Second Semester:

Subjects	Course Code	Credit Hours	Full Marks	Pass Marks
Inorganic Chemistry	CHE-551	4	100	50
Inorganic Chemistry Practical	CHE-552	2	50	25
Physical Chemistry	CHE-553	4	100	50
Physical Chemistry Practical	CHE-554	2	50	25
Organic Chemistry	CHE-555	4	100	50
Organic Chemistry Practical	CHE-556	2	50	25
Research Methodology in Chemistry	CHE-557a	2	50	25
Term Paper in Chemistry	CHE-557b	1	25	12.5

A work load equivalent to 2 periods will be allotted to the supervisor who supervises the term paper of each student.

On completion of M. Sc. second semester, the students will have the option of specializing either in inorganic or physical or organic chemistry in M. Sc. third and fourth semesters.

Inorganic Chemistry

Course Title: Inorganic Chemistry (Theory) **Credit:** Four (4) hrs.
Course No.: CHE-551 **Full Marks:** 100
Semester: Second (2^{nd}) **Pass Marks:** 50

Course Objective:

- To provide a broad knowledge of the advanced Inorganic Chemistry.

Course Contents:

Group A

Co-ordination Compounds: Crystal field theory, splitting of orbitals in different geometries using group theory, crystal field stabilization energy, explanation of spectrochemical series, limitations and uses of CFT, Evidences for covalent bonding in complex and nephelauxetic series, thermodynamic effect of CFSE, enthalpies of hydration and free energy, lattice energies, Jahn Teller effect, dynamic Jahn Teller behavior, explanation of magnetic properties, colour of transition metal complexes, characterization of coordination compounds, different spectroscopic and analytical techniques.

Group B

Acid Base Chemistry: Review of acid base concept, generalized acid-base concept, measures of acid base strength, Lewis interaction in non polar solvents, systematic of Lewis acid-base interaction, bond energies, steric effects, proton sponges, solvation effect, and acid-base anomalies, acid-base strength and hardness and softness, electronegativity and hardness and softness, MC-Daniel diagram, super acids and super bases.

Chromatography: Size exclusion chromatography, ion exclusion chromatography, ion-retardation chromatography, inorganic molecular sieves.

Isoelectronic and Isolobal Relationship: Isoelectronic species, criteria for isolobality, organic and organometallic isolobal fragements, extension of isolobal analogy, importance of the concept of isolobality.

Supra Molecular Chemistry: Molecular recognization, transformation and translocation, supra molecules, supra molecular assemblies, factors affecting molecular recognization, crown ethers, cryptands, mesoporous materials, inorganic-organic nanocomposities catalysis.

Group C

Buckminister Fullerene: Introduction, preparation, structure, compounds formed by fullerene, higher fullerenes.

Nanochemistry: Fundamentals of nanochemistry, building blocks, concepts of quantum dots, tools of nanotechnology (AFM, SEM, TEM, STM), applications and toxicity of nanomaterials.

Carbon Nanotubes: Introduction, types of carbon nanotubes, different synthesis techniques of carbon nanotubes, applications.

Radio-activity and Nuclear Reaction: Characteristics of nuclear reactions and their similarity with chemical reactions, nuclear reactors, types of nuclear reactors, classification of reactors, fission probability, process yield and applications and fall out, units and measurement of radioactivity and radiation, activation analysis, ^{14}C dating, tracer technique, radiochemical analysis.

Group D

Cement: Manufacture, composition of cement, Portland cement, types of cement, concrete, additive, hydration process.

Ceramics: Types of ceramics, glass, structural characteristics, glass transition temperature, composition, production and application, optical fibres, electrochromism, photochromism.

Zeolites: Molecular sieves, zeolite aluminosilicate, structure of zeolites, synthesis of zeolites, applications of zeolites, composition and properties of zeolites, zeolites as shape selective heterogenous catalyst.

Intercalation Chemistry: Types of intercalation compound, graphite intercalation compounds, layered silicate structures, applications.

One Dimensional Conductors: Polythiazyls (polymeric sulphur nitride), structural characteristics, stacked columnar complexes.

Isopolyanions and Heteropolyanions: Structural characteristic, variation of composition with pH value.

