Course outcome Semester wise

Course: PG Chemistry

I Semester:
Fundamentals of Chemical Analysis

- This course in analytical chemistry will make students to get emphasized on quantitative and qualitative methods of analysis with relevant equilibrium chemistry.
- In this course content he will develop the ideas with the fundamental aspects in analytical chemistry.
- Students will be enriched with topics such as experimental design, sampling, calibration strategies, standardization, optimization, statistics, and the validation of experimental results.
- This course will build the interest in students in developing good experimental protocols, and in interpreting results.
- Analytical knowledge for the quantitative analysis of various samples of different origin is best sowed among the students under titrimetric aspects.
- The statistical aspects are learnt and from which the spirit of assessing the results will be enhanced.
- Method of development and validation features will become familiar, so that they will become outstanding basement for their career in various industries.
- Students will earn 3 credits upon successful completion of this course.
- Describe the meaning of applied analysis
- Make out the causes for air pollution and water pollution, and knowledge an control devices or techniques or processes of such pollutions
- Understand the importance of food and drug analysis
- Gives knowledge to choose methodologies for the preliminary and complete analysis of air, water, food and drugs
- Adopt suitable analytical technique for sampling and analysis of air, water, food and drug samples for analysis
- Describe suitable analytical method for the determination of required analysts /components of the sample provided
- After completing this course student will gain 3 credits into his/her account.

Inorganic chemistry-I

- The students will be able to acquire the skills for molecular symmetry and group theory and interpretation in rather simple point groups.
- The student will get idea about representation of groups and applications of group theory.
- Demonstrate an understanding of the basic principles of periodicity.
- This course in inorganic chemistry will make students to illustrate an understanding of the principles of molecular orbital theory.
- These topics will build the interest in students in understanding of VSEPR theory.
- Demonstrate an understanding of the basic principles of acid – base chemistry and non – aqueous solvents.
- From this course the student will be competent in designing synthesis of higher boranes and extraction of lanthanides and actinides.

- Demonstrate an understanding of chemistry of ‘d’ and ‘f’ block elements.
- Students will earn 3 credits upon successful completion of this course.

Stereochemistry; Reaction mechanisms and Heterocyclic Chemistry

- This course will enable the students to learn the deeper concepts of stereochemistry, rearrangements as well as heterocyclic chemistry.
- Assigning the configuration and conformation for an organic molecule is highly important since the property of the molecule depends on these concepts. Hence, learning these will make students to gain more knowledge about the chiral carbon atoms, isomerism, symmetry concepts etc.
- Conversion of reactants into products sometimes involves the migration of atoms/groups and that will be studied under Molecular Rearrangements, which will enable a student acquire different concepts of migration and also the fate of the reaction.
- In nature, more than 90% of the compounds are heterocyclic in nature. They present numerous applications in different branches.
- A student, by studying this will be able to classify the different categories of heterocyclics, their preparation and also applications.
- Students will be tailor-maid for careers in pharmaceutical industries.
- Students will earn 3 credits upon successful completion of this course.
- Identify the reactivity of the molecules
- After completing this course student will gain 2 credits into his/her account.

Physical Chemistry -I

- This course in physical chemistry will make students to get knowledge on the basic fundamental concepts of physical chemistry i.e, Thermodynamics, Chemical kinetics and Electrochemistry.
- Learning this course content will develop the ideas with the fundamental aspects in physical chemistry.
- After studying this unit students will get explored, with the topics such as Second law of thermodynamics, partial molar properties, fugacity, statistical thermodynamics, kinetics of fast reaction, some of the important theories of kinetics, isotopic effects, batteries construction and working, liquid junction potential etc.
- Applying the reaction rate for simple, complex reaction and also fast reaction is covered in this unit.
- A brief description about the primary and secondary batteries is explained with the suitable examples; by this students will get an idea about the batteries which they are using in their daily life.
- Students will earn 3 credits upon successful completion of this course.

Analytical chemistry practical

- Student will earn 4 credits upon successful completion of this course.
- Student will evolve as a analyst with various classical and simple instrumental skills
- Students will obtain the knowledge for selection of analytical methods with suitable technique being adopted for the analysis different samples like, water, laboratory chemicals and reagents, body fluids such as urine etc.

