS 42612 | Innovation and Entrepreneurship | 2 | O |
| APCH 42922 | Nanoscience and Nanotechnology | 2 | O |
| MIBI 42512 | Industrial Microbiology | 2 | O |
| MACS 42622 | Industrial Law | 2 | O |
| APCH 42932 | Statistical Methods in Industry and Research | 2 | C |
| APCH 42942 | Biotechnology | 2 | O |
| APCH 44956 | Research | 6 | C |
| | Total No. of credits in the 4th year | **24 +12(O)** | |

# Lecture cum Practical

## 3.10 Programme Content

**University level 1**

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | CHEM 11601 | | |
| Course Name: | Calculations in Chemistry | | |
| Credit Value: | 01 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | A/L Chemistry | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 15 | - | 35 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of this course unit, the student should be able to,

- solve quantitative and qualitative problems related to chemistry using basic mathematical skills

**Course Content:**

Review of basic mathematics for chemistry: algebraic functions, logarithms, trigonometry, matrices, determinants, coordinate systems, calculus, differential equations.
Calculations based on stoichiometry, chemical equilibria, chemical kinetics, thermodynamics, diffractions, electrochemistry and quantum chemistry.
Use of graphical methods to solve various chemistry related problems.
Use of Excel and scientific calculator for data analysis.

**Teaching /Learning Methods:**

A combination of lectures and tutorial discussions (supporting materials will be provided via Computer Assisted Learning (CAL))

**Assessment Strategy**: Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment |
|---|---|
| 20 % | 80 % |

| **Details:** quizzes and/or mid-term | Theory | Practical | Other |
|---|---|---|---|
| 20 | 80 | - | - |

**References/Reading Materials:**

1. Tebbutt. P., (1998) *Basic Mathematics for Chemists*, John Wiley

2. Gormally. J., (2000) *Essential Mathematics for Chemists*, Prentice Hall

3. Graham, D., (2012) *Maths for Chemists*, Royal Society of Chemistry.

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | CHEM 11612 | | |
| Course Name: | Atomic Structure, Periodic Table and Chemical Bonding | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | A/L Chemistry | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | | 70 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit the student should be able to,

- explain basic atomic properties using theories of atomic structure
- recognize various types of chemical bonding and apply the theories of bonding to predict properties of compounds
- explain the periodic trends of physical and chemical properties of the main group, d- block, and f-block elements
- compare chemistry of the main group elements with that of d- block and f-block elements

**Course Content:**

**Atomic Structure and Chemical Bonding:**

Modern view of atomic structure, ionic, covalent, coordinate and metallic bonds. Theories of covalent bonding (valence bond theory and molecular orbital theory of simple polyatomic molecules and ions), intermolecular forces, and lattice structure, crystal structure, unit cell, unit cell types, and band theory of solids.

**Chemistry of Main Group and Transition Elements:**

Classification of elements, chemistry of *s* and *p* block elements; allotropes, extraction, physical and chemical properties: color, ionization energy, melting point, boiling points, hydration enthalpy, lattice enthalpy, solubility of the salts, reaction with water, reaction with oxygen, reaction with halogens, reaction with liquid ammonia, etc. tendency to form complexes, periodicity of properties, compounds of *s* and *p* block elements; hydrides, halides, silicates, oxides, oxoacids, interhalogen compounds, polyhalides, pseudo halides, introduction and properties of *d* and *f*- block elements.

**Teaching /Learning Methods:**

A combination of lectures and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment |
|---|---|
| 20 % | 80 % |

| Details: quizzes/ Assignments<br>20 | Theory<br>80 | Practical | Other |
|---|---|---|---|

**Recommended Reading:**


1. Brown, T. E., LeMay, H, E., Bursten, B.E., Murphy C., Woodward, P., (2014) *Chemistry: The Central Science*, Prentice Hall.
2. Huheey, J. E., Keiter, E., Keiter, R. L., Okhil K. M., (2006) *Inorganic Chemistry*, Pearson.
3. Lee, J.D., (2008) *Concise Inorganic Chemistry*, Blackwell.
4. Weller, M., Overton, T., Rourke, J; Armstrong, F., (2018) *Inorganic Chemistry*, Oxford.


| **Semester** | **1** | | |
|---|---|---|---|
| Course Code: | CHEM 11622 | | |
| Course Name: | General Chemistry | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | A/L Chemistry | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit, the student should be able to,

- use significant figures in the calculations in chemistry
- apply basic concepts of solubility, precipitation, and titrations in chemical analysis
- describe the activity and decay processes of radioactive isotopes and their properties, effects and reactions

**Course Content:**

**Aqueous Solution Chemistry**

Significant figures and scientific notation, error, uncertainty in chemical analysis.

Solubility and solubility product, mechanism of precipitation. Gravimetry, Contamination of precipitates; co-precipitation and post precipitation, Purification of precipitates.

Titrimetry; Acid-base titrations, buffers. Complexometric titrations; EDTA titrations. Redox titrations; permanganometry, iodometry and iodimetry, dichromate titrations. Precipitation titrations.

**Structure and Reactions of Atomic Nucleus**

Structure of atomic nucleus, radioisotopes, binding energy, nuclear stability, radioactivity and decay,

| |
|---|
| nuclear reactions, effects of radiation on matter, applications of radiation, and radio analytical techniques. |
| **Teaching /Learning Methods:** A combination of lectures and tutorial discussions (supporting materials will be provided via CAL) |
| **Assessment Strategy:** Continuous assessment and end of course unit examination. |

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 20 % | 80 % | | |
| **Details**: quizzes and/or mid-term | Theory | Practical | Other |
| 20 | 80 | | |

**Recommended Reading:**


1. Harris, D. C., Lucy, C. A., (2020) *Quantitative Chemical Analysis*, Macmillan.
2. Denney, R.C., Mendham J., Bassett J., Jeffery G.H., (2008) *Vogel's Textbook of Quantitative Chemical Analysis*, Pearsons.
3. Weller, M., Overton, T., Rourke, J., Armstrong, F., (2018) *Inorganic Chemistry*, Oxford.
4. Silberberg, M., Amateis, P., (2017) *Chemistry: The Molecular Nature of Matter and Change*, McGraw-Hill Education.


| **Semester** | **1** | | |
|---|---|---|---|
| Course Code: | CHEM 11631 | | |
| Course Name: | Basic Chemical Analysis Laboratory | | |
| Credit Value: | 01 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | - | | |
| Co-requisite | CHEM 11622 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit the student should be able to

- adhere to safety rules and good laboratory practice at all times
- effectively use basic laboratory techniques for chemical analysis
- identify and separate cations and anions in inorganic compounds by standard chemical tests
- use titrimetric and gravimetric methods to quantify analytes in aqueous media.

**Course Content:**

Laboratory safety, laboratory rules and regulations, handling of chemicals and glassware, basic laboratory techniques; filtration, preparation of solutions, dilution, sample preparation etc.

Qualitative analysis of basic cations and anions in inorganic compounds.

Quantitative analysis of aqueous analytes; acid base titrations, redox titrations, complexometric titrations and gravimetry.

**Teaching /Learning Methods:**

A 3-hour laboratory class per week (15 weeks) Pre lab quizzes and assignments.

**Assessment Strategy:** Continuous assessment, mini project with viva and end of semester examination.

| Continuous Assessment 30 % | | Final Assessment 70 % | | |
|---|---|---|---|---|
| quizzes and assignments | Laboratory reports | Theory | Practical | Other |
| 20 | 10 | - | 70 | |

**References/Reading Materials:**


1. Reading materials (journal articles related to each experiment) will be provided during the laboratory classes.
2. Mendham, J; Denney, R.C.; Barnes, J.D.; (2002) *Vogel's Textbook of Quantitative Chemical Analysis*. Prentice Hall.
3. Svehal, G; (2001) *Vogel's Qualitative Inorganic Analysis,* Longmans


| **Semester** | **1** | | |
|---|---|---|---|
| Course Code: | APCH 11612 | | |
| Course Name: | Computer Skills for Chemists | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- Draw chemical structures, schematic diagrams and laboratory set-ups using available computer software packages
- Convert scientific data into various graphical forms
- Use a spreadsheet program to perform mathematical operations and statistical analysis of chemical data
- Perform simulation and modeling of chemical concepts
- Collect, import and analyse data from an analytical instrument
- Create a presentation of chemical information in a poster, slideshow or web page

**Course Content:**

**Computer basics** :

Representation of numbers- decimal to binary conversion, input/output units, processor, computer languages, operating subsystems, computers and communications.

Introduction to internet, E-mail and World Wide Web.

**Introduction to web and graphic designing:**

HTML, use of commercial and open-source software for web designing, use of Photoshop and flash for graphic designing.

**Chemical structure drawing, data collection, analysis and presentation:**

Introduction of various software that are used in word processing, spread sheets, presentations, data base, scientific software used in the practice of chemistry and other relevant software, freeware and shareware that are available.

**Teaching /Learning Methods:** A combination of lectures and tutorial discussions

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| **Details:** quizzes and/or mid-term | Theory | practical | Other |
| 30 | 40 | 30 | |

**References/Reading Materials:**


1. Billo, E. J., (2011) Excel for Chemists, 3rd E, Wiley.
2. Morrison, C., (2012) Computer Literacy BASICS, 4th Ed, Cengage Learning.
3. Willard, W., (2013) HTML: A Beginner's Guide, 5th Ed, McGraw-Hill.

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | DELT 11552 | | |
| Course Name: | English for Applied Chemistry | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course the student would have acquired the necessary English language skills to

- listen to academic discourse
- take notes
- write answers
- laboratory reports
- conduct preliminary research

**Course Content:**

Introduction to English for academic purposes. Basic pronunciation and vocabulary used in studying science with special emphasis to areas in Applied Chemistry. Introduction and politeness markers. Writing in academic styles: grammar for academic writing, note taking skills, report writing, extracting important components from research papers.

**Teaching /Learning Methods**:

The course will be delivered as a combination of lectures, presentations, discussions and group work. Groups will be selected according to the proficiency in English by a diagnostic test comprising of writing and comprehensive components conducted before the commencement of the course. The lesson materials will reflect the academic content of first year courses in Applied Chemistry.

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Other |
| 30 | 40 | 30 | |

**References/Reading Materials:**

1. Materials designed by the Department of English Language Teaching (DELT), University of Kelaniya and materials provided by the Department of Chemistry.

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | ELEC 11534 | | |
| Course Name: | Basic Electronics | | |
| Credit Value: | 04 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | A/L physics | | |
| Co-requisite | ELEC 11541 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 60 | - | 140 |

**Course Aim/Intended Learning Outcomes**:

At the end of the course, the student will be able to

- demonstrate basic knowledge and understanding of analogue and digital electronics and their principles of operation
- gain ability in solving problems of analogue and digital electronics

**Course Content:**

**Semiconductor diodes:** Diode and diode circuits, Rectifier circuits, Filters, Clippers, Clamping circuits.

**Bipolar junction transistors:** Characteristics of transistor configurations, Operating point, Frequency response, Transistor biasing, Equivalent circuits, Small signal parameters.

**Amplifiers:** Single stage amplifiers, multistage amplifiers, comparison of different types of coupling, Negative feedback, Oscillators, Transistor tuned amplifiers. Operational amplifiers: feedback-amplifiers (inverting, non-inverting and summing), follower, comparator.

Digital Electronics, binary logic, Boolean Algebra, number systems, conversion from decimal to binary, binary coded decimal (BCD), binary addition, laws and rules of Boolean Algebra, truth tables, logic symbols, logic implementation, sum-of-products, product-of-sums, De Morgan's theorem and the shape of gates, two-level ALL-NAND & ALL-NOR circuits

**Teaching /Learning Methods:** A combination of lectures and tutorial discussions

**Assessment Strategy:** Continuous assessment and end of semester examination.

| | | | |
|---|---|---|---|
| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | Practical | Other<br>- |

**References/Reading Materials:**


1. Millman, J. and Grabel, A. (1987). Microelectronics, 2nd Edition, McGraw-Hill Book Company
2. Shepherd, J., Mortan, A. H. and Spence, L. F. (1998). Higher Electrical Engineering, Pitman Publishing Ltd.
3. Nilsson, J. W. and Riedel, S. A. (2001). Electric Circuits, Prentice Hall.
4. Horowitz, P. and Hill, W. (1997). The art of electronics, 2nd Edition, Cambridge University Press.
5. Floyd, T. L. (2004). Electronic Devices, 6th Edition, Prentice-Hall International.
6. Floyd, T. L. (1992). Digital Fundamentals, 6th Edition, Prentice-Hall International.
7. Holdsworth, B. and Woods, R. C. (2002). Digital system design, Newnes Publications.
8. Hambley, A. R.,(2002).Electrical Engineering: Principles and Applications 3rd Edition, Prentice Hall


| **Semester** | **1** | | |
|---|---|---|---|
| Course Code: | ELEC 11541 | | |
| Course Name: | Basic Electronics | | |
| Credit Value: | 01 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | A/L physics | | |
| Co-requisite | ELEC 11534 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- demonstrate knowledge and experimental skills gained on applications of fundamental concepts of analogue and digital electronics in experiments
- the ability to write technical reports based on experimental data

**Course Content:**

Basic electronic instruments, Diode and Zener diode characteristics, and applications. Transistor characteristics and a single stage amplifier. Computer circuit analysis and practical realization. Operational amplifier characteristics and applications. Digital logic operation and combinational circuits

| | | | |
|---|---|---|---|
| **Teaching /Learning Methods:** 3 hour laboratory classes for 15 weeks | | | |
| **Assessment Strategy:** Continuous assessment and end of semester examination. | | | |
| Continuous Assessment<br>40 % | Final Assessment<br>60 % | | |
| Details: quizzes and/or mid-term %,<br>40 | Theory<br>20 | Practical<br>40 | Other<br>- |

**References/Reading Materials:**


1. Worsnof, B. L and Flint, H. J. (1965). *Advanced Practical Physics for Students*, Jerrold & Sons Ltd.
2. Nilsson, J. W. and Riedel, S. A. (2001). *Electric Circuits*, Prentice Hall.
3. Horowitz, P. and Hill, W. (1997). *The art of electronics*, 2nd Edition, Cambridge University Press.
4. Mortan, A. H., Spence, L. F., and Shepherd, J. (1998). *Higher Electrical Engineering*.
5. Havill, R. L., and Walton, A. K. (1975). *Elements of Electronics for Physical Scientists*.
6. Floyd, T. L. (2004). *Electronic Devices*, 6th Edition, Prentice-Hall International.


| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | MACS 11512 | | |
| Course Name: | Management Theory and Practices | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- Demonstrate understanding of different historical perspectives in management and organization studies
- Demonstrate understanding of the characteristics of contemporary organizations and the different approaches to organizational structure and design

- Demonstrate understanding of the fundamentals of individual, team and group behaviour,;
- Analyse the process of organizational learning, adapting, and change

**Course Content:**

Understanding organizations, the evolution of management thought, Organizational structure and design, Organization and environment, The managerial process: planning, strategic decision making and controlling, The drivers of individual behavior, motives of group and team behavior, organizational culture, learning and the processes of organizational change

**Teaching /Learning Methods**:

Lectures, in-class discussions, real world case studies and self-study

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Robbins, S P, DeCenzo, D A and Coulter, M (2010), Fundamentals of Management- Essential Concepts and Applications,Prentice Hall, New Jersey.
2. Robbins, S P and DeCenzo, D A (2008), Fundamentals of Management, Prentice Hall, Delhi.
3. Certo, S (2008), Modern Management, Prentice Hall, Delhi.
4. Bateman, T S and Snell, S A (2007), Management: Leading & Collaborating in the Competitive World, McGraw Hill,Noida.
5. Robbins, SP, and Judge, TA (2010), Organizational Behaviour, Prentice Hall, New Jersey.
6. Robbins, S P and Judge, T A (2007), Organizational Behaviour, Prentice Hall, Delhi,
7. Luthans, F (2007), Organizational Behaviour, McGraw Hill, Noida.
8. Kreitner, R and Kinaki, A (2007), Organizational Behaviour, McGraw Hill, Noida.


| **Semester** | **1** |
|---|---|
| Course Code: | MACS 11521 |
| Course Name: | Introduction to Intellectual Property Rights |
| Credit Value: | 01 |
| Compulsory/Optional | Compulsory |
| Pre-requisite | None |

| Co-requisite | None | | |
|---|---|---|---|
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 15 | - | 35 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- recognize the various forms of intellectual property
- appreciate the importance of intellectual property and recognize the relative role and value of each type of intellectual property
- identify the basic legal principles governing intellectual property acquisition and enforcement
- recognize the potential intellectual property issues and identify the impact of these issues have on the economy and be able to apply appropriate concepts in intellectual property and perform patent searches

**Course Content:**

**Introduction**

Development of intellectual property rights and concepts, concept of knowledge as a property, basic norms of intellectual property, overview of copyright, latent and trademark, rationale and policy underlying intellectual property.

