CO-PO attainment
in
Outcome Based Education
CCFUP UNDER NEP 2020

Department of Chemistry

Government General Degree College, Kalna-I

Program Outcome (PO)

- **PO1: Disciplinary knowledge**
- **PO2: Communication Skills**
- **PO3: Critical thinking**
- **PO4 : Problem solving**
- **PO5: Self-directed learning**
- **PO6: Research-related skills**
- **PO7: Scientific reasoning**
- **PO8: Information/digital literacy**
- **PO9: Lifelong learning**

Program Specific Outcome (PSO): UG Chemistrty

- **PSO1: Foundation for Theoretical Concepts of Chemistry: To know the fundamentals, principles and theoretical methodologies to explain chemistry around us.**
- **PSO2: Foundation for Experimental/Numerical tools of Chemistry: The ability to implement/visualize the theoretical knowledge through laboratory based experimental /numerical techniques.**
- **PSO3: Foundation for possible further developments: Inspire and boost interest to realize global issues and to create foundation for advanced studies, research and development in Chemistry.**

Course Content

Semester: I **Course name: Basic Chemistry-I**

Course Code: CHEM101-1 (Credits: Theory-03, Practicals-01)

Semester-I
Chemistry MAJOR
Paper code: CHEM101-1
Paper title: Basic Chemistry-I
Credits 3+1
FULL MARKS:40(THEORY)+20(PRACTICAL)+15(INTERNAL)=75
Theory: 60 Lectures

1. Atomic structure

Bohr's theory- its limitations and atomic spectra of hydrogen atom, Sommerfeld's theory, wave mechanics- de Broglie equation, Heisenberg's uncertainty principle and its significance, Schrödinger's wave equation, significance of ψ and ψ2, quantum numbers and their significance, Radial and angular wave functions for hydrogen atom, radial and angular distribution curves, shapes of s, p, d and f orbitals, Pauli's exclusion principle, Hund's rules and multiplicity, exchange energy, Aufbau principle and its limitations, Ground state Term symbols of atoms and ions for atomic number upto 30 *6 Hours*

2. Periodic properties

Modern IUPAC periodic table, effective nuclear charge, screening effects and penetration, Slater's rules, atomic radii, ionic radii (Pauling's univalent), covalent radii, lanthanide contraction; ionization potential, electron affinity and electronegativity (Pauling's, Mulliken's and AllredRochow's scales) and factors influencing these properties, group electronegativities, group trends and periodic trends in these properties in respect of s-, p- and d-block elements, secondary periodicity, relativistic Effect, inert pair effect *6 Hours*

3. Acids and bases

Acid-Base concept- Arrhenius concept, theory of solvent system (in H2O, NH3, SO2 and HF); Bronsted-Lowry's concept, relative strength of acids, Pauling's rules, Lux-Flood concept, Lewis concept, group characteristics of Lewis acids, solvent levelling and differentiating effects, thermodynamic acidity parameters, Drago-Wayland equation, superacids, gas phase acidity and proton affinity, HSAB principle, acid-base equilibria in aqueous solution (proton transfer equilibria in water), pH, buffer, acid-base neutralisation curves, indicator, choice of indicators, concept of organic acids and bases, effect of structure, substituent and solvent on acidity and basicity, proton sponge, gas-phase acidity and basicity *6 Hours*

4. Fundamentals in Organic chemistry

Electron displacement phenomena and physical properties: inductive effect, field effect, hyperconjugation, mesomeric effect, resonance energy, bond polarization and bond polarizability, electromeric effect, steric effect, steric inhibition of resonance, influence of hybridization on bond properties, bond dissociation energy (BDE) and bond energy, bond distances, bond angles, concept of bond angle strain (Baeyer's strain theory), melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces, polarity of molecules and dipole moments, relative stabilities of isomeric hydrocarbons in terms of heat of hydrogenation, heat of combustion and heat of formation, calculation of formal charges and double bond equivalent (DBE) Reactive intermediates: carbocations (carbenium and carbonium ions), carbanions, carbon radicals, carbenes, benzynes and nitrenes, generation and stability, structure using orbital picture and electrophilic/nucleophilic behaviour of the reactive intermediates (elementary idea) Concept of aromaticity: Hückel's rules for aromaticity up to [10]-annulene (including mononuclear heterocyclic compounds up to 6-membered ring), concept of antiaromaticity and homoaromaticity, non-aromatic molecules, Frost diagram, elementary idea about α and β, measurement of delocalization energies in terms of β for buta-1,3-diene, cyclobutadiene, hexa-1,3,5-triene and benzene 12 *Hours*

5. Properties of Gases

Ideal and real gases: Deviation of gases from ideal behaviour, compressibility factor, Boyle temperature, Andrew's and Amagat's plots, van der Waals equation and its features, its derivation and application in explaining real gas behaviour, Dieterici equation of state, existence of critical state, critical constants in terms of van der Waals constants, law of corresponding states, virial equation of state, van der Waals equation expressed in virial form and significance of second virial coefficient, intermolecular forces (Debye, Keesom and London interactions, Lennard-Jones potential - elementary idea) *4 Hours*