- Student will be able to distinguish classical and instrumental methods.
- Student will get the ability to propose and conduct experiment for quantification of individual analyses.

Inorganic chemistry practical

- Student will have knowledge to prepare reagents required for analysis.
- Student will be more informative in putting the schemes for semi-micro qualitative analysis.
- Student will get the ability to propose and conduct experiment for quantitative analysis of inorganic samples such as ore, metals, complexes mixture of metals and complexes etc.
- Students will obtain the skills for scientific and relevant documentation and risk and security assessment.
- Student will earn **4 credits** upon successful completion of this course.

Organic chemistry practical

- Student will earn 4 credits upon successful completion of this course.
- Students will evolve as an organic chemist with various classical and simple preparation skills.
- Student will obtain the knowledge of different reactions, conditions to be maintained, precautions to be exercised before/during/after the reaction.
- Students will learn qualitative analysis and will be able to separate a mixture of two components and systematically analyse them so as to identify to which class does the organic compounds belongs to.
- Students gain confidence / expertise to work in Pharma Industry.

Applied Analysis I

After completion of this course student will be able to

- Describe the meaning of applied analysis
- Make out the causes for air pollution and water pollution, and knowledge an control devices or techniques or processes of such pollutions
- Understand the importance of food and drug analysis
- Acquire the knowledge to choose methodologies for the preliminary and complete analysis of air, water, food and drugs
- Adopt suitable analytical technique for sampling and analysis of air, water, food and drug samples for analysis
- Describe suitable analytical method for the determination of required analytes/components of the sample provided

Frontiers in Inorganic Chemistry

After completion of this course student will be able to

- The students will be able to know the significance of materials chemistry
- Students will acquire knowledge of various characterization techniques
- Students will obtain the skills for the inorganic pigments.
- After completing this course student will gain **2 credits** into his/her account.

Reaction Mechanism

After completion of this course, a student will be able to

- Identify the reactivity of the molecules
- Fate of the reaction by knowing the thermodynamic and kinetic requirements.
- Students learn to identify the products, structure, stability & Mechanistic pathway of different reactions.
- Basics of organic chemistry lie in knowing the nucleophilic, electrophilic and elimination reactions. Each of these will have different mechanistic route and a student will learn these concepts and hence will help in the future.
- After completing this course student will gain 2 credits into his/her account.

Solid State Chemistry and Chemistry of Nano Materials

- Student will earn 2 credits after successful completion of this course. Besides the following are the outcomes a student is emerged with:
- Nowadays nanotechnology is considered as an important branch in which many research is going on.
- Students will be educated about the fundamentals of nano materials and the methods by which nano particle is synthesised.
- Semiconductors, superconductors, X-ray crystallography are the important concepts that is learnt in this unit.
- After completing this course student will gain 2 credits into his/her account

II Semester:

Separation Techniques

- Knowledge of various physico-chemical separation techniques with principle, mechanism of separation, materials or compounds or analyses in the sample to be separated.
- Built in ability to select appropriate separation technique for intended problem.
- Capacity and scope of the built knowledge to separate analyses in multi-component mixtures.
- Ability to design separation procedure for the effective solution of intended problem.
- Enriched knowledge on method development and validation to propose new analytical separation method.
- Students will acquire the ability to describe the instrumentation required for the various separation techniques and their associated operating principles.
- Student will reach a stage to understand the significance, quality, and limitations of the results produced by the various separation techniques.
- Ability for execution of separation procedure and troubleshooting during the separation.
- To get deposited with 3 credits into student's account of programme as a result of completion of the course.

Advanced coordination chemistry

- Students acquire knowledge for demonstration and understanding of nomenclature and isomerism of coordination compounds.
- Illustrate an understanding of the principles of theories of metal-ligand bond.
- Demonstrate an understanding of spectra of coordination compounds.