International dimension: Introduction to the international instruments on intellectual property. International organizations dealing with intellectual property.

**Copyright**

The world of copyright: history, philosophy, recent developments and its significance in the intellectual property regime, subject matter of protection, term of copyright requirements for protection with special reference to originality in copyright law, ownership, assignment and licensing of copyright, protection of traditional knowledge and cultural expressions, infringement of copyright and related rights and remedies, limitation of rights including fair use and international protection of copyright and related rights.

Patents: History and philosophy, the patent application, process of obtaining patent rights, novelty, patentable subject matter, the role of patent agents and attorneys, protection in other countries.

**Trademarks**

History and evolution, the functions of trademark law, acquisition of trademarks, registration procedure, assignment and license, infringement and remedies.

Emerging and Global Intellectual Property Issues: Overview of the impact of new technologies on the protection, exercise and enforcement of intellectual property rights, intellectual property issues in: internet, use of trademark on the internet, e-commerce, protecting copyright and related rights in the digital environment. Attempts to use intellectual property laws for the protection of: traditional knowledge, biodiversity and biotechnology.

**Role of IP**

Promotion of inventions and creativity, transfer of knowledge, information, investment, research and development, industry promotion, commercialization, employment creation, public revenue, and

| | | | |
|---|---|---|---|
| consumer protection.<br>Intellectual property related case study | | | |
| **Teaching /Learning Methods:** A combination of lectures and assignments | | | |
| **Assessment Strategy:** Continuous assessment and end of semester examination. | | | |
| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | Practical | Other |
| **References/Reading Materials:**<br>1. Cornish, W. R. (2007). Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights, Sweet & Maxwell, London.<br>2. Cornish, W. R. (2006) Cases and Materials on Intellectual Property, Sweet & Maxwell, London.<br>3. Karunaratna, D. M. (2007) A guide to Law of Trademarks and Service Marks in Sri Lanka, Vishva Lekha<br>4. Karunaratna, D. M. (2006) Law of Copyright and Related Rights in Sri Lanka, Vishva Lekha | | | |

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code | CHEM 12642 | | |
| Course Name | Physical Chemistry I | | |
| Credit Value | 2 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | G.C.E. A/L Chemistry | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |
| **Course Aim/ Intended Learning Outcomes:**<br>Upon successful completion of this course unit the student should be able to,<br>• apply the concepts, methods and techniques of thermodynamics, kinetics and electrochemistry to chemical systems and make predictions<br>• explain the role of kinetic studies in chemistry across the physical and life sciences and derive rate laws for simple chemical processes from proposed mechanisms | | | |

- explain the conductivity in terms of ionic motion and apply conductometric measurements for the determination of certain equilibrium constants, endpoints of titrations etc.
- assess the activities of chemical species in a solution using Debye-Huckel theory
- simplify physical problems by making physically reasonable, justifiable and testable assumptions and develop critical analytical thinking and logical reasoning

**Course Content:**

**Thermodynamics :**
First law of thermodynamics: work, heat, internal energy, enthalpy, thermochemistry, Second law of thermodynamics: entropy, Gibbs energy, Helmholtz energy, exothermic and endothermic reactions, reactions at equilibrium, temperature dependence of equilibrium constants, effect of concentration, pressure, volume and temperature on the position of equilibrium, Maxwell relations and chemical potentials.

**Chemical Kinetics :**
Basic concepts; rates of reactions, elementary reactions, rate expressions, order and the rate constant of a reaction, molecularity, Experimental determination of rate laws: fitting data to rate laws, obtaining data for different timescales, Introduction to theories about reaction rates: collision theory and activated complex theory. Complex reactions and reaction mechanisms: rate determining steps, pre-equilibrium hypothesis, steady-state approximation and their applications. Temperature dependence of reaction rates: Arrhenius rate law and deviation, Maxwell-Boltzmann distribution, Chain reactions, fast reactions and catalysis.

**Electrochemistry :**
Electrolytic conductance; resistivity, conductivity and molar conductance, molar conductance of ions and Kohlrausch law of independent ionic migration, ionic mobility and ionic conductance, application of measurement of conductance. Ion-ion interaction and activity coefficients. Equilibrium electrochemistry; Nernst equation for equilibrium electrode potentials.

**Teaching/ Learning Methods:** A combination of lectures and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 20% | 80% | | |
| Details: Quizzes/ Assignments | Theory | Practical | Other |
| 20 | 80 | - | - |

**Recommended Reading:**


1. Atkins, P. W., De Paula, J., Keeler, J., (2018) *Physical Chemistry*, Oxford.
2. Levine, I. N., (2011) *Physical Chemistry*, McGraw-Hill.
3. Daniels, F., Alberty, R. L., (2004) *Physical Chemistry*, John Wiley.
4. Barrow, G. M., (1996) *Physical Chemistry*, McGraw-Hill.
5. McQuarrie, D. A., (1997) *Physical Chemistry: A Molecular Approach*, University Science Books.
6. Jayasuriya, C., (2016) *Basic Chemical Thermodynamics*, Stamfordlake.

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code | CHEM 12652 | | |
| Course Name | Stereochemistry and Reaction Mechanisms in Organic Chemistry | | |
| Credit Value | 2 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | CHEM 11612 | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit the student should be able to,

- draw the structures of isomers and conformers of organic molecules
- assign absolute configurations of chiral centers of organic molecules
- write IUPAC names for given simple organic compounds and draw structures corresponding to their IUPAC names
- identify key organic functional groups and their reactions
- predict and rationalize potential reaction mechanisms for selected organic reactions using kinetics and thermodynamics
- transform one simple organic functional group to another

**Course Content:**

**Stereochemistry:**
Isomerism in organic compounds; structural isomers, stereoisomers. Chirality, R and S convention optical activity measurements, chirality of non-mobile conformers and meso compounds. Fisher projections, Newman Projections, Conformational isomers of monocyclic, bicyclic and acyclic alkanes.

**Mechanistic Aspects of Organic Reactions :**
$S_N1$, $S_N2$, E1 and E2 mechanisms including their thermodynamic, kinetic aspects and solvent effects.

**Nomenclature and Reaction Mechanisms of Organic Compounds :**
Nomenclature of alkanes, alkenes, alkynes, aldehydes, ketones, alcohols, carboxylic acids, amines and aromatic compounds. Structure, physical properties, synthesis and reactions mechanisms of alkanes (acyclic and bicyclic), alkenes, alkynes, halides, aromatic compounds, alcohols, carbonyl compounds, carboxylic acids, acid derivatives, and amines. Chemistry of reaction intermediates (carbocations, carbanions and radicals).

**Teaching/ Learning Methods:** A combination of lectures and tutorial discussions (supporting materials will be provided via CAL)

| **Assessment Strategy:** Continuous assessment and end of course unit examination. | | | |
|---|---|---|---|
| Continuous Assessment<br>20% | Final Assessment<br>80% | | |
| Details: Quizzes/ Assignments<br>20 | Theory<br>80 | Practical<br>- | Other<br>- |

**Recommended Reading:**


1. Solomons, T. W. G., (2017) *Organic Chemistry*, John Wiley.
2. Wade, L. G., (2013) *Organic Chemistry*, Pearson Education.
3. Brown, W. H., (2016) *Organic Chemistry*, Harcourt Brace.
4. McMurry, J., (2012) *Organic Chemistry*, Brooks & Cole.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code | CHEM 12661 | | |
| Course Name | Basic Organic Chemistry Laboratory | | |
| Credit Value | 01 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | - | | |
| Co-requisites | CHEM 12652 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit, the student should be able to,

- identify functional groups of unknown organic compounds using standard chemical tests
- apply techniques to separate, purify, derivatize and characterize organic compounds present in mixtures
- identify limiting reagents and calculate theoretical and experimental yields of chemical reactions
- perform single step syntheses, isolate and purify products

**Course Content:**

Safety aspects in an organic laboratory.

Qualitative analysis of functional groups in organic compounds; solubility, tests for unsaturation,

alcohols, alkyl halides, ketones, aldehydes, carboxylic acids, phenols, esters, amines (including Hinsberg's test, diazotization, Liebermann's nitroso reaction), nitro compounds, sulphonic acid and amides.

Purification of organic compounds: recrystallization, determination of melting points and mix melting points, derivatization, separation of mixtures (containing neutral / acid / base / phenol/ salts), simple distillation and fractional distillation.

Single step syntheses; monitoring the progress of a reaction by TLC; isolation and purification of products; identification of limiting reagent of a reaction, calculation of experimental yield.

**Teaching/ Learning Methods:**

A 3-hour laboratory class per week (15 weeks), pre lab quizzes and assignments

**Assessment Strategy:**

Continuous assessment and end of semester examination.

| Continuous Assessment | | Final Assessment | | |
|---|---|---|---|---|
| 30% | | 70% | | |
| Details: Quizzes/ Assignments | Lab reports | Theory | Practical | Other |
| 20 | 10 | - | 70 | - |

**Recommended Reading:**


1. Campbell, B. N., McCarthy, M., (1994) *Organic Chemistry Experiments, Microscale and Semi microscale*, Brooks and Cole Publishing Co.
2. Williamson, K. L., (1989) *Macroscale and Microscale Organic Experiments*, D.C. Heath and Co.
3. Nimitz, J. S., (1990) *Experiments in Organic Chemistry*, Prentice-Hall.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | MACS 12532 | | |
| Course Name: | Principles of Accounting and Costing | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |

| | | | |
|---|---|---|---|
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- Demonstrate an understanding of the principles of financial and managerial accounting
- Record economic transactions and develop the key financial statements for the enterprise
- Reconcile a bank statement
- Identify and estimate the cost components for a product or service

**Course Content:**

Concepts of financial accounting, Practice of book keeping including books of Prime Entry, Ledgers and trial balance preparation of trading profit & lLoss and balance sheet, Cash flow Statement Bank Reconciliation, Use of accounting information for managerial decision-making in planning and control including cost classification; estimation and analysis; job-order, variable, and activity-based costing.

**Teaching /Learning Methods:** Lectures, case discussions and presentations

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Williams, J,Haka, S, Bettner, M andCarcello, J (2009),Financial Accounting, 14th Edition, McGraw-Hill/Irwin.
2. Hilton, R W (2011),Managerial Accounting: Creating Value in a Dynamic Business Environment,9th Edition, McGraw-Hill/Irwin


| **Semester** | **2** |
|---|---|
| Course Code: | APCH 12622 |
| Course Name: | Basic Statistical Methods |
| Credit Value: | 02 |
| Compulsory/Optional | Compulsory |
| Pre-requisite | CHEM 11622, CHEM 11631 |
| Co-requisite | None |

| Hourly Breakdown | Theory | Practical | Independent Learning |
|---|---|---|---|
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- condense a given set of data,
- compute various measures of Central Tendency, Dispersion, Skewness and Kurtosis of a given data set,
- identify outliers from a set of analytical data by statistical analysis,
- fit a probability distribution to a given set of data,
- determine the confidence limits for measurements computed from a given set of data,
- conduct test of hypothesis for making statistical decisions

**Course Content:**

**Nature of Statistical Methods**.

**Frequency Distributions:** Frequency table, Histogram, Frequency polygon, Cumulative distribution or Ogive, Frequency curve, Probability curve, Probability density, Measures of central tendency and spread, Form of distribution, Normal distribution, Standard measure, Extreme values, Normal probability paper, Population and sample, Samples and sampling fluctuations.

**Averages and Measures of Dispersion:** Measures of location, Weighted averages, Measures of dispersion, Measures of skewness and kurtosis.

**Outliers, Covariance, Standard Errors:** Standard errors of mean and standard error, Standard error of a linear function of several variables.

**Statistical Inference:** Introduction to confidence limits, Confidence limits for mean values, Confidence limits for the standard deviations, The effect of non-normality, Tests of significance, Significance of means, Distribution free tests, *F*-test, Statistical decisions.

**Statistical Tests:** Choosing the number of observations, Introduction to prior distribution and costs, Prior distribution and costs known, Prior distribution unknown, Prior distribution and costs unknown, Comparison of two means, Standard deviation not precisely known, Number of observations in comparing standard deviations, Sequential testing.

**Frequency Data and Contingency Tables:** Binomial, Poisson, Negative binomial and Chi-squared distributions, Analysis of single classification data, Contingency tables, General considerations on frequency data.

**Teaching /Learning Methods:** Lectures and analysis of data

**Assessment Strategy**: Continuous assessment and end of semester examination.

| Continuous Assessment | Final Assessment |
|---|---|
| 30 % | 70 % |

| Details: quizzes and/or mid-term | Theory | Practical | Other |
|---|---|---|---|
| 30 | 50 | 20 | |

**References/Reading Materials:**


1. D. Brynn Hibbert, J. Justin Gooding (2006). Data Analysis for Chemistr'. Oxford University Press.
2. James N. Miller, Jane C. Miller, Pearson 6th Edition 2010,'Statistics and Chemometrice for Analytical Chemistry'.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 12632 | | |
| Course Name: | Biomolecules | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | CHEM 12652, CHEM 12661 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 15 | 45 | 40 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- articulate an understanding of the relationships between chemistry and the biological sciences
- explain the nature, properties (chemical and biological) of four major classes of biomoleules
- catalytic effect of enzymes

**Course Content:**

Structure of living cell; structure, properties (chemical and physical) and functions of amino acids, proteins, simple sugars and polysachharides, fatty acids and lipids including cell membrane, lipoproteins and glycoproteins, nucleosides and nucleic acids including genetic code; DNA replication, transcription and translation; enzymes and mechanism of action including inhibition and action of coenzymes.

**Laboratory classes:** Qualitative analysis of amino acids, proteins, carbohydrates, lipids and physical properties of nucleic acids and enzyme kinetics.

**Teaching /Learning Methods:** A combination of lectures, tutorials and laboratory classes

| **Assessment Strategy:** Continuous assessment and end of semester examination. | | | |
|---|---|---|---|
| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
| Details: quizzes, lab reports and/or mid-term<br>30 | Theory<br>50 | Practical<br>20 | Other |

**References:**


1. Stryer, L. (2001), Biochemistry, Freeman.
2. Voet, D and Voet, G. (1995), Biochemistry, John Wiley.
3. Lehninger, L., Nelson, D.L. and Cox, M.M. (2000), Principles of Biochemistry, Worth.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | MIBI 12532 | | |
| Course Name: | Introduction to Microbiology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 15 | 45 | 40 |

**Course Aim/Intended Learning Outcomes:**

At the end of the course, the student will be able to

- Describe what microorganisms are and their major divisions
- Explain differences between prokaryotic cell and eukaryotic cell
- Demonstrate the understanding of basic physiological and some biochemical characteristics of microorganisms
- Demonstrate the understanding of the basic laboratory methods used in the study of microorganisms
- Describe importance of microorganisms in some related industries: examples food, soil and wastewater treatment

**Course Content:**

**General introduction to Microbiology:** Scope of microbiology, Major divisions of the living world. Different groups of microorganisms: Bacteria, Fungi, Virus etc., Structure & functions of prokaryotic and eukaryotic cell. Microorganisms: their habitats, nutritional requirements and nutritional related classification. Basic physiological and some biochemical characteristics of microorganisms. Basic principles in microbial genetics. Basic microbiological tools used to observe and study microorganisms.