Reference Books for CHE-551:

1. F. A. Cottton and G. Wilkinson, *Advanced Inorganic Chemistry* (5th Edition) John Wiley and Sons Ins., 1988.
2. F. A. Cottton and G. Wilkinson and Paul L. Gauss, *Basic Inorganic Chemistry* (3rd Edition), John Wiley and Sons Incorporation, 1995.
3. J. E. Huheey, Ellen A. Keiter and Richard L. Keiter, *Inorganic Chemistry* (4th Edition), Harper Collins College Publishers, 1993.
4. Bodie Douglas, Darl McDanniel and John Alexander, *Concepts and Models of Inorganic Chemistry* (3rd Edition), John Wiley and Sons Incorporation, 1994.
5. G. L. Miessler and D. A. Tarr, *Inorganic Chemistry*, (5th Edition).
6. D.F. Shriver and P.W. Atkins, *Inorganic Chemistry*, (5th Edition), Oxford University Press.
7. A.F. Wells, *Structural Inorganic Chemistry*, (4th Edition) Clarendon, Oxford, 1975.
8. P. J. Durrant and B. Durrant, *Introduction to Advanced Inorganic Chemistry*, (Latest Edition), Wiley (Interscience), New York.
9. L. Pauling, *The Nature of the Chemical Bond* (Latest Edition), Cornell University Press.
10. G.H. Jeffery, J. Bassett, J. Mendharm and R. C. Denny, *Vogel's Textbook of Quantitative Chemical Analysis*, E.L.B.S., 1994.
11. R.A. Day and A.L. Underwood, *Quantitative Analysis*, (6th Edition), Prentice-Hall of India, 1993.

12. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan, *Advanced Inorganic Chemistry* (Vol. II), (Reprinted Edition), S. Chand Publishing, 2013.

Inorganic Chemistry

Course Title: Inorganic Chemistry Practical
Course No.: CHE-552
Semester: Second (2^{nd})

Credit: Two (2) hrs.
Full Marks: 50
Pass Marks: 25

Course Objectives:

- To acquaint the students with quantitative and qualitative analytical methods.
- To familiarize students with the techniques of preparation and with characterization of coordination compounds.

Course Contents:

Gravimetric Analysis:

1. Estimation of copper as thiocyanate and zinc as pyrophosphate in a mixture of the two.
2. Estimation of Ca as oxide and Mg as pyrophosphate in a mixture of the two.

Salt Analysis:

Qualitative analysis of inorganic salt mixture containing 8 radicals excluding rare earth metals by semimicro method.

Preparations:

1. Preparation and characterization of hexaamminenickel(II) chloride, $[Ni(NH_3)_6]Cl_2$.
2. Preparation and characterization of potassium trioxalato chomate(III)
3. Preparation and characterization of cuprous thiourea complex.
4. Preparation of cuprous oxide and characterization.
5. Preparation and characterization of cuprous mercuric iodide, $Cu_2[HgI_4]$.
6. Preparation of about 6 to 8 complexes.

Any other experiments to be introduced in class work during the semester.

Reference Books for CHE-552:

1. M.R. Pokhrel, P.N. Yadav and S. Shrestha, *Advanced Practical Inorganic Chemistry* for M.Sc., (2^{nd} Edition), Kshitiz Publication, 2017.
2. A.I. Vogel, *Qualitative Analysis*; E.L.B.S., 1994
3. Palmer, *Experimental Inorganic Chemistry*, Cambridge University Press, UK, 1954
4. Angelici, *Synthesis and Technique in Inorganic Chemistry*; W.B. Sounders Co. (Sounders Golden Series), Philadelphia, 1991.
5. K. N. Ghimire, M. R. Pokhrel & K. P. Bohara, *University Experimental Inorganic Chemistry*, Quest Publication, Kirtipur, Kathmandu, 2008.

Physical Chemistry

Course Title: Physical Chemistry (Theory) **Credit:** Four (4) hrs.
Course No.: CHE-553 **Full Mark:** 100
Semester: Second (2^{nd}) **Pass Mark:** 50

Course Objectives:

- To provide knowledge on solid state chemistry, surface and colloidal chemistry, and thermodynamics
- To introduce about the structure of the electrified interfaces

Course Contents:

Group A

Solid State Chemistry: Chemical bonding in solids, lattice energies of ionic solids, structure of solids, determination of crystal structures, factors affecting crystal structure; classical free electron theory of metals, electrical conductivity, Ohm's law, Widemann-Franz ratio, heat capacity, conduction electrons, drawbacks of classical free electron theory; solid surfaces: surface forces, surface structure & surface composition.