- Student will analyze the spectra of transition metal ions.
- Student will analyze MOT, CFT, Orgel and Tanabe – Sugano diagrams.
- Interpret the stability of complexes.
- Understands the substitution reactions in transition metal complexes.
- To get deposited with 3 credits into student's account of programme as a result of completion of the course.

Reagents in Organic Synthesis; Photochemistry and Pericyclic Reactions

- Reagents play a key role in organic chemistry. Fate of the reaction highly depends on the role of the reagents as they readily involve the conversion of reactants into products.
- Hence, a student will be able to judge which reagent is needed for a particular type of reaction.
- He will also learn the mechanism by which reagent/s work during the reaction.
- Environmental friendly reactions are on the rise since solvents/harsh reaction conditions/reagents is harming the environment. Thus, studying of Green Synthesis will guide the students about the choice of solvents/reagents/catalysts that needs be incorporated for the reactions.
- Generally, reactions are carried under thermal or photochemical conditions. Sometimes, thermal reactions destroy the compounds and hence photochemical reactions are best suited in such cases. Thus, students can adopt photochemistry for such failures which will enable them to carry out different photochemical reactions.
- Students will also be able to judge the stereochemistry of the products obtained.
- On the other hand, pericyclic reactions are highly concerned since they guide the chemists through which path the reaction is taking place.
- 3 Credits will be deposited into student's account as a result of completion of the course.

Quantum chemistry and molecular spectroscopy:

- Students will be able to differentiate the principles of microwave, vibration, Raman, UV-Visible, NQR and Mossbauer spectroscopic techniques.
- Student will have idea about nature of interaction of electromagnetic radiation with matter.
- After studying quantum chemistry students will get an idea about the fundamental concepts like black body radiation, photoelectric effect, Schrodinger wave equation and application, etc.
- Knowledge on calculation of ionization energy and binding energy.
- To get deposited with 3 credits into student's account of programme as a result of completion of the course.

Analytical chemistry practical:

- Student will earn 4 credits upon successful completion of this course.
- Student will evolve as a analyst with various classical and simple instrumental skills
- Students will obtain the knowledge for selection of analytical methods with suitable technique being adopted for the analysis different samples like, water, laboratory chemicals and reagents, body fluids such as urine etc.

- Student will be able to distinguish classical and instrumental methods.
- Students will get the ability to propose and conduct experiment for quantification of individual analysts.
- Students will obtain the skills for the scientific and relevant documentation and risk and security assessment

Inorganic chemistry practical:

- Student will prepare reagents and operate modern inorganic instrumentation.
- Student will evolve as an analyst with various qualitative, quantitative and instrumental methods.
- Student will get the ability to propose and conduct experiment for quantification of individual analytes.
- Students will obtain the skills for the scientific and relevant documentation and risk and security assessment.
- Student will earn **4 credits** upon successful completion of this course.

Organic chemistry practical:

- Student will evolve as an organic chemist with various classical and simple preparation skills.
- Student will obtain the knowledge of different reactions, conditions to be maintained, precautions to be exercised before/during/after the reaction.
- Student will learn qualitative analysis and will be able to separate a mixture of two components and systematically analyse them so as to identify to which class does the organic compounds belong to.
- Students gain confidence to set up reactions individually either in the pharma industry or for the Research.
- Student will earn 4 credits upon successful completion of this course.

Physical chemistry practical:

- Student will get an idea about handling the instruments like UV-Visible Spectrophotometer, Potentiometer, pH meter etc.
- Students will be able to determine the concentration of the species in given solutions.
- Student will have distinction between different physical properties of substances or compounds
- Student will earn 4 credits upon successful completion of this course.

III Semester

Instrumental Methods of Analysis:

- Students will gain the knowledge on the differences between classical and instrumental methods of chemical analysis.
- Students will be able to explain different types of Instrumental methods employed in chemical analysis.
- Students are developed with the understanding of the range and theories of instrumental methods available in analytical chemistry.

- Students can make out the clear distinctions among spectrometric, electro-analytical, thermal and microscopic methods with respect principle, materials and procedural or operational aspects in each.
- Students gain the knowledge pertaining to the appropriate instrumental technique to be employed for the successful analysis of complex mixtures.
- Obtain the practical experience in selected instrumental methods of analysis.
- Develop the skills on instrumental methods for planning, developing, conducting, reviewing, conducting experiments and reporting results.
- Student account will be filled with 3 credits for completing this course.