**Microbial growth:** The definition of growth and growth curve of bacteria

**Control of microorganisms:** Theory and practice of pasteurization, sterilization and disinfections.

**Introduction to industrial microbiology:** Basic aspects of soil microbiology and water & wastewater microbiology and microorganisms in food industry.

**Practical:** Examination of living micro-organisms in natural environment, examination of microorganisms using Wet Mount Techniques and Dry Mount Techniques. Microscopic examination of bacteria, endospores, capsules. Growing microorganisms in laboratory environment.

**Teaching /Learning Methods:** A combination of lectures**,** tutorials and laboratory classes.

**Assessment Strategy:** Continuous assessment and end of semester theory and practical examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes, lab report and/or mid-term | Theory | Practical | Other |
| 30 | 50 | 20 | |

**References/Reading Materials:**


1. Atlas, R.M. (1996). Microbiology: Fundamentals and applications. Publishers Wm. C. Brown
2. Talaro, K. P, and Chess, B. (2011) Foundations in Microbiology. Publisher: McGraw-Hill Science/Engineering/Math; 8 Edition
3. Tortora, G.J., Funke, B.R., Case, C.L (2009) Microbiology: An Introduction (11th Edition). Publisher :Benjamin

**University level 2**

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code | APCH 21642 | | |
| Course Name | Principals of Analytical Chemistry | | |
| Credit Value | 02 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | CHEM 11622 | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit the student should be able to,

- select the most appropriate sampling technique for a particular analytical experiment
- apply fundamentals of separation techniques (solvent extraction and chromatography), spectroscopy and electro analytical techniques for quantitative chemical analysis

**Course Content:**

**Analytical Spectroscopy :**

Emission, absorption, fluorescence and scattering processes of radiation. Atomic emission spectrometry: flame photometry, flame atomic emission spectrometry, inductively coupled plasma atomic emission spectrometry. Atomic absorption spectrophotometry; flame and electro-thermal atomic absorption spectrometry, hydride generation and cold vapor generation techniques. X-ray fluorescence spectrometry. Molecular spectrometry, UV-visible spectrometry, fluorescence spectrometry. Techniques based on the light scattering principle; Nephelometry and turbidimetry.

**Analytical Electrochemistry :**

Potentiometry; reference electrodes, indicator electrodes, direct potentiometry, potentiometric titrations, ion selective electrodes, solid state chemical sensors. Voltammetry; classical polarography, two electrode cells, three electrode cells and potentiostats, Tast polarography, pulse polarography, stripping analysis, voltammetry with other working electrodes, cyclic voltammetry and square wave voltammetry. Amperometric titrations. Coulometry; electrogravimetry, constant current and controlled potential coulometry.

**Analytical Separation :**

Solvent extraction. An introduction to chromatography; gas chromatography, classical liquid chromatography, high performance liquid chromatography, ion exchange chromatography, molecular exclusion chromatography and affinity chromatography.

**Analytical Instrumentation :**

Instrument performance characteristics; instrument calibration, linear range, linear dynamic range,

sensitivity, instrument detection limit, method detection limit, limit of quantization. Signal, noise and signal to noise ratio.

**Teaching/ Learning Methods:** A combination of lectures and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 20% | 80% | | |
| Details: Quizzes/ Assignments | Theory | Practical | Other |
| 20 | 80 | | |

**Recommended Reading:**


1. Skoog, D. A., James, F. H., Nieman, T. A., (2018) *Principles of Instrumental Analysis,* Harcourt Brace College Publishers.
2. Gary, D.C., (1994) *Analytical Chemistry*, John Wiley & Sons, Inc.
3. Kealey, D., Haines, P. J., (2002) *Analytical Chemistry*, BIOS.
4. Miguel V., (2000) *Principles of Analytical Chemistry,* Springer.
5. Skoog, D. A., Donald M. W., James, F. H., (2014) *Fundamentals of Analytical Chemistry*, Saunders College Publishing.
6. Monk, P. M. S., (2001) *Fundamentals of Electroanalytical Chemistry*, Wiley.
7. Robert, de L., (1997) *Principles of Quantitative Chemical Analysis,* McGraw Hill.
8. Skoog, D. A., Donald, M. W., James, F. H., (1994) *Analytical Chemistry: An Introduction,* Saunders College Publishing.
9. Miller J. C., Miller J. N., (1999) *Statistics for Analytical Chemistry,* Ellis Horwood and Prentice Hall.


| **Semester** | **1** | | |
|---|---|---|---|
| Course Code | CHEM 21682 | | |
| Course Name | Physical Chemistry II | | |
| Credit Value | 02 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | CHEM 12642 | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit the student should be able to,

- explain the limitations of classical mechanics and merits of quantum mechanics
- apply fundamentals of quantum mechanics to basic chemical models representing translation, rotation and vibration of particles
- interpret physical properties of surfaces and colloids using fundamentals
- interpret molecular spectra of simple molecules
- explain phase equilibria and phase transformations of mixtures using phase diagrams

**Course Content:**

**Quantum Mechanics (9 h)**
Failure of classical mechanics, wave-particle duality, Heisenberg's uncertainty principle, postulates in quantum mechanics, Schrödinger equation, quantum numbers and their significance, particle in infinite potential boxes of 1, 2 and 3 dimensions, rotation in 2-dimension, harmonic oscillator and the hydrogen atom.

**Surface and Colloid Chemistry (6 h)**
Introduction to the fundamental and applications of interfacial phenomena; capillarity, surface and interfacial tension, wetting and contact angles, chemical and physical adsorption. Gas-solid adsorption; Langmuir and Freundlich isotherms, Colloids; classification and preparation; properties of colloidal dispersion.

**Atomic and Molecular Spectroscopy (9 h)**
Interaction of electromagnetic radiation with matter. Rotational spectroscopy; rigid rotor model. vibrational spectroscopy; harmonic and anharmonic oscillator models. Raman spectroscopy and electronic spectroscopy, Spectroscopic term symbols.

**Phase Equilibria (6 h)**

Thermodynamical description of mixtures, partial molar quantities; partial molar volume and Gibbs free energy. Phases, components and degree of freedom, the phase rule, phase diagrams; interpretation, lever rule. Liquid-liquid phase diagrams; phase separation, critical solution temperatures. Temperature-composition diagrams; distillation of mixtures, zeotropes and azeotropes. Liquid solid phase diagrams; eutectics and three component systems.

**Teaching/ Learning Methods:** A combination of lectures and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 20% | 80% | | |
| Details: Quizzes/ Assignments | Theory | Practical | Other |
| 20 | 80 | - | - |

**Recommended Reading:**


1. Atkins, P. W., De Paula, J., Keeler, J., (2018) *Physical Chemistry*, Oxford.
2. Levine, I. N., (2011) *Physical Chemistry*, McGraw-Hill.
3. Daniels, F., Alberty, R. L., (2004) *Physical Chemistry*, John Wiley.

4. Barrow, G. M., (1996) *Physical Chemistry*, McGraw-Hill.
5. Hollas, M., (2002) *Basic Atomic and Molecular Spectroscopy*, RSC.
6. Monk, P. M. S., (2001) *Fundamentals of Electroanalytical Chemistry*, Wiley.

| **Semester** | **1** | | |
|---|---|---|---|
| Course Code | CHEM 21691 | | |
| Course Name | Physical Chemistry Laboratory | | |
| Credit Value | 01 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | CHEM 12642 | | |
| Co-requisites | CHEM 21682 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit, the student should be able to,

- measure physico-chemical properties and evaluate data using fundamental concepts of physical chemistry
- properly operate some basic laboratory equipment and use instrumental techniques in chemical analysis
- use standard mathematical analyses to correctly explain the numerical significance of experimental results

**Course Content:**

Instrumental techniques for determination of physicochemical properties based on chemical equilibrium, thermodynamics, chemical kinetics, spectroscopy, and electrochemistry.
Use of statistical methods for the analysis of experimental data and disciplinary reporting of results.

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment | | Final Assessment | | |
|---|---|---|---|---|
| 30% | | 70% | | |
| Details Quizzes/ Assignments | Lab reports | Theory | Practical | Other |
| 20 | 10 | - | 70 | - |

**Recommended Reading:**

1. Shoemaker, D. P., Garland, G. W., Nibler, J. W., (2002) *Experiments in Physical Chemistry*, McGraw-Hill.

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 21652 | | |
| Course Name: | Soil Chemistry, Terrestrial Pollution and Management of Solid and Hazardous Waste | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | CHEM 11622 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course unit, students should be able to demonstrate an understand

- the properties of soil, nutrients in soil and their availability
- soil water and soil air
- methods used to determine the physical and chemical properties of soil
- terrestrial pollution resulting from soil degradation and erosion
- causes of soil pollution and develop reduction methods to be used for handling solid and hazardous wastes.

**Course Content:**

**Soil chemistry:** Definition of soil and its importance, Soil formation, constituents of soil including physical properties of soil (profile, texture, density, porosity), chemical properties of soil (acidity, alkalinity and salinity of soil, cation and anion exchange capacities, oxidation and reduction potential, organics, nutrients in soil and their availability, soil water and soil air contents

**Soil analysis:** Methods of sampling and analysis of soil physical and chemical parameters**.**

**Terrestrial pollution:** Soil degradation and soil erosion; chemical aspects of causes and the processes, minimization and remedy. Causes of terrestrial pollution (natural and anthropogenic sources, acid rain, agro-chemicals, solid and liquid wastes from industry and household).

**Solid waste and hazardous waste management:** Types of solid and hazardous wastes (domestic, municipal, industrial, radioactive, clinical, e-waste); monitoring, volume reduction, treatment, environment impact, proper disposal (incineration, land filling, recycling) and value added products

(biogases, compost) of solid and hazardous waste, regulations in Sri Lanka regarding disposal.

**Teaching /Learning Methods:** A combination of lectures and tutorials.

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Bunce, N., (1998). Environmental Chemistry, Wuerz.
2. Williams, I., (1999). Environmental Chemistry, A Modular Approach, John Wiley.
3. Raymond Miller, (2007) Soils in our environment, 11th ed, Pearson College
4. H.D Foth., (1990). *Fundamentals of Soil Science*, John Wiley & sons.
5. Cheremisinoff, N. P. (1996) Biotechnology for waste and wastewater treatment. Noyes Publications, Westwood, New Jersey, USA.
6. LaGrega, M., Buckingham, P., and Evans, J. Hazardous Waste Management (1994) McGraw-Hill, NY.
7. McBean E., Rovers F., and Farquhar G. (1995) Solid Waste Landfill Engineering and Design, Prentice-Hall, NJ.
8. Scholze, R. J., Smith, E. D., Bandy, J. T., Wu, Y. C. and Basilico, J. V. (1998) Biotechnology for degradation of toxic chemicals in hazardous wastes. Noyes data corporation, New Jersey, USA.
9. Tchobanoglous, G. et al. (1993) Integrated Solid Waste Management, McGraw-Hill, New York.


| **Semester** | **1** |
|---|---|
| Course Code: | APCH 21663 |
| Course Name: | Atmospheric Chemistry, Aquatic Chemistry and Pollution Analysis &Treatment |
| Credit Value: | 03 |
| Compulsory/Optional | Compulsory |
| Pre-requisite | CHEM 11631 |
| Co-requisite | None |

| Hourly Breakdown | Theory | Practical | Independent Learning |
|---|---|---|---|
| | 45 | - | 105 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course unit, students should be able to demonstrate and understand

- chemistry of atmosphere
- pollutants in the atmosphere and water bodies and their impact on environment including living organisms
- methods of treatment or reduction.

**Course Content:**

**Atmospheric chemistry**

Structure and composition of the atmosphere, the importance of chemical cycles and of trace species in the atmosphere, chemistry of the stratosphere: the ozone layer, Ozone layer depletion; chemistry of the natural and polluted troposphere (enhanced greenhouse effect, climate change and global warming, photochemical smog, acid rain, thermal & sound pollution).

**Atmospheric pollution**:

Air quality, Nature of atmospheric pollution. Classification of air pollutants, Sources of air pollutants. Plume behavior and dispersion of air pollutants. Effects of air pollution on environment and health. Indoor air pollution.

**Aquatic chemistry:**

Water bodies (fresh water including ground water, marine, brackish), their characterization and significance; chemical equilibrium principles of acids-bases, dissolution-precipitation, oxidation-reduction, and complexation applied to understanding the chemistry of water.

**Water pollution:**

Types of water pollutants (inorganic, organic chemicals and biological) including those in sediments, wastewater, sewage pollution eutrophication, algal toxins, thermal pollution and oil spillage. Impact on living organisms including food web and health.

**Atmospheric and aquatic pollution analysis and treatments:**

Major aspects of air and water pollution problems and sources, analysis of air and water pollution, water quality parameters (Physical and chemical characteristics. BOD, COD and their importance.), evaluation and control of air and water pollutants.

Methods of analysis of aquatic pollution (pH, electrical conductivity, salinity, sodium absorption ratio, anions, cations, discharge problems, agrochemicals, detergents)

**Wastewater treatment:**

Preliminary, primary, secondary and tertiary treatments of wastewater. Sludge treatment and disposal. Modern treatment methods. Recovery of materials from process effluents

**Air pollution treatment**:

Sampling of pollutants. Methods of estimation of air pollutants. Automobile pollution. Control methods for particulates and gaseous pollutants. Pollution from chemical industries. Origin, control

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|---|
| methods, and equipment used in typical industries, Carbon credits. |
| **Teaching /Learning Methods:**<br>Lectures, assignments, field visit(s) to at least one organization dealing with wastewater treatment and air pollution, computer assisted learning |
| **Assessment Strategy:** Continuous assessment and end of semester examination. |

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Barbara J. Finlayson-Pitts (1999). Chemistry of the Upper and Lower Atmosphere,Academic Press In
2. Manahan S.E. (2000). Fundamentals of Environmental Chemistry, Lewis Publishers
3. Keith L.H. (1996). Principles of Environmental Sampling, American Chemical Society
4. Leiser K.H. (1970). Nuclear and Radiochemistry, VCH.
5. Stumm W. and Morgan J.J. (1981). Aquatic Chemistry, John Wiley.
6. Huang C.P., O'nelia C.P. and Morgan J.J. (1995). Aquatic Chemistry – Interfacial and Interspecies Process, American Chemical Society.
7. Williams I. (2001). Environmental Chemistry, John Wiley.
8. Harrison R. M. (1998). Understanding of Our Environment-Introduction to environmental Chemistry and Pollution, Royal Society of Chemistry.


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|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 21672 | | |
| Course Name: | Polymer Chemistry | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | CHEM 12652 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |
| **Course Aim/Intended Learning Outcomes:** | | | |

On successful completion of this course, the student will be able to demonstrate the knowledge and understanding about

- the structures of polymers, mechanism of reactions leading to polymerization
- different polymerization processes, different types of polymerizations,
- vulcanization process
- general characteristics of polymers, characterization of polymers, degradation processes occurring and stabilization processes used in industry and recycling of polymers.
- degradation and stabilization of polymers

**Course Content:**

**Introduction:**

Introduction to polymers and their applications, repeating units, natural polymers, synthetic polymers, linear polymers, branched polymers, hyperbranched polymers, dendrimers, polymer networks, homochain polymers, heterochain polymers, homopolymers, copolymers, terpolymers, types of copolymers: random copolymers, alternating copolymers, block copolymers, graft copolymers, tacticity of polymers; types of polymers: elastomers, plastics, thermoplastics, thermoplastic elastomers and fibres.