Group B

Electrified Interfaces: Electrification of an interface; potential difference across electrified interfaces; accumulation and depletion of substances at an interface (concept of surface excess, determination of surface excess); thermodynamics of electrified interfaces (electo-capillary curve, Lippmann equation); quantitative treatment of electric double layer models (Helmholtz-Perrin, Gouy-Chapman, Stern, specific adsorption and complete-capacity models); structure of semiconductor-electrolyte interface: some *in situ* and *ex situ* techniques for studying electrified interface.

Group C

Chemistry of Surfaces & Colloids: *Adsorption:* Practical adsorbent materials; activated carbon and carbon molecular sieves; forces and energies of adsorption; calculation of heat of adsorption; adsorption at low coverage-Henry's law

Review lecture of Langmuir, Freundlich and BET adsorption isotherms; derivation of isotherms equation from Gibbs equation; adsorption mixtures; extended Langmuir model; Langmuir-Freundlich equations; Dubinin Polanyi theory; ideal adsorption solution theory; other model isotherms and their comparison.

Colloids: Importance of colloids and colloidal phenomena; mechanism of colloidal formation; roots of colloidal behavior; ground rules for colloidal stability; sources of colloidal stability; steric stabilization; coagulation kinetics; association colloids (micelles, vesicles and membranes); correlation between surfactant structure, environment and micellization.

Group D

Thermodynamics: Thermodynamic properties of solution: partial molar quantities; Gibbs-Duhem equation; chemical potential; chemical potential of pure substance; chemical potential of real gas and fugacity and its determination; chemical potential in ideal gas mixture; thermodynamics functions of mixing; properties of liquid solutions; colligative properties.

Non-equilibrium thermodynamics: limitations of classical thermodynamics, steady state or stationary state, principle of non-equilibrium thermodynamics; Onsager's reciprocity relations; entropy: production its rate in chemical and electro-chemical reaction; thermo-osmosis; electro-kinetic phenomenon.

Reference Books for CHE-553:

1. S. O. Pillai, *Solid State Chemistry*, Wiley Eastern Ltd., New Delhi, 1994.
2. P. Atkins and J. de Paula, *Atkins' Physical Chemistry* (10^{th} Edition), Indian edition, Oxford University

Press, 2014.
3. H. V. Keer, *Principles of the Solid State*, New Age Inlt. Ltd., New Delhi, 2002.
4. J. Bhattarai and D. B. Khadka, *Surface Characterization and Solid State Chemistry*, (1st Edition), Sunlight Publication, Kirtipur, Kathmandu, 2010.
5. D. K. Chakrabarty, *Solid State Chemistry*, New Age Inlt. Ltd., New Delhi, 1996.
6. J. O'M. Bockris, A. K. N. Reddy and M. Gamboa-Aldeco, *Modern Electrochemistry, Fundamentals of Electrodics*, (2nd Edition), Vol. 2A, Kluwer Academic/Plenum Publishers, New York, 2000.
7. A. J. Bard and L. R. Faulkner, *Electrochemical Methods: Fundamentals and Applications*, (2nd Edition), John Wiley & Sons Inc., New York, 2001.
8. R. P. Rastogi and R. R. Mishra, *An Introduction to Chemical Thermodynamics*, (6th Edition), Vikash Publ. House Pvt. Ltd., India, 1st reprint 2013.
9. G. K. Vemulapalli, *Physical Chemistry*, Prentice Hall of India, New Delhi (1997).
10. I. M. Klotz, *Chemical Thermodynamics*, Menlo Park, CA, 1986.
11. H. K. Moudgil, *Textbook of Physical Chemistry*, PHI Learning Pvt. Ltd., New Delhi, 2010.
12. S. Glasstone, *Theoretical Chemistry*, (1st Edition), D. Van Nostrand Company, Inc., New York, 1944.
13. Douglass M. Ruthven, *Principles of Adsorption and Adsorption Processes*, John Wiley & Sons, New York, 1984.
14. Drew Myers, *Surfaces, Interfaces and Colloids: Principles and Applications*, (2nd Edition), John Wiley & Sons, New York, 1999.