Spectroscopy

- Student will be able to differentiate the principles of microwave, vibration, Raman, UV-Visible, NQR and Mossbauer spectroscopic techniques.
- Student will have idea about nature of interaction of electromagnetic radiation with matter.
- Knowledge on calculation of ionization energy and binding energy by simple expressions will be built in student.
- Identification of the unknown compounds would be struggling, had spectroscopy was not existing. Students will be able to apply their minds to come at a preliminary judgement about the structure of the compounds.
- Students will study different types of transitions that are involved in UV-Vis spectroscopy.
- A student will be able to assign the wavelength of the organic compounds (different classes).
- By studying IR spectroscopy, students will learn which class of functional group will be present in the molecules. Also they learn the different factors that affect group frequencies and also the band shapes.
- To get deposited with 3 credits into student's account
- of programme as a result of completion of the course.

Inorganic chemistry-II

Student will be treated as enriched with resource after the completion of this course with the following outcomes to himself or herself:

- Students gain the knowledge from basic concepts of ionic solids, modern concept of acids and bases.
- Demonstrate and understanding of the basic principles of acid-base chemistry and non-aqueous solvents.
- Student will acquire the knowledge to handle homogeneous and heterogeneous catalysis.
- This course will earn **2 credits** into each student's account

Biophysical chemistry and polymers:

- Student will be interpretative to electrophoresis, kinetics of polymerization, phase transition in polymer, polymers in solution etc, with respect to their principles and other asapects.

- Students will be able to clearly distinguish different types of electrophoresis like free electrophoresis, zone electrophoresis, gel electrophoresis.
- Idea on fundamentals of polymers, degree of polymerization and classification of polymers will be composed in the mind of student.
- Students will have talent and knowledge on different methods for the classification of compounds based on their molecular weights.
- Student account will be filled with 3 credits for completing this course.

OPEN ELECTIVE

Selected Topics in Chemistry

- A non-chemistry student's account will be obtained 4 credits into account after completing this course.
- Student will have the knowledge on importance of chemistry or different branches of chemistry along with their unheard significant aspects
- Students will have fundamental knowledge of use of chemistry in human's daily life
- Students will have their preachment of chemistry from its different special branches
- Students will get the knowledge to apply their skills in chemistry in their daily lives.
- Students will have capability to predict the arrangements of components of an object or compound or matter

Analytical chemistry practical

- Student is exposed to get the experience of analysis of various complex mixtures by following multistep reactions.
- Student will acquire the knowledge to handle instruments and to overcome the general problems arises during the analysis.
- Students will be an industry-ready resource with the skills required for sampling, analytical and interpretation and presentation of results.
- Adequate knowledge on literature search for developed analytical methods.
- Student will earn 4 credits to the account of himself/herself.

Inorganic chemistry practical

- Student is exposed to get the experience of analysis of various complex mixtures by multistep reactions.
- Students will acquire the knowledge to handle instruments and to overcome the general problems arises during the analysis.
- Student will be an industry ready resource with the skills required for sampling, analytical and interpretation and presentation of results.
- Adequate knowledge on literature search for developed preparative methods.
- To make the student conversant with the synthesis and characterization of complexes.
- Student will earn **4 credits** to the account of himself/herself.

Organic chemistry practical

- Student is exposed to get the experience on multistep synthesis.
- Here, a student will learn different kinds of reactions under Multistep Synthesis which will enable them to be placed in Research & Development department of pharma industries.

- Students will have learnt isolation of natural products, their preliminary identification and separation.
- Students will acquire knowledge of the various estimations like sugars, enol content, ketones, nitro protein etc. which help them to be emerged as organic chemists.
- Student will earn 4 credits to the account.