**Polymerization Techniques:**

Raw materials and their resources for manufacturing polymers. Polymerization reactions: condensation polymerization, addition polymerization (free radical polymerization, cationic polymerization, anionic polymerization) coordination polymerization, ring opening polymerization, polymerization with special catalysts (metalocene); polymerization kinetics, copolymerization and copolymerization kinetics

**Polymerization Processes:**

Homogeneous polymerization (bulk polymerization, solution polymerization), Heterogeneous polymerization (suspension polymerization, emulsion polymerization, interfacial polymerization)

**Vulcanization of Polymers:**

Vulcanization reactions using peroxides, sulfur and metal oxides

**General Characteristics and Characterization of Polymers:**

Different versions of molar mass and molar mass distribution, polydispersity index, degree of polymerization, determination of molar mass, mechanical properties, glass transition temperature and melting temperature.

**Degradation, Stabilization and Recycling of Polymers:**

Internal factors and external factors affecting degradation of polymers; types of degradation and their reaction mechanisms: thermal degradation, oxidative degradation, photo-degradation, ozone degradation, biodegradation and mechanical degradation; stabilizers and stabilization reactions in preventing degradations, recycling of polymers

**Teaching /Learning Methods:** A combination of lectures**,** tutorials and field visits to at least one relevant industry.

| | | | |
|---|---|---|---|
| **Assessment Strategy:** Continuous assessment and end of semester examination. | | | |
| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | Practical | Others |

**References/Reading Materials:**


1. Rawe A. (1995). Principles of Polymer Chemistry, Plenum.
2. Billmeyer F.W. (2007). Text Book of Polymer Science, 3rd Edition, John Wiley.
3. Young R.J. and Lovell P.A. (1991). Introduction to Polymers, Chapman Hall.
4. Nicholson, J.W. (2011). Chemistry of Polymers, RSC Publication.


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|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 21682 | | |
| Course Name: | Scientific Communication Skills | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | DELT 11552 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit the student should be able to extract data from scientific communications using modern information searching methods and demonstrate skills in scientific writing and presentation.

**Course Content:**

**Scientific Communication Process**:
scientific research and the use and generation of information, brief communications, abstracts, journal articles, conference papers, dissertations.

**Information Literacy**:
Concept and definitions, competencies.

**Sources of information**:

primary, secondary and tertiary sources, hard and soft types, media and formats, full text sources.

**Information Searching:**
traditional methods, online searching, search engines, search techniques.

**Synthesis and Presentation**:
ability to interpret information into academic discussions, oral, written and poster presentations, constructing and delivering effective technical presentations, citations, plagiarism and copyright.

**Bibliography management system:**
Introduction to reference management software

**Teaching /Learning Methods:** Lectures, individual and group assignments and discussions.

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
|---|---|---|---|
| Details: quizzes and/or mid-term,<br>30 | Theory<br>50 | Practical | Others<br>20 |

**References/Reading Materials:**


1. Andretta, S.E. (2005). Information Literacy: a practitioner's guide. Chandos Publishing, Oxford
2. Secker, J. B. and Gwyneth, D.P. (Ed). (2007). The Information Literacy Cookbook: ingredients, recipes and tips for success. Chandos Publishing, Oxford
3. Lloyd, A. (2010). Information Literacy Landscapes: information literacy in education workplace and everyday context. Chandos Publishing, Oxford.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code | CHEM 22702 | | |
| Course Name | Inorganic Chemistry | | |
| Credit Value | 2 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | CHEM 11622 | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit the student should be able to,

- name coordination compounds systematically according to IUPAC nomenclature
- draw the structures of the different types of isomers of coordination compounds
- explain magnetic properties, colors, hybridizations, geometries, and distortions of coordination complexes using the bonding theories of coordination compounds
- explain the involvement of electrons in metal-ligand bonding
- propose mechanisms for simple catalytic processes involving organometallic compounds
- identify the symmetry and point groups of molecules

**Course Content:**

**Coordination Chemistry :**

History, isomerism and nomenclature of coordination compounds, Lewis theory, valence bond theory, crystal field theory. Applications of crystal field theory; colors, magnetic properties etc., spectrochemical series, factors affecting the crystal field splitting, Jahn-Teller distortion, introduction of ligand field theory.

**Organotransition Metal Chemistry :**

Importance of organometallic chemistry, organometallic ligands. Formalisms in organometallic chemistry; oxidation state, *d* electron configuration, number of valence electrons, metal–carbon bonding, bonding properties of $H_2$, carbon monoxide, alkenes, alkyne and $N_2$. Reactivity of organometallic compounds, mechanisms for simple catalytic processes.

**Molecular Symmetry :**

Symmetry elements, symmetry operations, determination of molecular symmetry and point groups

**Teaching/ Learning Methods:** A combination of lectures and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 20% | 80% | | |
| Details: Quizzes/ Assignments | Theory | Practical | Other |
| 20 | 80 | - | - |

**Recommended Reading:**


1. Miessler, G. L., Fischer, P. J., Tarr, D.A., (2014), *Inorganic Chemistry*, Pearson.
2. Crabtree, R. H., (2013) *The Organometallic Chemistry of the Transition Metals*, Wiley.
3. Lee, J. D., (2008) *Concise Inorganic Chemistry*, Blackwell.
4. Weller, M., Overton, T., Rourke, J., Armstrong, F., (2018) *Inorganic Chemistry*, Oxford.
5. Cotton, F. A., Wilkinson, G., Murillo, C. A, Bochmann, M., (2007) *Advanced Inorganic Chemistry*, New York, John Wiley.
6. Sharp, A. G., Housecroft, C., (2012) *Inorganic Chemistry*, Pearson.

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|---|---|---|---|
| **Semester** | **2** | | |
| Course Code | CHEM 22712 | | |
| Course Name | Organic Synthesis, Spectroscopy and Aromaticity | | |
| Credit Value | 02 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | CHEM 12652 | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit the student should be able to,

- construct C-C and C-N bonds using efficient synthetic methods
- construct simple organic molecules employing suitable methods, reagents and reaction conditions
- interpret spectra of simple organic compounds
- determine the structure of simple organic compounds by analyzing spectra
- identify aromatic compounds and rationalize their stability

**Course Content:**

**Organic Synthesis :**

Carbon-carbon single bond formation; carbonyl condensations, inter and intra molecular condensations, specific enolates, base promoted alkylations. Carbon- carbon double bond formation; Wittig reaction. The use of organometallics in synthesis; Mg and Cu reagents. Carbon-nitrogen bond formation, use of rearrangements in synthesis; Baeyer Villiger and Claisen rearrangements. Functional group transformations in synthesis including oxidation and reduction.

**Spectroscopic Methods in Structure Elucidation of Organic Chemistry :**

Electromagnetic spectrum and organic molecules; UV and visible spectroscopy, molecular orbital description, color of compounds, chromophores, solvent effects, Beer Lambert's law, UV spectrometer. Infra-red spectroscopy; stretching frequencies of functional groups, effects of hydrogen bonding, IR spectrometer and experimental considerations. $^{1}$H-Nuclear magnetic resonance spectroscopy; theory, secondary magnetic fields, chemical shift values of aliphatic and aromatic compounds, including annulenes, chemical equivalence, peak area measurement and integration, spin-spin splitting, effect of hydrogen bonding, $D_2O$ exchange, NMR spectrometer and experimental considerations. $^{13}$C-NMR; theory, chemical shift assignments, effect of neighboring protons, proton coupled $^{13}$C-NMR spectrum, off resonance decoupled spectra, experimental considerations. Mass spectroscopy; theory, mass spectrometer and mass spectrum, molecular ion and fragmentation patterns of compounds, use of molecular formula, N-rule, high resolution mass spectra. Interpretation of the spectra of organic compounds.

**Aromaticity and Aromatic Heterocyclic Compounds :**
Aromatic character; application of Hückel's rule, Frost circles, aromatic hydrocarbon ions, annulenes. antiaromatic hydrocarbons. Introduction to aromatic heterocyclic compounds: nomenclature, structure and physical and chemical properties of five, six, and bicyclic heteroaromatic compounds with one heteroatom.

**Teaching/ Learning Methods:** A combination of lectures and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 20% | 80% | | |
| Details: Quizzes/ Assignments | Theory | Practical | Other |
| 20 | 80 | - | - |

**Recommended Reading:**


1. Norman, R. O. C., Coxon J.M., (1993) *Principles of Organic synthesis*, Chapman & Hill.
2. Pavia, D. L., Lapman, G. M., Kriz, G. S., (1979) *Introduction to Spectroscopy*, Saunders.
3. Williams, D.H., (1989) *Spectroscopic Methods in Organic Chemistry*, McGraw and Hill.
4. Murphy, P., (2002) *Heterocyclic Chemistry; Series: Tutorial Chemistry Texts*. M. Sainsbury, University of Bath.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code | CHEM 22721 | | |
| Course Name | Analytical Chemistry Laboratory | | |
| Credit Value | 01 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | APCH 21642 | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit, the student should be able to,

- perform an appropriate sampling technique prior to chemical analysis
- apply the best analytical technique for an unknown sample to be characterized chemically

- validate the analytical method and data obtained by chemometric techniques
- identify, differentiate and demonstrate the classical and instrumental methods of chemical analysis

**Course Content:**

Experiments based on sampling and data handling, gravimetric analysis of metals using homogeneous precipitation method, complexometric titration of metal mixtures. Experiments based on analytical spectrometry; atomic absorption spectrometry, flame photometry and colorimetry. Electroanalytical techniques; voltammetry, potentiometry, separation techniques; solvent extractions, ion exchange chromatography, basic GC and LC methods. Method development and validation.

**Teaching/ Learning Methods:** A 3-hour laboratory class per week (15 weeks), pre-lab quizzes and assignments

**Assessment Strategy:** Continuous assessment and end of semester examination.

| Continuous Assessment 30% | | Final Assessment 70% | | |
|---|---|---|---|---|
| Details: Quizzes/ Assignments | Lab reports | Theory | Practical | Other |
| 20 | 10 | - | 70 | - |

**Recommended Reading:**


1. Skoog, D. A., James F. H., Nieman. T. A., (1998) *Principles of Instrumental Analysis*, HarcourtBrace College Publishers.
2. Skoog, D. A., Donald M. W., James, F.H., (1996) *Fundamentals of Analytical Chemistry*, Saunders College Publishing.
3. Harris, D. C., (2006) *Quantitative Chemical Analysis*, Freeman.
4. Mendham, J., Denney, R. C., Barnes, J. D., (2002) *Vogel's Textbook of Quantitative Chemical Analysis*, Prentice Hall.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 22692 | | |
| Course Name: | Sample Preparation and Chemometrics | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On completion of this course, students will be able to

- demonstrate skills on sample gathering and prepare working samples
- critically evaluate the use of statistical techniques to investigate data quality method development and optimization.

**Course Content:**

**Sampling:** Sampling of gases, vapour, liquids and solids from environment, field sampling, sampling statistics.

**Sample preparation:** Analytical perspective, extraction and enrichment techniques, other techniques to prepare and purify samples for analysis.

**Chemometrics**; Introduction, experimental design, selection of approved analytical methods, rejection of data, simple ANOVA, development and validation of methods, data evaluation and statistical analysis

**Teaching /Learning Methods:**

A combination of lectures, assignments and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination.

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Others |
| 30 | 70 | | |

**References/Reading Materials**


1. Skoog, D.A., James F.H., Nieman. T. A., (1998) *Principles of Instrumental Analysis,* Harcourt Brace College Publishers
2. Svehal, G. (2001). Vogel's Qualitative Inorganic Analysis. 7th edition, Longmans.


| **Semester** | **2** |
|---|---|
| Course Code: | APCH 22702 |
| Course Name: | Case Study I (Environmental) |
| Credit Value: | 02 |
| Compulsory/Optional | Compulsory |
| Pre-requisite | APCH 21542, CHEM 11622, |

| | | | |
|---|---|---|---|
| Co-requisite | CHEM 22721 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 10 | - | 90 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit the student will be able to analyze and suggest remedial measures in a real-world problem pertaining to an environmental issue in Sri Lanka in a scientific manner.

**Course Content:**

Identify, analyze, design strategies and possible solution in a scientific manner to solve the chosen problem related to an environmental issue in Sri Lanka for a period at least 120 hours. The case study will be conducted in groups comprising of 4-5 undergraduates under the guidance of a senior academic staff member in the department.

**Teaching /Learning Methods:**

Literature survey, field study, discussions, data analysis, problem solving and report writing.

**Assessment Strategy**: Continuous assessment and end of course unit examination (written and oral)

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Others |
| 30 | 10 | | 60 |

**References/Reading Materials:**

Literature related to the case study

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 22712 | | |
| Course Name: | Polymer Technology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 21672 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |

| | | | |
|---|---|---|---|
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course, the student will be able to demonstrate the knowledge and understanding about the

- synthesis, chemistry and applications of industrially important polymers
- latex technology, rubber technology, plastic technology, polymer blends and composites.

**Course Content:**

**Properties and applications of industrially important Polymers:**
Natural rubber and derivatives of natural rubber (chlorinated rubber, epoxidized rubber, oil extended rubber, viscosity modified rubber), polybutadiene rubber, butyl rubber, styrene-butadiene rubber, nitrile rubber, Polyethylene, polypropylene, polyvinyl chloride, polystyrene,polymethyl methacrylate, polyacrylonitrile, polyvinylacetate, polyamides, polyesters, polyurethanes, polysiloxanes, engineering plastics, thermosetting plastics,phenolic resins, unsaturated polyester resins, epoxy resins, vinyl resins high-temperature polymers, biodegradable polymers, liquid crystalline polymers.

**Latex Technology:**
Introduction to natural and synthetic lattices, stabilization of lattices, preservation of natural rubber (NR) latex, methods of preparing concentrated NR latex, characterization of NR latex, deproteinized NR latex, additives used in latex processing, latex compounding and vulcanization methods, manufacturing processes of latex based products (dipping, foaming, casting, threading), latex based adhesives, paints and surface coatings based on lattices

**Rubber Technology:**
Types of NR (RSS, crepe rubber, TSR) and their manufacturing processes, additives used in rubber processing (fillers, vulcanizing agents, softeners, extenders, antidegradents, pigments, mold releasing agents); rubber compounding processes and vulcanization technics; manufacturing processes of selected dry rubber products (compression moulding, extrusion, calendaring), liquid rubber and liquid rubber-based products

**Plastic Technology:**
Principle of thermoplastic and thermoset processing, additives for plastics, manufacturing processes of plastic products (compression moulding, extrusion, injection moulding, reaction injection moulding, transfer moulding, rotational moulding, blow moulding, film blowing, spinning, thermoforming vacuum forming, casting), manufacture of plastic foam products

**Polymer Blends and Composites:**
Introduction to polymer blends and composites, manufacturing processes of blends and composites, use of coupling agents

**Teaching /Learning Methods:**

A combination of lectures**,** tutorials and field visits to at least one relevant industry.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
|---|---|---|---|
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | Practical | Others |

**References/Reading Materials:**


1. Rawe A. (1995). Principles of Polymer Chemistry, Plenum.
2. Billmeyer F.W. (2007). Textbook of Polymer Science, 3rd Edition, John Wiley.
3. Young R.J. and Lovell P.A. (1991). Introduction to Polymers, Chapman Hall.
4. Nicholson, J.W. (2011). Chemistry of Polymers, RSC Publication.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 22721 | | |
| Course Name: | Environmental Chemistry Laboratory | | |
| Credit Value: | 01 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 21652, APCH 21662 | | |
| Co-requisite | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit the student should be able to demonstrate skills involved in sampling and preparation of samples for analysis, deduce properties of pollutants in environment and their mitigation.

**Course Content:**

Techniques of environmental sample collection, sample preparation and sample storage. Study of inorganic and organic chemical properties of natural and waste waters, soil and air. Study of processes of generation, propagation and transformation of environmental pollutants in the geosphere and biosphere. Investigate pollution mitigation methods.