Physical Chemistry

Course Title: Physical Chemistry Practical
Course No.: CHE-554
Semester: Second (2nd)

Credit: Two (2) hrs.
Full Mark: 50
Pass Mark: 25

Course Objective:

- To make students capable of conducting physical chemistry experiments and analysis the data independently.

Course Contents:

Electrochemistry

1. Analyze the mixture of HCl, NH4Cl and NaCl by conductometric titration.
2. Determine the equivalent conductivity of strong electrolytes at different dilutions and verify the Debye-Huckel-Onsager equation.
3. Potentiometric determination of solubility and solubility product of a sparingly soluble salt (AgCl) in water.
4. Potentiometric titration of phosphoric acid with sodium hydroxide using pH electrode (metal oxide or glass electrode) and find out the first and second dissociation constant of acid at room temperature.
5. Potentiometric titration of ferrous ammonium sulphate with potassium dichromate and determine the formal potential of Fe^{3+}/Fe^{2+} system.
6. Potentiometric determination of equilibrium constant for the formation of complex ion $[Ag(NH_3)_2]^+$.

Chemical Kinetics

7. Kinetic study of the saponification of ethyl acetate with sodium hydroxide by titration method.
8. Determination of total order of reaction between oxalic acid and chromic acid.

Surface Chemistry

9. Verification of Freundlich and Langmuir adsorption isotherms in adsorption process of oxalic acid onto activated charcoal and determine the specific surface area.
10. Study the variation of surface tension of solutions of n-propyl alchohol with concentration and determine the limiting cross-sectional area of alcohol molecule.

Spectrophotometry

11. Spectrophotometric determination of chromium (VI) by 1,5 diphenyl carbazide as a reagent for color development.
12. Determination of nitrite nitrogen in water using 1-napthol and 4-aminophenylacetic acid as color developing reagent.

Miscellaneous

13. Determine of the equilibrium constant of $I_2 + KI \rightarrow KI_3$ reaction by distribution method.

Any other experiments can be introduced in class work during the semester.

Reference Books for CHE-554:

1. J. N. Gurtu and A. Gurtu, *Advanced Physical Chemistry Experiments,* (6^{th} Edition), Pragati Prakashan, Meerut, India, 2014.
2. M. K. Sthapit and R. R. Pradhananga, *Experimental Physical Chemistry*, Taleju Prakashan, Kathmandu, 1998.
3. *Findlay's Practical Physical Chemistry*: (9^{th} Edition), revised by B. P. Levitt, Longman Group Ltd., London, 1973.
4. D. B. Khadka, *Practical Physical Chemistry*, Sunlight Publication (Student's Book), Kathmandu, 2009.

Organic Chemistry

Course Title: Organic Chemistry (Theory) **Credit:** Four (4) hrs.
Course No.: CHE-555 **Full Marks**: 100
Semester: Second (2^{nd}) **Pass marks**: 50

Course Objectives:

- To introduce macromolecular chemistry and supramolecules.
- To acquaint with different aspects of stereochemistry.
- To acquaint with heterocyclic, carbohydrate and carbocyclic chemistry.
- To provide fundamental knowledge about natural product chemistry.
- To provide basic knowledge about chromatographic and spectroscopic techniques.

Course Contents:

Group A

Macromolecular Chemistry: Introduction to macromolecules, type of polymerization, mechanism of chain growth polymerization, step growth polymerization, co-ordination polymerization, macromolecule of industrial importance (functional polymers, biomedical polymers (contact lens, dental polymers, artificial heart, kidney, skin and blood cells, special properties of large molecules (in terms of difference in behavior on heating, solubility pattern of low molecular weight compound and a polymer, reactions of polymer, stereoisomerism).

Supramolecular Chemistry: Introduction to supramolecular chemistry, concepts of supramolecular chemistry, examples of supramolecular compounds, uses, synthesis of Crown ethers and their uses, inclusion compounds.

Alicyclic Compounds: Synthesis of small rings (3-4 membered ring), medium sized rings (5-7) and large rings (above 8 members), structure elucidation and synthesis of muscone and civetone.

Group B

Stereochemistry:

Structure and symmetry: Symmetry introduction, symmetry elements, symmetry operators, symmetry points groups, point groups containing chiral molecules, point groups containing only achiral molecules, point groups corresponding to the platonic solids T_d, O_h, I_h.