Physical chemistry practical

- Student will acquire the knowledge to handle instruments and to overcome the general problems arises during the analysis.
- Concepts of rate constants, energy of activation, order of the reaction and also thermodynamics parameters will become familiar in students mind.
- Students will have the knowledge to handle the instruments like UV-Visible Spectrophotometer, Potentiometer, pH meter etc.Which will be useful in future research work. or handling instruments in industries.
- Student will earn 4 credits to the account of himself/herself

IV Semester

Bioinorganic chemistry:

Enriched with the knowledge of

- Students will get knowledge on structural aspects various bio molecules and learn characteristic features of bioenergetics.
- Biochemistry of minerals & Vitamins & their importancebiological system
- Transport systems , electron transport complexes & redox enzymes

Student account will be filled with 3 credits for completing this course

Advanced Physical Chemistry

Kinetics and Thermodynamics of Polymerization

Student will be treated as enriched resource after the completion of this course with the following outcomes to himself or herself:

- Main topics that are discussed in this unit are copolymerization, conducting polymers, solid state chemistry, photophysical kinetics, photodegradation, hydrogen over voltage, oxygen overvoltage, corrosion etc
- Students will be able to differentiate between different types of overvoltage & different methods for the determination of molecular weight of the polymer.
- Brief explanation about conducting polymers
- A brief explanation of polymer degradation stability and environmental issues

Applied Analysis II

Student will earn 2 credits after successful completion of this course. Besides the following are the outcomes a student is emerged with:

- Meaning, laws and techniques of chemical kinetics
- Importance of chemical kinetics in enzyme catalysed and non-enzyme catalysed reactions to the analysis of samples for quantification of analyte
- Knowledge on automated and automatic methods of analysis with choice on instrumental methods
- Clear distinction ability between conventional and radio-chemical methods
- Type of samples subjected to radio-chemical analysis and radioimmunoassay.

Applied Analysis III

Student will earn 2 credits after successful completion of this course. Besides the following are the outcomes a student is emerged with:

- Meaning, laws and techniques of chemical kinetics
- Importance of chemical kinetics in enzyme catalysed and non-enzyme catalysed reactions to the analysis of samples for quantification of analyte
- Knowledge on automated and automatic methods of analysis with choice on instrumental methods
- Learns to distinguish between conventional and radio-chemical methods
- Type of samples subjected to radio-chemical analysis and radioimmunoassay.

Solid State Chemistry and Chemistry of Nano Materials

- Student will earn 2 credits after successful completion of this course. Besides the following are the outcomes a student is emerged with:
- Now a days nanotechnology is considered as an important branch in which many research is going on.
- Students will be educated about the fundamentals of nano materials and the methods by which nano particle is synthesised.
- Semiconductors, superconductors, X-ray crystallography are the important concepts that is learnt in this unit.
- After completing this course student will gain 2 credits into his/her account

Retrosynthesis and Organometallic Chemistry

Student will be treated as enriched resource after the completion of this course with the following outcomes:

- Knowledge of protection and deprotection in organic synthesis.
- Acquisition of different named reactions which are highly useful for competitive exams and interviews.
- Students will be exposed to disconnection approach, their principles and terminologies.
- Students will be able to learn the retro synthesis of different complex organic molecules.
- This course will earn 2 credits into each student's account.

Biomolecules and Natural Products

Student will earn 2 credits after successful completion of this course. Besides, the following are the outcomes a student is emerged with:

- Knowing amino acids, peptides, proteins: their structure, function and properties.
- Students will know the structural determination of the proteins which are called as energy of the body.
- Students will learn about the chemistry lying behind the heredity.

Students will also learn the nomenclature, classification and biological importance of other natural products like carbohydrates, lipids, terpenoids and steroids.

Dissertation or Project Work

- Student will get earned with 4 credits after completion of this course.
- Student will be able to carry out literature survey on the problem to be solved

- Student will be made to learn and follow suitable research methodologies to propose and to perform experiment individually along with skills to interpret and present results and consequently to prepare final report of the problem under taken to solve
- Student will attain the state of ability to take up research work
- Better knowledge is acquired by a student from research articles, patents, book chapters or books on relevant research problem
- Students will obtain the skills of writing research reports in the form of articles or thesis.