**Teaching /Learning Methods:**

3 hour laboratory classes per week for 15 weeks, prelabs and assignments

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
|---|---|---|---|
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | Practical | Others |

**References/Reading Materials:**


1. Willard, H.H, Merritt, L, Dean, J, Settle, F., (1988) *Instrumental methods of analysis*. Wadsworth.
2. Harris, D.C. (2006) *Quantitative Chemical Analysis, 6th or 7th edition,* Freeman
3. Mendham, J; Denney, R.C.; Barnes, J.D., (2002) *Vogel's textbook of Quantitative Chemical analysis*, Prentice Hall.
4. Keith, L. H., (1991) *Environmental sampling and Analysis*. A Practical Guide, Lewis
5. Azara, J. et.al. (1997) *ASTM standards on Environmental Sampling*, 2nd edition.
6. Radojevic, M. and Bashkin, V. N., (1999) *Practical Environmental analysis*, RSC
7. Boehnke, D. N. and Delumyea, R. D., (2000) *Laboratory Experiments in Environmental Chemistry*, Prentice Hall.
8. Maria, C. and Saba, C., (2002) *Environmental Sampling and Analysis* Metals,Lewis Publishers
9. Eugene,R.W.,(2000) *Applications of Environmental Chemistry. A practical guide for environmental professionals,* CRC


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 22732 | | |
| Course Name: | Environmental Toxicology, Green Chemistry and Cleaner Production | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 21652, APCH 21662 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On completion of this course, the student should be able to

- demonstrate the knowledge and understanding of the basic principles in toxicology
- apply different toxicological frameworks within the professional disciplines and have awareness about different risk assessment criteria
- apply principles of cleaner product technology and green chemistry for the benefit of industry and environment.

**Course Content:**

**Toxicology:**

Introduction: Terminologies used in toxicity evaluation, absorption and excretion of toxins, bioaccumulation and biomagnifications. Metabolism of xenobiotics (phase I and II reactions), mechanism of biochemical effects due to environmental, food and clinical toxins and radioactivity resulting in acute and chronic toxicity (carcinogenesis, tetragenesis, mutagenesis, chemically induced neurotoxicity and endocrine toxicity), risk assessment and management.

**Green Chemistry:**

The essentials of green chemistry, applying the twelve principles of green chemistry, emerging green technologies and alternative energy sources, adverse effects of chemicals on health and the environment, industrial case studies.

**Cleaner Production:**

Cleaner production fundamentals, material- and energy balances of industrial processes, cleaner production and life cycle assessment, valuation of process alternatives in cleaner production in a sustainability perspective, a cleaner production study group task.

**Teaching /Learning Methods:** A combination of lectures, tutorials and team project.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Lancaster, M., (2002). Green Chemistry, RSC.
2. Hillary, R., (1997) Environmental Management Systems and Cleaner Production, Wiley.
3. Ouano, E. A. (2009) Cleaner Production: Myth and Reality: Cleaner Production and Pollution Control, VDM Verlag.
4. Timbrell, J., (2001) Introduction to Toxicology, 3rd Ed. Taylor & Francis.
5. Wright, D. A., (2002) Environmental Toxicology, Cambridge University Press.

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|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | MACS 22563 | | |
| Course Name: | Introduction to Marketing & International Trade | | |
| Credit Value: | 03 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 45 | - | 105 |

**Course Aim/Intended Learning Outcomes:**

On completion of this course, the student should be able to:

- Differentiate between domestic and international trade
- Evaluate the impact of factors affecting international marketing
- Advise SMEs on developing entry strategies

**Course Content:**

**Introduction to marketing:**
Marketing mix (product price place promotion) and extended marketing mix for the service industry, brand and branding tools,

**The international environment:**
Definitions and the concept of global marketing, Economic, political, legal, socio-cultural environment, International Marketing Management – Global marketing strategy, International Marketing Intelligence and entry strategies. Application of the marking mix in the international arena

**Teaching /Learning Methods:** Lectures, case discussions, tutorials and projects

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Kotler, P (2002), Marketing Management, 11th Edition, Prentice Hall.
2. Onkvisit, S and Show, J J (1996), International Marketing, analysis and strategy, 3rdEdition, Prentice Hall.

**University level 3**

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code | CHEM 31731 | | |
| Course Name | Organic and Inorganic Synthesis, Analysis and Natural Products Chemistry Laboratory | | |
| Credit Value | 01 | | |
| Compulsory/ Optional | Compulsory | | |
| Pre-requisites | CHEM 11631, CHEM 12661 | | |
| Co-requisites | - | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/ Intended Learning Outcomes:**

Upon successful completion of this course unit the student should be able to,

- synthesize and isolate air-stable coordination complexes
- analyze the isolated purified complexes by titrimetric and spectrophotometric methods
- solve problems and plan schemes related to the analysis of coordination complexes
- learn effective communication of scientific results by scientific report writing
- isolate natural products using hot and cold extraction techniques
- separate natural products using chromatographic techniques
- interpret the UV, IR, NMR, and mass spectra of simple organic compounds and determine the structure using these spectra
- perform single/multi step syntheses, isolate and purify products

**Course Content:**

**Inorganic Synthesis and Analysis Laboratory**

Synthesis of inorganic complexes, isolation, purification and analysis by titrimetric, spectrophotometric methods (UV-Visible Spectrophotometry, Infrared Spectrophotometry and Nuclear Magnetic Resonance Spectrometry) and conductivity measurements.
Mini-project/ group presentations/ Industrial visit.

**Natural Products, Organic Spectroscopy and Synthesis**

Isolation of natural products; steam distillation, cold and hot extraction, Separation; chromatographic techniques: column and TLC and analysis of natural products. Structure elucidation of simple organic compounds by the use of spectroscopy; $^{1}H$ NMR, $^{13}C$ NMR, MS, FTIR and UV. Synthesis of simple organic compounds via Diels-Alder reaction and Aldol condensation, and characterization of products. Multistep syntheses.

**Teaching/ Learning Methods:** A 3-hour laboratory class per week (15 weeks), pre lab quizzes and assignments

**Assessment Strategy:**

Continuous assessment and end of semester examination.

| Continuous Assessment 30% | | Final Assessment 70% | | |
|---|---|---|---|---|
| Details: Quizzes/ Assignments | Lab reports | Theory | Practical | Other |
| 20 | 10 | - | 70 | - |

**Recommended Reading:**

1. Reading materials (journal articles related to each experiment) will be provided during the laboratory classes.
2. Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M., Sivasankar, B., (2009) *Vogel's Textbook of Quantitative Chemical Analysis*. Prentice Hall.
3. Campbell, B. N., McCarthy, M., (1994) *Organic Chemistry Experiments, Microscale and Semimicroscale*, Brooks and Cole Publishing Co.
4. Wickramarachchi, S., (2018) *Structure Elucidation of Organic Compounds Using Spectroscopy: A Work Book, Problems and Answers*, College of Chemical Sciences.

| **Semester** | **1** | | |
|---|---|---|---|
| Course Code: | APCH 31742 | | |
| Course Name: | Food Chemistry | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 12632 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | - |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit, the student should be able to

- briefly explain the nature of food industry in the world and in Sri Lanka
- explain the structure, chemical composition, functions of components in food enzymes found in food and their role
- indicate the chemical and biochemical changes resulting during deterioration and spoilage of food

- indicate the role of permitted additives in processed food

**Course Content**:

**Introduction:**
Food science and its interdisciplinary nature, components in food, food industry globally and in Sri Lanka.

**Food Components:**
Natural sources, structure, functional properties, beneficial and non-beneficial role (e.g. nutritional, health) and determination of water, macro-nutrients (carbohydrates, amino acids and proteins, fatty acids and lipids), micro-nutrients (vitamins, minerals) and phytochemicals (e.g. compounds that impart colour, odour, flavor, texture and acts as antioxidants)

**Food enzymes:**
Enzymes causing beneficial and non-beneficial effects in food industry.

**Quality of food:**
Food spoilage and deterioration and their effect on the quality of food. Food borne diseases. Classification, functions and detection of food additives, food adulterants and food contaminants.

**Teaching /Learning Methods:**

A combination of lectures, assignments and tutorial discussions (supporting materials will be provided via CAL)

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Potter, N. N. and Hotchkiss, J. H**.** (1997)**,** *Food Science***,** Chapman and Hall.
2. Belitz, H. D. and Grosch, W., Scheiber,P. (2009), *Food Chemistry*, Springer.
3. Fennema, O.W. (1999). *Food Chemistry*, Marcel Dekker Inc., New York.
4. De Mann, J.M. (1999). Principles of Food Chemistry, Springer.
5. Wong, D.W.S., (1989). *Mechanism and Theory in Food Chemistry.* , Van Nostrand, New York.

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|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 31752 | | |
| Course Name: | Food Technology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 12632 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit, the student should be able to explain

- the principals involved in the unit operations used in food industry
- beneficial and non-beneficial effect of food processing
- explain the technology and chemistry involved in different food processing industries including packaging
- explain the regulations, legislations and standards imposed on processed food
- explain the analytical methods used in deducing the quality of processed food.

**Course Content:**

**Food technology and food processing:**

Effect processing, spoilage and deterioration in raw materials and processed food, post-harvest preservation of raw materials, principles used in food processing (heat processing, cold processing, dehydration including osmotic dehydration, fermentation, extrusion, curing, smoking, modified atmosphere packaging, minimal processing), effect of food processing on nutrition and shelf life and safety of processed and marketed food. Technology and chemistry involved in processing in food industry (dairy, cereals, legumes, tubers and bakery products, legumes, fruits, vegetables, meat, fish, carbonated beverages, starches, sea weeds, gums), new trends in food processing (fortification, neutraceuticals, functional food).

**Consumer protection and regulations:**

Food analysis (sampling, proximate analysis, detection of components in food including contaminants and adulterants, sensory evaluation). Food regulations and legislations, packaging, labelling including nutritional labelling, Introduction to quality assurance (ISO, SLS, GMP, HACCP).

**Teaching /Learning Methods:** A combination of lectures, assignments and tutorial discussions

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|---|---|---|---|
| **Assessment Strategy:** Continuous assessment and end of course unit examination | | | |
| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | practical<br>- | Others |

**References/Reading Materials:**


1. Potter, N. N. and Hotchkiss, J. H**.** (1997)**,** *Food Science***,** Chapman and Hall.
2. Belitz, H. D. and Grosch, W., Scheiber,P. (2009), *Food Chemistry*, Springer.
3. Fennema, O.R. (2007). *Food Chemistry*, Marcel Dekker Inc., New York.
4. De Mann, J.M. (1999). Principles of Food Chemistry, Springer.
5. Manual of Chemical Industries in Sri Lanka (1986). Part I, Institute of Chemistry, Ceylon.
6. Richardson T. and Finley J.W. (1985). Chemical Changes in Food During Processing, Chapman and Hall.


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|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 31761 | | |
| Course Name: | Food Chemistry Laboratory | | |
| Credit Value: | 01 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 22611 | | |
| Co-requisite | APCH 31742, APCH 31752 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit, the student should be able to

- apply AOAC methods to deduce the nutritional quality of food, deduce the quality of marketed food by detecting the contaminants including adulterants.

**Course Content:**

AOAC methods used in proximate analysis and determination of micro-nutrients of components in food including dietary fibres, methods used in analysis of parameters given by SLS (e.g. acid value, saponification value, iodine value, lipid peroxidation, iodine in salt), detection of adulterants, contaminants including common micro-organisms, tests used to detect completion of processing (e.g.

| | | | |
|---|---|---|---|
| pasteurization), sensory evaluation. | | | |
| **Teaching /Learning Methods:** Laboratory classes and a visit to at least one food processing industry | | | |
| **Assessment Strategy:** Continuous assessment and end of course unit examination | | | |
| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | practical | Other |
| **References/Reading Materials:**<br>1. Nielsen, S. S. (2010), *Food analysis second edition*, Aspen.<br>2. *Official Method of Analysis of AOAC International* (2009). 19th edition, AOAC International , New York. | | | |

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| **Semester** | **1** | | |
| Course Code: | APCH 31772 | | |
| Course Name: | Solid State Chemistry | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | CHEM 12642, CHEM 11612 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |
| **Course Aim/Intended Learning Outcomes:**<br>On successful completion of this course, the student will be able to<br>• describe methods of synthesis of solid-state compounds using examples.<br>• explain a non-stoichiometric solid and a solid solution.<br>• utilize band theory to describe the operation of modern semiconductor devices<br>• sketch the seven crystal systems and fourteen Bravais lattices.<br>• specify atomic planes, directions, and families of planes and directions within a given crystal structure using Miller indices.<br>• correlate X-ray diffraction information with crystal structure | | | |

- describe point, line, planar, and bulk imperfections in crystalline solids
- utilize binary phase diagrams to identify weight and/or atomic percentages of components, and relative amounts of stable phases in binary and unary solutions

**Course Content:**

**Introduction:**
Methods of solid state synthesis and analysis, some structural properties of solids, Interactions between solids and magnetic fields, Cooperative magnetism, Dielectric Properties: Interactions between solids and electric fields, Superconductivity

**Electronic Materials**:
Band theory: metals, insulators and semiconductors. Band gaps, doping, and devices, diodes and transistors, semiconductor optoelctronic devices and solar cells: optical processes in semiconductors and junction formation

**Crystalline Materials;**
Crystal structure, X-ray diffraction and defects

**Amorphous Materials:**
Inorganic glasses: silicates, other oxides, metallics.

**Solid Solutions**:
Phase stability, unary and binary phase diagrams

**Heterogeneous catalysis:**
Theory and applications.

**Teaching /Learning Methods:** A combination of lectures, assignments and tutorial discussions

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory (%) | practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. West, A.R. (1999). Basic Solid State Chemistry. Wiley 2nd edition.
2. Smart, L. and Moore, E. (2012).Solid State Chemistry: An Introduction, CRC Press, 4th edition.
3. West, A.R. (2014).. Solid state chemistry and its applications, 2nd Edition. Wiley.

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|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 31782 | | |
| Course Name: | Laboratory safety, Occupational Health and Safety Management, Laboratory Quality Systems | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

By the end of this course, the students will be able to organize and maintain a chemical or a biological laboratory adhering to the principles laboratory safety and quality system as well as work safely in a laboratory and obtain validated results adhering to international standards; understand the principles and contribute to healthy working environment and prevention of accidents at the workplace.

**Course Content:**

**Laboratory safety:**

Introduction to the principles of laboratory safety in biological and chemical laboratories, safe laboratory practices, safety regulations in handling, storage, disposal of chemicals and biological samples, use of protective equipment, hazards (mechanical, electrical, physical, chemical and biologica), laboratory risk management, emergency responses and treatments.

**Laboratory Quality Systems:**

Quality systems and method development used within a laboratory; ensuring the integrity of procedures used in laboratory processes, ensuring validity and reliability of results, validation of analytical procedures, international laboratory standards; regulatory requirements for laboratory operation; bio-security precautions; laboratory management, Good Laboratory Practice (GLP).

**Occupational Health and Safety Management:**

Systematic occupational health and safety, general principles of occupational health and safety legislation, psycho-social working environment, working with hazardous compounds, prevention of poor working condition by means of systematic occupational health and safety management, professional practice for occupational health, Occupational Safety Practice, management requirements of contemporary occupational practice, introduction to OHSAS 18001 standard.

**Teaching /Learning Methods:** A combination of lectures, tutorials and industrial visits

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
|---|---|---|---|
| Details: quizzes and/or mid-term %,<br>30 | Theory<br>70 | practical | Other |

**References/Reading Materials:**


1. Furr, K., (2000) CRC Handbook of Laboratory Safety, 5th Ed., CRC Press.
2. Gile, T. J., (2014) Complete Guide to Laboratory Safety, 4th ED, HCPro.
3. Friend, M. A., (2014) Fundamentals of Occupational Safety and Health, 6th Ed, Bernan Press.
4. Ratliff, T., (2003) The Laboratory Quality Assurance System, 3rd Ed, Wiley-Interscience.
5. Seiler, J. P., (2005) Good Laboratory Practice, 2nd Ed, Springer.


| **Semester** | **1** | | |
|---|---|---|---|
| Course Code: | ENCM 31022 | | |
| Course Name: | Environmental Policies and Legislation | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

By the end of this course the student will be able to describe the environmental policies and legislation and apply knowledge to critically evaluate the environmental management policies in Sri Lanka and the world.

