(University of Delhi)
Shyam Lal College

Programme Specific Outcomes and Course Outcomes

B.Sc. (P) Chemistry

Programme Outcomes

Programme	Programme Outcomes
B.Sc. (Physical Sciences) with Chemistry	**PO-1:** An integral part of chemistry curriculum is problem solving. The student will be equipped to solve problems of numerical, synthetic and analytical nature that are best approached with critical thinking. **PO-2:** The student will be able to draw logical conclusions based on a group of observations, facts and rules. **PO-3:** The student is inquisitive about processes and phenomena happening during experiments in laboratories and seeks answers through the research path. **PO-4:** Students are aware of the importance of working with safety and consciousness in laboratory and actively seeks information about health and environmental safety of chemicals that are used in the laboratories and follows protocols for their safe disposal.

Course Outcomes (Semester 1)

Course Name	Course Outcomes	Methodology to Achieve the Specific Outcomes
Basic Concepts of Organic Chemistry	**CO-1:** Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt. **CO-2:** Understand the fundamental concepts of stereochemistry. **CO-3:** Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved. **CO-4:** Learn and identify many organic reactions and their mechanisms including electrophilic addition, nucleophilic addition,	**1.** Use of 3D models to visualize the organic molecules in a three dimensional space. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and blackboard method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in

	nucleophilic substitution, electrophilic substitution and rearrangement reactions.	Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Semester 2

Course Name	Course Outcomes	Methodology to Achieve the Specific Outcomes
Periodic Properties and Chemical Bonding	**CO-1:** Understand periodicity in ionization enthalpy, electron gain enthalpy, electronegativity and enthalpy of atomization. **CO-2:** Understand variability in oxidation state, colour, metallic character, magnetic and catalytic properties and ability to form complexes. **CO-3:** Understand the concept of lattice energy using BornLandé expression. **CO-4:** Draw Born Haber Cycle and analyse reaction energies. **CO-5:** Draw the plausible structures and geometries of molecules using VSEPR theory. **CO-6:** Understand and draw MO diagrams (homo- & heteronuclear diatomic	**1.** Use of Periodic table charts and models to better understand the chemistry of elements of periodic table. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lecture from SWAYAYAM and NPTEL. **4.** Use of virtual labs. **5.** Correlation of concepts with demonstration and experiments in laboratory.

	molecules). Understand the importance and applications of hydrogen and van der Wall bonding.	**6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Semester 3

Course Name	Course Outcomes	Methodology to Achieve the Specific Outcomes
Chemical Energetics and Equilibria	**CO-1:** Develop basic understanding of the chemical energetics, laws of thermodynamics and ionic equilibrium. **CO-2:** Provides basic understanding of the behavior of electrolytes and their solutions. **CO-3:** Make students learn about the properties of ideal and real gases and deviation from ideal behavior. **CO-4:** Explain the laws of thermodynamics, thermochemistry and equilibria. **CO-5:** Use the concept of pH and its effect on the various physical and chemical properties of the compounds. **CO-6:** Use the concepts learnt to predict feasibility of chemical reactions and to study the behaviour of reactions in equilibrium.	**1.** Use of 3D models to visualize the organic molecules in a three dimensional space. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test.

		7. In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.
Main Group Chemistry (DSE)	**CO-1:** Understand the basis of occurrence of metals in nature and the methods that can be applied on minerals to extract the metals from them. **CO-2:** Explain the importance of free energy of formation of oxides with the choice of reducing agents for extracting the metals. **CO-3:** Understand and explain the importance of refining of metals and the choice of a refining procedure. **CO-4:** Explain the group trends observed for different properties of s and p block elements, Explain the structures and the bonding of compounds of s- and p- block elements. **CO-5:** Explain the unique properties of alkali metals and some other main group elements. **CO-6:** Understand and explain the polymerization mechanism of inorganic ions to generate inorganic polymers and the difference between organic and inorganic polymers.	**1.** Use of 3D models to visualize the organic molecules in a three dimensional space. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Semester 4

Course Name	Course outcomes	Methodology to Achieve the Specific Outcomes
Chemistry of Carboxylic Acids & their Derivatives, Amines and Heterocycles	**CO-1:** Make students learn about the chemistry of carboxylic acids and their derivatives (aliphatic and aromatic). **CO-2:** Give basic understanding of amines (aliphatic & aromatic), diazonium salts. **CO-3:** Provide basic understanding of heterocyclic systems. **CO-4:** Understand reactions of carboxylic acids, esters, amides, amines and diazonium salts. **CO-5:** Understand the concept of protection and deprotection. **CO-7:** Use the synthetic chemistry learnt in this course to do functional group transformations. **CO-8:** Gain theoretical understanding of chemistry of heterocyclic compounds.	**1.** Use of 3D models to visualize the organic molecules in a three dimensional space. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Conductance, Electrochemistry and Chemical Kinetics (DSE)	**CO-1:** Develop basic understanding of electrolytic and galvanic cells. **CO-2:** Measurement of conductance and its applications, measurement of emf and its applications. **CO-3:** To understand reaction rate, order, activation energy and theories of reaction rates. **CO-4:** Explain the factors that affect conductance, migration of ions and application of conductance measurement. **CO-5:** Understand the importance of Nernst equation, measurement of emf, calculations of thermodynamic properties and other parameters from the emf measurements. **CO-7:** Understand rate law and rate of reaction, theories of reaction rates and catalysts; both chemical and enzymatic.	**1.** Use of 3D models to visualize the organic molecules in a three dimensional space. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Semester 5