Racemization and Methods of Resolution:

Recemization process: Thermal racemization, by anion formation, by cation formation, racemization via stable inactive intermediates, by chemical transformation, epimerization, mutarotation, and asymmetric transformation, acid catalyzed and base catalyzed processes, racemization of amino acids.

Racemates: Properties of racemates (m.p., solubility, vapour pressure), IR-spectra, NMR, chromatograph aplical activity, Interaction with other chiral substances, biological properties, determination of enantiomer and diastereomer composition (isotope dilution method, kinetic method, NMR Methods based on diastereotopicity, NMR in chiral solvents).

Resolution: Chemical separation of enantiomers via diastereomers (tartaric acid resolution, resolution of *α,β*- unstaturated ketones, optical activation of menthone), separation via complexes and inclusion compounds, asymmetric transformations of diastereomers, general methods for the separation of diastereomers, kinetic resolution, enzymatic resolution, Cram's and Prelog's rule.

Group C

Heterocyclic Compounds: Introduction to heterocyclic compounds, reactions, synthesis and uses of oxirane, aziridine, azetidine, imidazole, thiazole, isoquinoline, indoles.

Carbohydrates: Disaccharides (determination the structure of maltose and sucrose), Introduction to oligosaccharides and polysaccharides.

Natural Product Chemistry: Introduction, scope of natural products chemistry, sources of natural products, extraction procedure, phytochemical screening.

Group D

Separation Techniques: Types of chromatography, theory of chromatography, instrumentation and applications of TLC, column chromatography, gas chromatography, HPLC, GC-MS, LC-MS.

Spectroscopic Techniques: Theory and application of IR, UV, Mass, ^{1}H- and ^{13}C-NMR.

Spectroscopic Analysis: Use of spectroscopic techniques in structure elucidation of simple organic compounds.

Reference Books for CHE-555:

1. E. L. Eliel, S. H. Wilen and L. N. Mander, *Stereochemistry of Organic Compound;* John Wiley & Sons, Inc., 1994.
2. E. L. Eliel, *Stereochemistry of Carbon Compounds*, McGraw-Hill Book Company, T M H edition 1975.
3. R. M. Silverstein, G. C. Basslerand T. C. Morrill; *Spectroscopic Identification of Organic Compounds*, John Wiley and Sons Inc, 1991.
4. J. Dyer, *Applications of Absorption Spectroscopy of Organic Compounds*, Prentice Hall, 1989.
5. D. Williams and I. Fleming, *Spectroscopic Methods in Organic Chemistry*, (6th Edition), McGraw Hill, 2007.
6. E. Heftmann, *Chromatography*, (2nd Edition), Reinhold, 1967.

7. I. L. Finar, *Organic Chemistry* Vol. 1 and Vol. 2, ELBS Longman, 1975.
8. E. A. Davidson, *Carbohydrate Chemistry*, Holt, Reinhard and Winston, 1967.
9. J. Singh and R. C. Dubey, *Organic Polymer Chemistry*, (2nd Revised Edition), Pragati Prakashan, 2009.
10. J. M. Lehn, *Supramolecular Chemistry*, VCH, Weinheim, 1995.
11. 11.V. R. Gowariker, N. V. Viswanathan and J. Sreedhar, *Polymer Science*, New Age International, first edition, 1986.
12. J. Mendham, R.C. Denney, J. D. Barnes, M.J.K. Thomas, *Vogel's Quantitative Chemical Analysis* (6th Edition), Prentice Hall, 2000.
13. S. M. Khopkar, *Basic Concepts of Analytical Chemistry*, New Age International, 1998.
14. K. R. Palak, *Stereochemistry*, Pairavi Prakashan, Kathmandu, Nepal, 2017.
15. Y. R. Sharma, *Elementary Organic Spectroscopy*, S. Chand and Company, New Delhi, 2013.

Organic Chemistry

Course Title: Organic Chemistry Practical
Course No.: CHE-556
Semester: Second (2nd)

Credit: Two (2) hrs.
Full marks: 50
Pass marks: 25

Course Objective:

- To train the students in handing different equipment's and train them synthesis of different compounds and isolation of natural products.

Course Contents:

1. Synthesis of different compounds involving not more than two steps.
2. An experiment based on the use of soxhelt extraction.
3. An experiment on solvent-solvent extraction.
4. Phytochemical screening for alkaloids, terpenes and flavonoids.
5. Isolation and purification of caffeine.
6. Isolation of an essential oil.
7. An experiment on ion-exchange chromatography.
8. An experiment on gas-liquid chromatography.
9. An experiment on HPLC.