**Course Content:**

**Environmental policies:**

Environmental policy and environmental law, Environmental conservation and management policies in Sri Lanka and the world, Environmental legislation in Sri Lanka including various aspects of environmental legislation such as Fauna and Flora Protection Ordinance and Development Act, Coast Conservation Act, Forest Ordinance, legislation on local government, other environmental Acts and Status etc., System of approval of development projects and high polluting industries in Sri Lanka.

**Environmental impact assessment:**

Initial Environmental Examination and Environmental Impact Assessment,: Constitutional provisions in environmental management, environmental management under provincial administration, Environmental standards and rationale for setting environmental standards, Environmental Protection Licensing process, Delegation of power and central administration with special reference to environmental conventions and management and International conventions and protocols relevant to global environmental issues.

**Teaching /Learning Methods:** A combination of lectures, tutorials, assignments, and discussions

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Constitution of the Democratic Socialist Republic of Sri Lanka.
2. Shayam Divan and Armin Rosencranz. Environmental lawand Policy in India- second edition, Cases Materials and statutes. Oxford University press.
3. Shanthakumar S and Ambedkar. Environmental law- An introduction with Bare Acts and Summery of Cases. Surya Publication- No 66, Sri Nagar Colony, Chennai.
4. The South Asian Environmental Law reporter, Environmental foundation Ltd.
5. South Asia Co-operative environmental programme, Compendium of Summaries of Judicial
6. Decision in Environmental related cases.
7. South Asia Co-operative Environmental Programme, Report of the Regional Symposium on the Role judiciary in Promoting the Rule of Law in the area of Sustainable Development.
8. Bernie P. W. and Boyle A. E., International Law and the Environment.
9. National Environmental Act No. 47 of 1980 as amended by Acts Nos 56 of 1988 and 53 of 2000.


| **Semester** | **1** |
|---|---|
| Course Code: | ENCM 31073 |
| Course Name: | Environmental Impact Assessment and Environmental Monitoring |
| Credit Value: | 03 |

| | | | |
|---|---|---|---|
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | ENCM 31022 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 45 | - | 105 |

**Course Aim/Intended Learning Outcomes:**

By the end of this course, the students will be able to demonstrate knowledge on Environmental Impact Assessment process and environmental monitoring methods and, demonstrate skills in application of EIA in development projects. and common techniques used in monitoring the environment quality.

**Course Content:**

Introduction to Environmental Impact Assessment (EIA), Steps in EIA, EIA methods, EIA process, Problems associated with EIA process in developing countries and potential solutions, Myths about EIAs, Incorporation of impacts and their mitigation into the process, Use of EIA as a decision making tool for achieving sustainable development. Case studies. Importance of environmental monitoring for environmental impact assessment, Main parameters to be monitored in key environmental issues: physical parameters, chemical parameters, biological parameters, socio-economic parameters, design of a monitoring programme, Techniques commonly used in chemical and biological monitoring of the environment, Environmental sampling and analysis, Quality assurance and safety procedures.

**Teaching /Learning Methods:**

A combination of lectures, tutorials, laboratory and field studies, seminars, assignments, discussions, and computer assisted learning.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Canter, L.W., (1996) Environmental Impact Assessment, Second Edition, McGraw Hill Publishing Company, Inc., New York.
2. Gilpin, A., (1995). Environmental Impact Assessment (EIA) – Cutting edge for the Twenty First Century, Cambridge University Press, Cambridge, England.
3. Vanclay, F., and Bronstein, D.A., (1995) Environmental and Social Impact Assessment, John Wiley and Sons Ltd., Chichester, England,
4. Hennanayake, S.K., Hewage A., Wijeratne M.S. and Yasaratne S.E. (1997) Environmental Impact Assessment, The Sri Lankan Experience. Centre for Environmental Studies, Peradeniya.

5. ASTM Standards on Environmental Sampling (1997) American Society for Testing and Materials, PA.
6. Radojevic, M. and V.N. Bashkin (1999) Practical Environmental Analysis. Royal Society of Chemistry, Cambridge.
7. Jamil, K. (2001) Bioindicators and Biomarkers of Environmental Pollution and risk assessment, Science Publishers Inc. Plymouth

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|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 32792 | | |
| Course Name: | Advanced Analytical Chemistry | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 21672, CHEM 21682 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit the student should be able to apply advanced analytical techniques to investigate complex systems and understand the effect of surroundings and conditions on analysis.

**Course Content:**

**Conditional constants:**
Conditional effects in acid base, complexometric and redox titrations, gravimetry and spectroscopy and separations.

**Surface analytical techniques**:
Introduction to surface properties (e.g. XPS, UPS, AES, SEM, SAM, STM, AFM, EELS).

**Advanced Spectroscopy:**
Advanced techniques involving UV-visible spectroscopy, Inductively coupled plasma mass spectrometry, laser ablation in atomic spectrometry. Microwave induced plasma systems for atomic spectrometry. X-ray fluorescence specrtrometry, γ-spectrometry and neutron activation analysis. 2D NMR spectroscopy including NOE, COSY, HMBC, HSQC and DEPT techniques); Mass spectroscopy including FAB, HRMS, GC-MS, LC-MS

**Advanced Separation Techniques;**
Solvent extraction, distribution constant and distribution ratio, conditional effects on the efficiency of analytical separations, chromatography; concepts, terms, definitions and tools used, gas chromatography (GC), high performance liquid chromatography (HPLC), electrophoresis including capillary electrophresis(CE), ion exchange chromatography (IEC), method development in

separational analysis.

**Advanced Electro-analytical Techniques**
Control potential microelectrode techniques; potential step methods and potential sweep methods. Controlled current microelectrode techniques. Methods involving forced convection. Hydrodynamic methods. Techniques based on concept of impedance. Electrochemical quartz crystal micro and nano balance techniques.

**Teaching /Learning Methods**: A combination of lectures and tutorials.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | other |
| 30 | 70 | | |

**References**/Reading Materials:


1. Chemical analysis, modern instrumentation methods and techniques, Francis Rouessac and Annick Rouessac (second edition) John Wiley and sons Ltd. (2007)
2. Harris, D.C., (2006) *Quantitative Chemical Analysis*, Freeman
3. Willard, H.H., Merritt, L., Dean, J., Settle, F., (1988) *Instrumental methods of analysis*. Wadsworth.
4. Flaschka, H.A., Barnard, A.J., Sturrock, P.E.., (1969) *Quantitative Analytical Chemistry*, Vol 1, Banes & Noble.
5. Mendham, J., Denney, R.C., Barnes, J.D., (2002) *Vogel's textbook of Quantitative Chemical analysis*. Prentice Hall.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 32802 | | |
| Course Name: | Case study II (Industry) | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | APCH 32602, APCH 32611 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |
| **Course Aim/Intended Learning Outcomes:** | | | |

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|---|
| Upon successful completion of the course unit the student will be able to analyze and suggest remedial measures in a real-world problem pertaining to an industry in Sri Lanka in a scientific manner. |
| **Course Content:**<br><br>Identify, analyze, design strategies and possible solution in a scientific manner to solve the chosen problem related to industry in Sri Lanka. The case study will be conducted in groups comprising of 4-5 undergraduate under the guidance of a Senior academic staff member in the department for a period of at least 120 hours.<br>Students should identify, analyze, submit a report (with a SWOT analysis) and make a presentation on an issue relating to environment pollution or a problem related to chemistry, in an industry and possible solutions to the problem investigated. Case study will be carried out under the guidance of a senior academic. |
| **Teaching /Learning Methods:**<br><br>Literature survey, field study, discussions, data analysis, problem solving and report writing. |
| **Assessment Strategy:** Continuous assessment and end of course unit examination |

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Other |
| 30 | 70 | | |
| **References/Reading Materials:** Literature related to the case study | | | |

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 32812 | | |
| Course Name: | Chemical Industries in Sri Lanka I (mineral, petroleum, metals, packaging, leather based industries) | | |
| Credit Value: | 02 | | |
| Core/Optional | Core | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |
| **Course Aim/Intended Learning Outcomes:** | | | |

On successful completion of this course unit, the students should be able to demonstrate an understanding about the

- chemical industries in Sri Lanka involving minerals and metals, raw materials used and their properties, processing technology, products formed, properties of the products and uses, standard tests to evaluate the quality of the products.
- Packaging industry in s Sri Lanka

**Course Content:**

**Mineral based industries:**
Chemistry and identification of mineral resources (ores and deposits) of commercial value (clays, calcareous materials, siliconous materials, appetite, graphite, feldspar, mica, dimension stones, gems, salt, sand) in Sri Lanka, processing technology, chemistry and uses of products, value added products and available standard test for quality of products involved in

(i) Ceramic industry (utensils, electro-ceramics e.g. insulators, capacitors, structural ceramics e.g. valves, turbo chargers)

(ii) Quartz based industries (glass, glass ceramics, vein quartz in electronic industry, fillers)

(iii) Cement industry: (Natural cement, Puzzolana cement, Portland cement etc, settinging and hardness, strength of cement, ready-made concrete and other products)

**Metal based industries**
Processing technology of metal alloys including chemistry and uses of alloys (iron-carbon compounds including steel, aluminum, copper, magnesium, nickel, titanium, zinc) electroplating industry

**Leather industry:** Raw materials, processing of skin including preservation and tanning, chemistry involved in the processing technology

**Packaging industry**: Different types of packaging materials used and their applications

**Teaching /Learning Methods:**

A combination of lectures**,** tutorials and field visits to at least one relevant industry.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Riegel's Handbook of Industrial Chemistry (1997). Ed. J. A. Kent, Chapmann and Hall
2. Wills B.A. (1992). Mineral Processing Technology, Pergamon Press.
3. Jones M.P. Applied Mineralogy: A Quantitative Approach, Graham and Trotman Publisher Group.

4. Covington, A.D. (2011). Tanning Chemistry, The Science of Leather, Chemistry of Tanning, R.S.C. Publication.

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|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 32821 | | |
| Course Name: | Industrial Chemistry Laboratory | | |
| Credit Value: | 01 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 31772, APCH 21672, APCH 21712 | | |
| Co-requisite | APCH 32812 | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | 45 | 05 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit the student will be able to

- prepare and analyze samples related to polymers, electroplating including solar paneling
- analysis involving parameters of minerals using X-ray fluorescence and radioactivity.

**Course Content:**

Laboratory experiments involve in handling instruments used in characterization of polymers and synthesis, electroplating, electrodeposition thin film semiconductors, radioactivity measurements, properties of minerals and other industrial samples.

**Teaching /Learning Methods:**

Laboratory classes of 3 hour duration for 15 weeks at University of Kelaniya, research organization and other universities, pre-laboratory and post-laboratory assignments.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | Practical | Other |
| 30 | | 70 | |

**References/Reading Materials:**

Reading materials and references provided at the laboratory classes.

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 32832 | | |
| Course Name: | Chemical Technology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | A/L physics | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

By the end of this course, the students will be able to demonstrate knowledge on fundamentals of Industrial Chemistry and Chemical Technology.

**Course Content:**

**Introduction:**
Introduction to chemical and process engineering fundamentals, concept of unit operations and definition of different unit operation processes, development of a chemical process, material and energy balances for simple unit operations, flow sheeting for simple systems, different flow diagrams, thermodynamics of steam and properties of moist air.

**Principles and Applications of Transport Process:**
Principles of mass transfer (relationship between mass transfer and chemical process, introduction to diffusion, Fick's law, mass transfer through a stationary phase, equimolecular counter diffusion, mass transfer across phase boundary, unimolecular diffusion, two film theory), Fluid flow (rheology, Bernoulli's equation, frictional loss, pipe flow calculation, pumping of fluids, Newtonian and non-Newtonian fluids), Heat transfer (modes of heat transfer, heat transfer coefficient, heat transfer rate, heat exchangers), Energy (sources of energy, energy efficiency and conservation, low cost energy sources).

**Teaching /Learning Methods:** A combination of lectures, tutorials, assignments and discussions.

**Assessment Strategy**: Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Coulson J.M. and Richadson J. F. (2005). Chemical Engineering Volume 1-6, Pergamon Press.
2. Riegel's Hand Book of Industrial Chemistry
3. Levenspiel O. (1999). Chemical Reactor Engineering 3rd Edition, John Wiley, New York.


| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | MACS 32603 | | |
| Course Name: | Principles of Human Resource Management and Leadership | | |
| Credit Value: | 03 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 45 | - | 105 |

**Course Aim/Intended Learning Outcomes:**

On completion of this course, the student should be able to:

- Demonstrate understanding of the theoretical aspects of HRM functions.
- Analyse the application of HRM techniques of staffing, recruitment & selection, training and development, performance appraisal in less complex scenarios
- Identify different leadership styles and their application

**Course Content:**

Introduction to HRM, Recruitment and Selection, Performance Management and motivation, Training and Development, Influence of groups and environment on personality, Perception, Introduction to leadership, Leadership styles, Evaluation of Global Leaders and their styles of leadership, Universal communication model, Purpose and modes on organizational communication

**Teaching /Learning Methods:** A combination of lectures, tutorials, assignments and discussions.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment |
|---|---|
| 30 % | 70 % |

| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | practical | Other |
|---|---|---|---|

**References/Reading Materials:**


1. Dessler, *Human Resources Management*, 11th Edition, Prentice Hall.
2. Armstrong M - *A Handbook of Human Resource Practice*, 10th Edition.
3. Lesikar, Pettit, and Flatley, "Basic Business Communication", 2001, Irwin McGraw-Hill.
4. Kaagan Stephen S., "Leadership Games", 1999, Response Books.


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 32842 | | |
| Course Name: | Chemical Industries II (Plantation Crops) | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 12572, APCH 22592 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit the student should be able to discuss
the chemistry of raw materials, processing techniques including the chemistry involved, value added products obtained from primary processed products, evaluation of quality parameters of the products and methods used in prevention of deterioration of processed products in the edible oil industry; coconut, kithul and palmyrah based industries; tea, coffee and cocoa processing industries; essential oil and spice industry.

**Course Content:**

**Edible oil industry:**

Source of edible oil, edible oil industry globally and in Sri Lanka, Extraction and refining, value added products (food based and non-food based) from coconut oil, palm oil, palm kernel oil and soya oil. Deterioration and methods of prevention of deterioration in edible oils. SLS specification for quality and analysis of quality parameters.

**Coconut based industries:**

Chemistry, technology of processing of different parts of the plant into value added products (husk into fibre, coir, rubberized coir products, utensils, dust; coconut shell into activated charcoal, kernel

into copra, desiccated coconut, coconut cream, instant coconut milk and powder, poonac; coconut water in to drinks, vinegar, wine; sap into drinks, jiggery, treacle), their uses and determination of quality parameters.

**Kithul and palmyrah based products:**

Chemistry, technology of processing of different parts of the plant (sap, fruit, tender leaf, fiber) into value added products, their uses and determination of quality parameters.

**Tea processing industry:**

Categorizing tea leaves; chemistry of tea leaves; chemistry, technology involved in manufacture of black, green tea and instant tea; quality standards of tea, value added products.

**Coffee processing industry:**

Chemistry, technology involved in processing coffee bean and manufacture of value-added products (decaffeined coffee, instant coffee).

**Cocoa processing industry:**

Chemistry, technology involved in processing cocoa and manufacture of value-added products (chocolates, cocoa beverages).

**Essential oils and spice industry:**

Composition of essential oils and spices in industrially important plants. ASTA, FDA, SLSI definition of spices, grading of raw materials. Major compounds in the essential oils and oleoresins extracted from different parts of the plant, physico-chemical principles involved in methods used in processing and extraction of essential oils (hydrodistillation, steam distillation, supercritical carbon dioxide extraction, solvent extraction) and spice oleoresins. Quality standards, quality evaluation (quantitative and qualitative) using classical methods and modern analytical techniques including glc/mass spectroscopy. Value added products from essential oils and extracts of spices.