Course Name	Course outcomes	Methodology to Achieve the Specific Outcomes
Chemistry of d Block Elements, Quantum Chemistry and Spectroscopy (DSE)	**CO-1:** Understand chemistry of d and f block elements, Latimer diagrams, properties of coordination compounds and VBT and CFT for bonding in coordination compounds. **CO-2:** Understand basic principles of quantum mechanics: operators, eigen values, averages, probability distributions. **CO-3:** Understand and use basic concepts of microwave, IR and UV-VIS spectroscopy for interpretation of spectra. **CO-4:** Explain Lambert-Beer's law, quantum efficiency and photochemical processes.	**1.** Use of 3D models to visualize the organic molecules in a three dimensional space. Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Semester 6

Course Name	Course outcomes	Methodology to Achieve the Specific Outcomes
Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy (DSE)	**CO-1:** Understand the chemistry and applications of 3d elements including their oxidation states and important properties of the familiar compounds potassium dichromate, potassium permanganate and potassium ferrocyanide. **CO-2:** Use IR data to explain the extent of back bonding in carbonyl complexes. **CO-3:** Get a general idea of toxicity of metal ions through the study of Hg2+ and Cd2+ in the physiological system. **CO-4:** Understand the fundamentals of functional group chemistry, polynuclear hydrocarbons and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism. **CO-5:** Gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques. **CO-6:** Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.	**1.** Use of 3D models to visualize the organic molecules in a three dimensional space. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Skill Enhancement Course

Course Name	Course outcomes	Methodology to Achieve the Specific Outcomes
Green Methods in Chemistry	**CO-1:** Get idea of toxicology, environmental law, energy and the environment **CO-2:** Think to design and develop materials and processes that reduce the use and generation of hazardous substances in industry. **CO-3:** Think of chemical methods for recovering metals from used electronics materials. **CO-4:** Get ideas of innovative approaches to environmental and societal challenges. **CO-5:** Know how chemicals can have an adverse/potentially damaging effect on human and vegetation. **CO-6:** Critically analyse the existing traditional chemical pathways and processes and creatively think about bringing environmentally benign reformations in these protocols. **CO-7:** Convert biomass into valuable chemicals through green technologies.	**1.** Some motivating short movies in green chemistry especially in bio mimicry. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of Examination and viva voce. **8.** Visit to a green chemistry lab.

Basic Analytical Chemistry	**CO-1:** Make students aware of the importance and the concepts of chemical analysis of water and soil samples collected from different sources. **CO-2:** Make them learn few techniques like chromatography, analytical techniques and instrumentation techniques, for example: spectrophotometry and flame photometry. **CO-3:** Handle analytical data. **CO-4:** Determine the pH and conductance of soil samples, which can be useful in agriculture sector. **CO-5:** Do quantitative analysis of metal ions in water samples. **CO-6:** Separate ions using chromatographic techniques. **CO-7:** Estimate macronutrients using Flame photometry.	**1.** Some motivating short movies in green chemistry especially in bio mimicry. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments inLaboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of Examination and viva voce.

Chemistry Lab Operations and Safety Measures	**CO-1:** Cultivate efficient working skills among the students to work in a chemistry laboratory. **CO-2:** Create a trained workforce which can responsibly learn imbibe and explore verticals on structured knowledge safely. **CO-3:** Make students aware of different chemicals and their properties being used in the chemistry laboratory. **CO-4:** Able to design and implement safe working practices in chemistry laboratory. **CO-5:** Able to safely handle different glass apparatus. **CO-6:** Able to handle the chemicals and equipment safely and properly. **CO-7:** Able to design working protocols related to various methods and instruments in chemistry laboratory.	**1.** Some motivating short movies in green chemistry especially in bio mimicry. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of Examination and viva voce.

Chemistry of Cosmetics and Hygiene Products	**CO-1:** Introduce the concept of cosmetics in terms of chemistry and their formulation. **CO-2:** Make students understand the role of each ingredients in the preparation of the cosmetic products. **CO-3:** Give an idea about the role of herbal ingredients in the making of any cosmetic product. **CO-4:** Be familiar with the basic principles of various cosmetic formulations. **CO-5:** Be aware of different ingredients and their roles in cosmetic products. **CO-6:** Appreciate the role of herbal ingredients in various cosmetic products. **CO-7:** Use safe, economic and body-friendly cosmetics. **CO-8:**Prepare new innovative formulations to achieve the aimed efficacies and effects.	**1.** Some motivating short movies in green chemistry especially in bio mimicry. **2.** Blended mode of teaching with flip classroom approach along with traditional chalk and black board method. **3.** Video lectures from SWAYAM and NPTEL. **4.** Use of Virtual Labs. **5.** Correlation of concepts with demonstration and experiments in Laboratory. **6.** Assessment based upon continuous evaluation including quizzes, assignments projects, presentations, and class test. **7.** In Practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of Examination and viva voce.