Any other experiments to be introduced in class work during the semester.

References Books for CHE-556:

1. N. K. Vishnoi, *Advanced Practical Organic Chemistry* (3rd Edition), Vikas Publishing House Pvt. Ltd, 1996.
2. A. I. Vogel, *A Text Book of Practical Organic Chemistry* (5th Edition), Longman, 1989.
3. R. L. Shriner, R. C. Fuson and D. Y. Curtin and T. C. Morrill, *The Systematic Identification of Organic Compounds* (6th Edition), John Wiley & Sons, 1980.

Research Methodology in Chemistry

Course Title: Research Methodology in Chemistry (Theory) **Credit:** Two (2) hrs.
Course No.: CHE-557a **Full marks**: 50
Semester: Second (2^{nd}) **Pass marks**: 25

Course Objective:

- To impart the students the knowledge of research methodology in chemistry.

Course Contents:

Group A

Distinctive Concept: Definition of research, importance of research, motivation in research, research methodology and research methods, purpose of research, classification of research, types of research, research approaches, research process, research design, scientific method of research.

Comparative Concepts: Comparative idea of research methodology, social sciences and natural sciences, physical sciences and biological sciences, different branches of chemistry e.g. inorganic, organic, physical, analytical, fundamental and applied field research, library research and laboratory research, research methodology in different areas of chemistry.

Literature Survey: Chemical literature (Chemical Abstracts Beilstein and chemistry journals), primary and secondary sources of chemical information eg journals, reviews, monographs, text books, modern techniques in chemical literature search e.g. use of internet, INSDOC, computers, software programs, etc., identification of research problem and proposal writing.

Group B

Tools and Techniques used in Research: Solvents, purification of solvent, drying agents, reagents, reagent preparation, special lab techniques and experimental setting., grades of reagent, cost factors, hazards due to chemicals, apparatus and reaction procedure, vacuum line technique, handling of air sensitive compounds and hazardous chemicals, chromatographic techniques, spectroscopic techniques, chemical and physical techniques, high and low pressure techniques, techniques to study fast reaction, high and low temperature techniques, use of non-aqueous solvents.

Analysis of Research Finding: Analysis involved in data base research findings e.g., sampling, precision, accuracy, reproducibility, checking reproducibility of results, deviation, standard deviation, regression analysis, confidence limit, data analysis through computers, simple program development in chemical research, interpretation skill regarding spectroscopic data e.g. UV, IR, ^{1}HNMR, ^{13}CNMR, Mass, GC-MS and X-ray-crystallography and different chromatograms.

Research Paper, Report and Thesis Writing: Format development, penmanship: variation in the format of report writing, drilling exercise in report writing and paper writing, citation of the references, bibliography.

References Books for CHE-557a:

1. S. P. Dhoubhadel, *Research Methodology in Chemistry*, Curriculum Development Centre, Tribhuvan University, Kirtipur, Kathmandu, 2002.
2. G. H. Jafferyetal, *Text book of Quantitative Chemical Analysis*; ELBS, Langman Group UK Ltd., 1989.
3. R. B. Bates and J. P. Schaefer, *Research Technique in Organic Chemistry*; Prentice Hall of India, 1971.
4. Paul Stapleton, *Writing Research paper; an Easy Guide for Non-native English Speaker*, ACIAR, Canberra, 1990.
5. R. J. Angelici, *Synthesis and Technique in Inorganic Chemistry*; W.B. Saunders Company (Saunders Golden Series), Philadelphia, 1977.

6. J. March, *Advanced organic Chemistry*, (4th Edition), John Wiley and Sons, 1992.

Term Paper

Course Title: Term Paper in Chemistry
Course No.: CHE-557b
Semester: Second (2nd)

Credit: One (1) hr.
Full marks: 25
Pass marks: 12.5

Course Objective:

- To make the students familiar with the original research papers published in peer reviewed chemistry journals.

Course Contents:

The students have to write and submit a term paper in the 2nd Semester on the topic provided by supervisor selecting at least five recent research papers published in peer reviewed chemistry journals. The format of the term paper and submission date will be provided by Central Department of Chemistry/Campuses.