**Teaching /Learning Methods:** A combination of lectures, tutorials and at least one industrial visit.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Potter, N. N. and Hotchkiss, J. H**.** (1997)**,** Food Science**,** Chapman and Hall.
2. Manual of Chemical Industries in Sri Lanka (1986). Part I, Institute of Chemistry, Ceylon.
3. De Silva, K. Tuely (edited). A manual of essential oil industry
4. CISIR (ITI) monograph on spice oleoresins, spice processing, cinnamon, pepper, nutmeg, cardamom, ginger, cocoa.
5. Zoysa, A.K.N. (Editor) (2008), Handbook on tea, Tea research Institute of Sri Lanka.

**University level 4**

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 43853 | | |
| Course Name: | Industrial Training | | |
| Credit Value: | 03 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | - | - | 400 |

**Course Aim/Intended Learning Outcomes:**

Upon successful completion of the course unit, the students will be able to

- discuss the functions and management of an industrial organization
- apply the knowledge gained in theory and laboratory classes at an industrial organization
- suggest improvements by a SWOT analysis if necessary
- accumulate skills that will help them on their future carrier due to exposure to working in a real world environment

**Course Content:**

The student will be placed in a selected industry or an institute and carry out research/analysis/ product development related to chemistry for a period of 3-4 months (4-5 days per week) full time under the supervision of a senior academic of the Department of Chemistry and a Senior staff member of the institute with regular monitoring by the officials of NAITA.

**Teaching /Learning Methods:**

Training under the supervision and guidance of academic staff in the department of Chemistry and senior staff member of the relevant industry with monitoring by NAITA and maintaining a diary.

**Assessment Strategy:** Presentations, *viva-voce* examination, and evaluation of progress report submitted by the trainee

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 0 % | 100 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 0 | 30 | 30 | 40 |

**References/Reading Materials:**

Materials will be provided by the institute where training is carried out and Department of Chemistry.

| | | | |
|---|---|---|---|
| **Semester** | **1** | | |
| Course Code: | APCH 41862 | | |
| Course Name: | Molecular Biology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | MIBI 12532, APCH 12632 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course, students will be able to

- describe DNA replication, transcription and translation as molecular processes of accurate transmission and expression of genetic message
- describe the organization of the eukaryotic chromosome, the gene and other genetic elements
- describe basic gene manipulation techniques and apply techniques in cloning genes and genome analysis
- describe the principles of techniques for separation and analysis of DNA and RNA
- appreciate the social, ethical issues surrounding the application of gene manipulation techniques

**Course Content:**

DNA replication, transcription and translation processes, protein synthesis; Molecular constituents of the cell, chromosome structure, genes and genomes; Classical cloning, Modern gene cloning, Recombinant DNA techniques, analysis of DNA/RNA, agarose gel electrophoresis, restriction and other DNA manipulating enzymes, restriction mapping, basic cloning vectors, recombinants, DNA transfer into hosts, gene library construction and screening, Southern/northern hybridizations, DNA sequencing, protein expression, PCR, Introduction to Bioinformatics. Ethical issues in DNA manipulation.

**Teaching /Learning Methods:** A combination of lectures and tutorial discussions

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
|---|---|---|---|
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | practical | Others |

**References/Reading Materials:**


1. Alberts et al, (1994), *Molecular biology of the cell*, Garland.
2. Brown, T. A. **(**1990), *Gene cloning*, *An introduction*, Chapman.
3. Freifelder, D (1983) *Molecular Biology*, 2nd Ed, John Wiley and sons
4. Mount D.W, and Mount D (2002) *Bioinformatics: Sequence and genome analysis*, Cold spring harbor laboratory.
5. Old, R. W. and Primrose, S. B. **(**1989), *Principles of Gene manipulation*, *an introduction to genetic engineering*, Blackwell. 4. Kahn I.M, (2005) *Elementary bioinformatics*, Pharma Book Syndicate, Williams B.L. & Wilson K. (2003), 4th edition, *Principles and techniques of practical Biochemistry*, Edward Arnold.


| **Semester** | **1** | | |
|---|---|---|---|
| Course Code: | APCH 41872 | | |
| Course Name: | Productivity and Quality Management | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course, the student will be able to explain

- the concepts used in industrial standardization, quality tools
- productivity improvement tools and measurement assurance
- laboratory accreditation, ISO certification systems and OHASAS system.

**Course Content:**

**Industrial Standardization:**
Types of standards, Process of standard formulation, Stakeholder engagement of standard formulation activity, Role of national standard body

**Seven quality control tools:**
Control chart, Scatter Diagram, Cause and effect diagram, Histogram, Parato analysis, Flaw charts, Check sheets and their application in quality management

**Teamwork and role of leader:**

Characteristics of team, Types of teams, Cost of teams, Implementation of teams in an organization, Application of Quality Circles (QC) in an Organization

**Productivity improvement tools**: Kaizan, Six sigma, just in time (JIT), 5 S, Total productivity maintenance (TPM)

**Measurement Assurance:**
Factors affect to quality of measurement, types of errors of instruments, Instrument calibration, types of standards, calibration pyramid, traceability, uncertainty, evaluation of capability of an instrument, reporting of results in meaningful way

**Laboratory Accreditation:**
Types of accreditation, Management and technical requirements of ISO 17025, Laboratory quality management,

**ISO 9000 QMS:**
Preparation of quality management system documents; Quality policy, Objectives, manual, procedures, work instruction and other related documents, , Installation of a QMS system, Internal quality audit

**ISO 14000:**
Environmental Management Systems Requirements, Development of Aspect Impact Register, Emergency Preparedness, Operational Control Procedures. Documentation Requirement, Installation of a QMS system

**ISO 22000:**
Food Safety Management Systems Requirements, Pre- Requisites programmes and Hazard Identification and Critical Control Points (HACCP) and Operational Pre requisite Programmes. Documentation Requirement, Installation of a QMS system

**OHSAS**:
OHSAS 18001:2007 Occupational Health and Safety Management Systems Requirements, Development of Occupational Hazard Identification and Risk Assessment (HIRA), Emergency Preparedness, Operational Control Procedures. Documentation Requirement, Installation of a QMS system

**Teaching /Learning Methods:** Lectures, tutorials, applications from real world situations

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
|---|---|---|---|
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | practical | Others |

**References/Reading Materials:**

1. Evans, J.R. (2007). Total Quality, Thomson SouthWestern
2. Evans, J.R. and Lindsaay, (2005). The Management of the Control Quality. Cincinati South West Publication.
3. Publications of SLSI cited during the course

| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 42882 | | |
| Course Name: | Chemical Technology II | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 32832 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On completion of this course the student will be able to demonstrate, understand and explain about

- unit operations in chemical industries
- chemical kinetics and different types of chemical reactors and their functions
- developments in chemical technology and use of raw
- different types of equipment and machinery used in chemical processing

**Course Content:**

**Unit Operations in Chemical Industries:**
Concept of unit operation, application of unit operation in chemical industries, design of process equipment:

**Separation processes:**
Distillation, gravitational methods, extraction, filtration including membrane processes, drying,

evaporation, adsorption, centrifugation, chromatography, electrophoresis

**Mixing processes**:
Liquid-liquid, gas-gas, solid-solid, liquid-gas, liquid-solid, and gas-solid, different types of mechanical mixtures used in industry.

**Introduction to chemical reactor design:**
Chemical kinetics (kinetics of irreversible, reversible, parallel and series reactions), ideal reactors (batch reactors, plug-flow reactors, continuous stirred tank reactors), reactor design (plug flow reactors, packed bed reactors, continuous stirred tank reactors, fluidized bed reactors, bio-reactors, enzyme kinetics and enzyme reactor design, cellular kinetics, fermentor design, plug flow reactors, packed bed reactors, continuous stirred tank reactors, fluidised bed reactors, bio reactors

**Chemical Technology:**
Raw materials, raw materials for the chemical industry; new development in chemical technology; Automation and some selected examples; homogenous and heterogeneous catalysis.

**Equipment and machinery in chemical process engineering**:
Different types of pumps, heat exchangers and other specific equipment/machines used in unit operations.

**Teaching /Learning Methods:**

A combination of lectures, tutorials, assignments, discussions and a visit to an industry dealing with unit operations

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | other |
| 30 | 70 | | |

**References/Reading Materials:**


1. Coulson J.M. and Richadson J. F. (2005). Chemical Engineering Volume 1-6, Pergamon Press.
2. Riegel's Hand Book of Industrial Chemistry
3. Levenspiel O. (1999). Chemical Reactor Engineering 3rd Edition, John Wiley, New York.


| **Semester** | **2** |
|---|---|
| Course Code: | APCH 42893 |
| Course Name: | Ethnopharmacology and Health Products |
| Credit Value: | 03 |

| | | | |
|---|---|---|---|
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | CHEM 22712 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 45 | - | 105 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course, the student will be able to explain about

- ethanopharmacology and chemistry of herbal medicines
- chemical technology involved in herbal product development and formulation
- modern pharmaceutical analysis and bioassays involved in analysis of raw material and herbal products,
- methods used in development of drugs from natural products
- regulatory effects and intellectual property rights in marketing products.

**Course Content:**

**Ethnopharmacology:**
Important medicinal and aromatic plants in indigenous medicine, Systems of medicine; Ayurveda, Siddha, Unani, Tibetanetc., drug discovery from plants

**Herbal product Development and formulation:**
Introduction: Global overview of herbal products, drug discovery from herbal products

Raw materials: Collection, authentication and post-harvest treatment of raw materials.

Process technology: Methods of extraction, isolation and purification of phyto-constituents and identification tests and quantitative determinationwith special emphasis on GC, GCMS, HPLC, LCMS and other advanced techniques,

Herbal product development: Lipid orals, tablets, capsules, dermatologic and herbal cosmetics, herbal teas, methods involved in preparing monoherbal and polyherbal formulations, Bioavailability& pharmaceutical equivalence, Quality control finished herbal medicinal products

**Modern pharmaceutical analysis and bioassays of herbal products:**
Chromatographic techniques: Thin layer chromatography (TLC), preparative thin layer chromatography, liquid chromatography, column chromatography, high performance liquid chromatography(HPLC), HPTLC, size exclusion chromatography, affinity chromatography, electrophoresis. Preparative columns, reverse phase columns, mobile phase selection and detectors in HPLC.

**Spectroscopy techniques:**
Characterization and quantification of herbal drugs and plants extracts using UV-visible spectroscopy including Optical Rotatory Dispersion. Cotton effect curves, octant rule, circular dichroism; IR

spectroscopy including FTIR, X-ray diffraction methods; Application of 1D and 2D NMR spectroscopy including NOE, COSY, HMBC, HSQC and DEPT techniques; Mass spectroscopy including FAB, HRMS, GC-MS, LC-MS

Bioassays for screening procedures for herbal drugs / plant extracts with current innovations in following therapeutic classes; antihypertensive, antioxidant, antipyretic, anti-inflamatory, antidiabetic, anticancer, antihepatotoxic, immunomodulatory, antimicrobial assays

**Development of drugs from natural products;**
Drug discovery, design, SAR studies, animal testing, Pharmacokinetics (Absorption, metabolism, excretion, duration of action), time line, preclinical and clinical studies (phase 1, phase 2, phase 3, phase4), cost incurred, challenges

**Development of drugs from natural products;**
Drug discovery, design, SAR studies, animal testing, Pharmacokinetics (Absorption, metabolism, excretion, duration of action), time line, preclinical and clinical studies (phase 1, phase 2, phase 3, phase4), cost incurred, challenges

**Regulatory affairs and Intellectual property rights:**
Registration, packaging, labeling, advertising and intellectual property rights on products.

**Teaching /Learning Methods:** Lectures, practicals and field visit to a related industry

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory (%) | practical | Others (%) |
| 30 | 70 | | |

**References/Reading Materials:**

1. Bhushan Patwardhan, Drug Discovery & Development (2007), New India Publishing Agency, India
2. SK Gupta, Drug Discovery and Clinical Research (2011), Jaypee Brothers Medical Publishers
3. Kenneth A. Connors, A TEXTBOOK OF PHARMACEUTICAL ANALYSIS, 3RD ED (2007) Wiley India Pvt. Limited
4. P. D. Chaithanya Sudha, Pharmaceutical Analysis (2007) Pearson Education India
5. Jag Mohan, Organic Analytical Chemistry: Theory and Practice (2006) Alpha Science International Limited
6. Willow, J H (Editor), Traditional Herbal Medicine Research Methods: Identification, Analysis, Bioassay, and Pharmaceutical and Clinical Studies, (2011) John *Wiley*& Sons
7. Nava Dayan (Editor), Lambros Kromidas (Editor), Formulating, Packaging, and Marketing of Natural Cosmetic Products (2011) John *Wiley*& Sons

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 42903 | | |
| Course Name: | Metabolism and Clinical Chemistry | | |
| Credit Value: | 03 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 12632 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 45 | - | 105 |

**Course Aim/Intended Learning Outcomes:**

By the end of this course the student will be able to

- explain the basic concepts in metabolism and the chemistry involved in the major metabolic pathways
- understand the organization of a laboratory handling biological samples
- demonstrate the methods of quantitative and qualitative determination of relevant biomarkers in biological samples
- explain the pathophysiology of selected diseases
- explain the detection and quantification of biomarkers for these diseases in body fluids
- quantify the biomarkers present in body fluid.

**Course Content:**

**Metabolism**

Bioenergetics, metabolism and biosynthesis of carbohydrates (glycolysis and gluconeogenesis, citric acid cycle, oxidative phosphorylation, pentose phosphate pathway, glycogen metabolism glycogen breakdown, glycogen synthesis, control of glycogen metabolism), amino acids and proteins (amino acid oxidation, production of urea,fatty acid (fatty acid oxidation, ketone bodies, regulation of fatty acid metabolism, cholesterol metabolism, phospholipids and glycolipid metabolism, biosynthesis of lipids)

**Clinical Chemistry**

Introduction to clinical chemistry and evidence based medicine. Organization of a laboratory handling biological samples; sample collection, preservation, transport and handling including radioactive samples, blood containing pathogens. Pathophysiology of selected diseases and analysis of biomarkers of these diseases in body fluids (assay of serum for ALT, ASt, acid phosphatase, isoenzymes, cholesterol, lipid profile, fasting blood sugar, assay of urine for glucose, amino acids, bilirubin, urobilinogen, Toxicology (chemical, clinical toxicology; overdose of selected substances,

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| drugs of abuse and toxic metals). Introduction to immunoassays. Introduction to DNA based diagnosis. |
| **Teaching /Learning Methods:** A combination of lectures, tutorial discussions and laboratory |
| **Assessment Strategy:** Continuous assessment and end of course unit examination |

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Stryer, L. (2001), *Biochemistry*, Freeman.
2. Voet, D and Voet, G. (1995), *Biochemistry*, John Wiley.
3. Lehninger, L., Nelson, D.L. and Cox, M.M. (2000), *Principles of Biochemistry*, Worth.
4. Burtis C.A., Ashwood E.R., Bruns D.E. (Eds.) (2008) *Tietz Fundamentals of Clinical Chemistry,* 6th Edition, Elsevier.
5. Burtis C.A., Ashwood E.R., Bruns D.E. (Eds.) (2005) *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics*, 4th Edition, Elsevier.
6. *Guidelines on standard operating procedures for clinical chemistry*, Sept. 2000, WHO
7. Richard A. McPherson and Matthew R. Pincus (Eds.) (2012) *Henry's Clinical Diagnosis and Management by Laboratory Methods*, 22nd Edition, Elsevier


| **Semester** | **2** | | |
|---|---|---|---|
| Course Code: | APCH 42912 | | |
| Course Name: | Agrochemicals and Chemical Ecology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Optional | | |
| Pre-requisite | APCH 21652, APCH 22732 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course unit, students should be able to demonstrate an

understanding of the

- physical and chemical properties of agrochemicals including those from natural sources
- manufacture formulation of agrochemicals
- metabolism, degradation in the environment, pollution and toxicity resulting from agrochemicals
- methods used in analysis of fertilizers, pesticides and pesticide residues.

**Course Content:**

**Introduction:**
Definition, classification, need to use agrochemicals, agrochemical industry in Sri Lanka, uses of agrochemicals in Sri Lanka, legislation regarding use and marketing of agrochemicals in Sri Lanka including labeling, formulations and spray equipment, toxicity of agrochemicals.

**Fertilizers:**
Chemistry, manufacture and application of synthetic and bio-fertilizers, effect on environment

**Pesticides:**
Classification, chemistry, manufacture, toxicity, mode of action, degradation and fate in environment of natural (bio-pesticides) and synthetic pesticides (insecticides, herbicides, fungicides, rodenticides, acracides, mollucidies). Antidotes in pesticides poisoning.

**Analysis of agrochemicals:**
Method used in analysis of fertilizers and pesticides and pesticides residues

**Chemical ecology:**
Chemical interaction in eco-system, classification of semiochemicals, their functions and mode of communication, chemistry of semiochemicals including stereochemistry and bioactivity, detection of bioactivity (insects bioassays e. g. Olfactometer bioassay, choice chamber bioassay, electroantenogram detection coupled to GC and MS, electrophysiological assay), integrated pest management and use of traps with semiochemicals.

**Teaching /Learning Methods:** A combination of lectures and tutorials

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Chemical Ecology of Insect Parasitoids, Eric Wajnberg (Editor), Stefano Colazza (Editor)
2. Behavioural Ecology of Insect Parasitoids: From theoretical approaches to field applications
   Eric Wajnberg (Editor), Carlos Bernstein (Editor), Jacques van Alphen (Editor) Chemical Ecology:
3. The Chemistry Of Biotic Interaction... Paperback , by Thomas Eisner, Jerrold Meinwald
4. Chemical Ecology, *Ernest Sondheimer*

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | MACS 42612 | | |
| Course Name: | Innovation & Entrepreneurship | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Optional | | |
| Pre-requisite | G.C.E. (A/L) | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On completion of this course, the student should be able to:

- Differentiate the terms: entrepreneurship, self-employment, and businessman, and acquire skills in conceptualizing, planning, and managing a small-scale venture.
- Plan and organize a small-scale business operation, and
- Provide advice to SMEs.

**Course Content:**

Theories of Entrepreneurship; Variables that build entrepreneurship. Traits and skills of entrepreneurs. Small-scale businesses. Family-owned business. Theories of growth of a small-scale venture. New product development. Global business. Starting a new business/Buying an existing business. Franchising and other alternatives. Analyses of markets and development of business strategy. Writing a business plan. The functions of marketing, management and personnel. Finance and legal issues. Insurance. The role of Internet in Business.

**Teaching /Learning Methods**: Lectures, case discussions, field projects, interactive classroom sessions and case analysis.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Hisrich and Peters, *"Entrepreneurship"*, 5th Ed, Irwin McGraw-Hill.
2. Nickels, McHugh and McHugh, *"Understanding Business"*, 4th Ed, Irwin McGraw-Hill.

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 42922 | | |
| Course Name: | Nanoscience and Nanotechnology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Optional | | |
| Pre-requisite | None | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course unit, students should be able to

- analytically use knowledge in topics in nanoscience and nanotechnology with the exposure to recent advances in the relevant areas
- describe and explain mechanical, optical, electronic, magnetic and chemical properties of nanomaterials and nanostructures, highlighting the atomic/molecular level structural environmental features that give rise to them
- explain reaction mechanisms and synthesis methods for the developments of nano materials using experimental data and structural features of compounds involved
- use microscopic and spectroscopic techniques to analyze nanomaterials and thereby extract surface and structural information of compounds
- apply knowledge of nanotechnology and properties of nanomaterials to explain the mechanics of devises and their applications.

**Course Content:**

**Fundamentals of Nanoscience and Nanotechnology**

**(**Scientific Revolutions, Types of Nanotechnology and Nanomachines , Energy, Molecular and atomic size, Surfaces and dimensional space, top down and bottom up methods. Opportunity at the nano scale, length and time scale in structures, energy landscapes , Inter dynamic aspects of inter molecular forces, Evolution of band structure and Fermi surface. Quantum dots, Nano wires, Nano tubes, 2D and 3D films. Influence of Nano structuring on mechanical, optical, electronic, magnetic and chemical properties, gram size effects on strength of metals- optical properties of quantum dots and quantum wires, electronic transport in quantum wires and carbon nano tubes, magnetic behavior of single domain particles and nanostructures.

**Synthesis and Characterization of Nanomaterial**

Bulk synthesis: synthesis of bulk nano structured materials, solgel processing, Mechanical alloying and mechanical milling, Nanopolymers, Bulk and nano composite materials.

Chemical approaches: Self-assembly, self-assembled monolayer (SAMs), Longmuir Blodgett (LB) films, clusters, colloids, zeolites, organic block copolymers, emulsion polymerization, templated

synthesis and confined nucleation and/or growth.
Physical approaches: Vapor deposition and different types of epitaxial growth techniques, pulsed laser deposition, Magnetron sputtering, Micro lithography
Characterization methods: Optical Microscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical Absorption and Emission Spectroscopy, Thermogravimetric Analysis, Differential Scanning Calorimetry, Thermomechanical Analysis, X-Ray Diffraction

**Nanotechnology Applications**
Nano finishing in textiles, coatings and polymers: UV resistant, antibacterial, hydrophilic, self-cleaning, flame retardant finishes. Nanostructuring polymers with cyclodextrins, Dyeable polypropylene via nanotechnology. Polyolefin/clay nanocomposites.
Nanotechnology for energy systems: Nanotechnology for sustainable energy, Materials for light emitting diodes, batterie ,advanced turbines, catalytic reactors, capacitors, fuel cells.

**Teaching /Learning Methods:** A combination of lectures and tutorials, visit to Sri Lanka Institute of Nanotechnology (SLINTEC).

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Wilson, Mick, Kannangara, Kamali and Smith, Geoff (2005). Nanotechnology: Basic Science and Emerging Technologies, Overseas press.
2. Goddard, W. (2007). Handbook of NanoScience, Engineering and Technology, CRC Press,
3. Brown, P. J. and Stevens, K, (2007). Nanofibers and Nanotechnology in Textiles. CRC Press.
4. Freris, Leon and Infield, David (2008). Renewable Energy in Power Systems, Wiley.


| **Semester** | **2** |
|---|---|
| Course Code: | MIBI 42512 |
| Course Name: | Industrial Microbiology |
| Credit Value: | 02 |
| Compulsory/Optional | Optional |
| Pre-requisite | MIBI 12532 |
| Co-requisite | None |

| Hourly Breakdown | Theory | Practical | Independent Learning |
|---|---|---|---|
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course unit, students should be able to

- describe the properties of industrial microorganisms
- demonstrate the understanding of different biochemical pathways used by microorganisms to utilize carbon substrates
- explain the microbial growth in different modes fermentation and describe the basic structure of a fermentor
- describe the role of microorganisms in food and beverage industry bio-fuel industry

**Course Content:**

**Introduction to industrial microbiology:**
Properties of industrial microorganisms, genetically modified microorganisms and their application in industry.

**Microbial biochemistry**:
degradation of carbon and nitrogen substrates, Microbial growth kinetics and the kinetic parameters important in application, Different modes of fermentation: Batch, continuous and Fed-batch processes. Different types of fermenters, Downstream processing

**Different microbial production processes:**
Production of bio-alcohols and other biofuels, microbial production of organic acids (vinegar and citric acid), penicillin and related antibiotics. Microbial products in food industry (dairy products, glutamic acid, soy sauce, etc.).

**Quality control and quality assurance**:
Standard procedures and guidelines for microbial quality control and quality assurance in selected products. HACCP and its application

**Teaching /Learning Methods:**

A combination of lectures and tutorials, visit to an industry dealing with industrial microbiology.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**


1. Willey, J., Sherwood, L. and ChrisWoolverton (2010). Prescott's Microbiology, 8th edition, McGraw-Hill Science/Engineering/Math
2. Waites, M. J., Morgan N. L., Rockey, J. S. andGary Higton (2001), Industrial Microbiology: Publisher: Wiley-Blackwell.

| | | | |
|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | MACS 42622 | | |
| Course Name: | Industrial Law | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Optional | | |
| Pre-requisite | G.C.E. (A/L) | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On completion of this course, the student should be able to:

- Apply the legal provisions learned in the class to less complex legal situations in organizational settings.

**Course Content:**

Application of legal principles relevant to the conduct and understanding of commercial business transactions. Topics include the legal, ethical and social environment of business; agencies, partnerships, and other forms of business organizations; and contracts and sales agreements. Government regulations affecting employment and marketing. Negotiable instruments. Debtor/creditor relationships. Bankruptcy and reorganization.
A general and practical knowledge in: Industrial Disputes Act No.43 of 1950; Employment of Women, Young Persons and Children Act No.47 of 1956; Employees Provident Fund Act No.15 of 1958; The Employees Trust Fund Act No.46 of 1980; The Payment of Gratuity Act No.12 of 1983.

**Teaching /Learning Methods:** A combination of lectures, and case discussions.

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment | Final Assessment | | |
|---|---|---|---|
| 30 % | 70 % | | |
| Details: quizzes and/or mid-term | Theory | practical | Others |
| 30 | 70 | | |

**References/Reading Materials:**

1. Industrial Disputes Act No.43 of 1950.Employment of Women, Young Persons and Children (47/1956).
2. EPF Act, ETF Act, and Gratuity Act.

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|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 42932 | | |
| Course Name: | Statistical Methods in Industry and Research | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Compulsory | | |
| Pre-requisite | APCH 11622 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |

**Course Aim/Intended Learning Outcomes:**

On successful completion of this course unit, students should be able to

- explain the basic one-way analysis of variance,
- choose proper approach to analysis of data
- use various techniques to determine relationships between variables,
- apply control charts in quality control,
- apply statistical process control methodology to chemical processes.

**Course Content:**

**Analysis of Variance:**
Additive property of variances, Types of classification and nature of variation, Hierarchic classification with two sources of variation, Hierarchic classification with three sources of variation, Cross-classifications, Comparison of means and further aspects of analysis of variance.

**Linear Relationships between Two Variables:**
Functional relationship and regression, Linear regression, Conditions for valid estimation of the regression equation, Regression through the origin, Weighted linear regression, Linear functional relationship, Comparison of several regression lines, Correlation.

**Multiple and Curvilinear Regression:**
Multiple linear regression, Generalization of the method of least squares, Selection of the best subset of variables, Further aspects of model building, Curvilinear regression, Multiple quadratic regression, Interpretation and presentation of a multiple regression analysis.

**Control Charts:**
Application in quality control, General purpose of control charts, Analysis of data by Shewhart control charts, Control charts for process control, Rate of detection of changes in average level, Cumulative sum charts, Decision making with a V-mask, Choice of charting method.

**Sampling and Specifications:**

| | | | |
|---|---|---|---|
| Reasons for sampling, Random sampling and systematic sampling, Sampling of attributes, Process of control of attributes, Sampling of variables, Process of control of variables. | | | |
| **Teaching /Learning Methods:** A combination of lectures, tutorial discussions and laboratory exercises | | | |
| **Assessment Strategy:** Continuous assessment and end of course unit examination | | | |
| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
| Details: quizzes and/or mid-term<br>30 | Theory<br>70 | practical | Others |
| **References/Reading Materials:**<br>1. Brynn D., Hibbert, J. , Justin Gooding, (2006). Data Analysis for Chemistry'. Oxford University Press<br>2. Miller James N., Miller Jane C. (2010). 6th Edition. Statistics and Chemometrics for Analytical Chemistry. Pearson | | | |

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|---|---|---|---|
| **Semester** | **2** | | |
| Course Code: | APCH 42942 | | |
| Course Name: | Biotechnology | | |
| Credit Value: | 02 | | |
| Compulsory/Optional | Optional | | |
| Pre-requisite | APCH 11632 | | |
| Co-requisite | None | | |
| Hourly Breakdown | Theory | Practical | Independent Learning |
| | 30 | - | 70 |
| **Course Aim/Intended Learning Outcomes:**<br>Upon successful completion of this course unit, students should be able to,<br>• apply the concepts of modern cell and molecular biology to manipulate organisms and their products for human benefit<br>• explain use of enzymes in industry<br>• explain safety legislations concerning substances hazardous to health and the regulatory requirements of GMOs<br>• explain the basic principles of tissue culture and establishment of a tissue culture laboratory | | | |

**Course Content:**

**Introduction:**
Scope and importance, genetic engineering for human welfare, molecular tools in disease diagnosis, gene therapy, transgenic technology for and livestock and crop improvement, molecular markers, mapping useful traits, DNA typing, metabolic engineering.

**Application of biotechnology in industry:**
Fermentation, bioreactors, single cell protein and biomass production, enzyme technology, industrial uses of enzymes, protein engineering, biosensors and biochips, renewable sources of energy, biomass energy, biogas and biodiesel, biotechnology and biosafety, intellectual property rights and protection, principles involved in tissue culture, types of cultures and their applications in crop breeding and prevention of diseases including establishment of a tissue culture laboratory.

**Teaching /Learning Methods:** A combination of lectures, tutorials and oral presentations**.**

**Assessment Strategy:** Continuous assessment and end of course unit examination

| Continuous Assessment<br>30 % | Final Assessment<br>70 % | | |
|---|---|---|---|
| Details: quizzes and/or mid-term<br>30 | Theory<br>50 | practical | Others<br>20 |

**References/Reading Materials:**


1. Smith J. E. (1997), *Biotechnology*, Cambridge university press.
2. Primrose S. B. (1987), *Modern Biotechnology*, Blackwell publishing
3. Kumar H. D. (2000), *Modern Concepts of Biotechnology*, Vikas publishing
4. Kahn I.M, (2005), *Elementary bioinformatics*, Pharma Book Syndicate,
5. Mount D.W, and Mount D (2002), *Bioinformatics: Sequence and genome analysis*, Cold spring harbor laboratory.
6. Razdan M. K. (2003). *Introduction to Plant Tissue Culture*. Science Publishers.


| **Semester** | **1 & 2** |
|---|---|
| Course Code: | APCH 44956 |
| Course Name: | Research |
| Credit Value: | 06 |
| Compulsory/Optional | Compulsory |
| Pre-requisite | None |

<table>
<tr><td>Co-requisite</td><td colspan="3">None</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td>Theory</td><td>Practical</td><td>Independent Learning</td></tr>
<tr><td>-</td><td>-</td><td>600</td></tr>
<tr><td colspan="4">Course Aim/Intended Learning Outcomes:<br>Upon successful completion of the course unit, the students will be able to<br>• demonstrate skills to plan and carry out a research project independently according to the scientific method, analyse the experimental data, interpret and report the data in a scientific manner in the form of a dissertation.</td></tr>
<tr><td colspan="4">Course Content:<br><br>The research project in an area related to analytical chemistry is assigned to the student. Research should be carried out on full time basis for at least 10 months.</td></tr>
<tr><td colspan="4">Teaching /Learning Methods:<br><br>Literature survey, laboratory and/or field work, data analysis and interpretation, dissertation, presentations</td></tr>
<tr><td colspan="4">Assessment Strategy: Continuous assessment, dissertation, progress reports, presentations, viva-voce examination</td></tr>
<tr><td colspan="2">Continuous Assessment<br><br>- %</td><td colspan="2">Final Assessment<br><br>100 %</td></tr>
<tr><td>Details: continuous assessment will be done however the evaluation is carried out at the final assessment</td><td>Theory<br><br>NA</td><td>Thesis (40%), viva voce (40%), presentation (20%)</td><td>Other (%)<br><br>NA</td></tr>
<tr><td colspan="4">References/Reading Materials:<br><br>NA</td></tr>
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