6. Chemical Kinetics-I

Rate law, order and molecularity: Introduction of rate law, extent of reaction, rate constants, order, forms of rate equations of first-, second- and n-th order reactions, pseudo first-order reactions (example using acid catalyzed hydrolysis of methyl acetate), determination of order of a reaction by half-life and differential method, opposing reactions, consecutive reactions and parallel reactions (with explanation of kinetic and thermodynamic control of products with all steps of first order) Temperature and theories of reaction rate: Temperature dependence of rate constant; Arrhenius equation, energy of activation, rate-determining step and steady-state approximation – explanation with suitable examples. *5 Hours*

7. Thermodynamics-I

Zeroth and 1st law of Thermodynamics: intensive and extensive variables, state and path functions, isolated, closed and open systems, zeroth law of thermodynamics,concept of heat q, work wand internal energy U, statement of first law, enthalpy H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions, Joule's experiment and its consequence Thermochemistry: standard states, heats of reaction, enthalpy of formation of molecules and ions and enthalpy of combustion and its applications, laws of thermochemistry, bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equations andeffect of pressure on enthalpy of reactions, adiabatic flame temperature, explosion temperature *6 Hours*

Contd……

PRACTICALS:

(i) Separation, purification and melting point determination

Separation of components of a binary solid mixture based on solubility by using common laboratory reagents like water (cold, hot), dil. HCl, dil. NaOH, dil. NaHCO3, etc., purification of any one ofthe separated components by crystallization and determination of its melting point. Thecomposition of the mixture may be of the following types: Benzoic acid/*p*toluidine, *p* nitrotolune/*p*-anisidine, benzoic acid/benzophenone, urea/benzophenone, salicylic acid/*p*-nitrotoluene, etc. *12 Hours*

(ii) Determination of boiling point

Boiling points of common organic liquid compounds e.g., ethanol,cyclohexane, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide, etc.

6 Hours

(ii) [Boiling points of the chosen organic compounds should preferably be less than 160°C]

(iii) Identification of a pure organic compound by chemical test(s)

Solid compounds: oxalic acid, succinic acid, resorcinol, urea, glucose and salicylic acid. Liquid Compounds: acetic acid, ethyl alcohol, acetone, aniline and nitrobenzene

12 Hours

Course Outcome (CO)		Paper: CHEM101-1		
Sl. No.	**Course Outcome (CO)**	**Knowledge Level**	**POs**	**PSOs**
Theory				
1	**Understand** bonding and orbital pictures of different organic molecules.	**L2:** Understanding	1, 2, 3, 4, 5, 8, 9	**1, 2, 3**
2	**Define** the physical properties of molecules such as hybridization, bond dissociation energy, bond angle etc.	**L1:** Remembering	1, 2, 3, 4, 5, 6, 7, 8, 9	**1, 2, 3**
3	**Elementary idea** about classification of reaction mechanism.	**L2:** Understanding	1, 3, 4, 7, 8	**1, 2, 3**
4	**Identify** reactive intermediates.	**L4:** Analyzing	1, 3, 4, 5, 7, 8	**1, 2, 3**
5	**Predict** three dimensional geometries of molecules and point groups therein**.**	**L3:** Applying	1, 3, 4, 5, 7, 8	**1, 2, 3**
Practical				
1	**Understand** bonding and orbital pictures of different organic molecules.	**L2:** Understanding	1, 2, 3, 4, 5, 8, 9	**1, 2, 3**
3	**Determination** of boiling point of common organic liquid compounds	**L5:** Evaluating	1, 2, 3, 4, 5, 6, 7, 8	**1, 2, 3**

Programme Articulation Matrix (CO-PO Matrix)

CO		Program Outcome (PO) & Program Specific Outcome (PSO)											
		PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO8	PO9	PSO 1	PSO 2	PSO 3
Theory	1	3	3	2	-	-	-	2	3	3	3	2	2
	2	3	3	2	2	2	2	2	2	2	2	2	2
	3	2	2	3	3	3	-	3	-	3	3	3	3
	4	3	3	3	3	3	3	3	2	2	2	3	3
	5	3	2	3	3	2	3	3	2	2	2	3	3
Practical	1	3	3	3	3	3	3	3	3	3	3	3	3
	2	3	3	3	3	3	3	3	3	3	3	3	3
	Average	2.9	2.7	2.7	2.8	2.7	2.8	2.7	2.8	2.6	2.6	2.7	2.7

Course Content

Semester: I

Course Code: CHEM105-1

Course name: Drugs and pharmacuticals

(Credits: Theory-03)

Course Title: Drugs and pharmacuticals
(Credits: Theory-03)
F.M. = 50 (Theory-40, Internal Assesment-10)

Theory: 30 Lectures

Drugs & Pharmaceuticals

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti- inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT-Zidovudine). 18 classes

Course Outcome (CO) Paper: CHEM105-1

Sl. No.	Course Outcome (CO)	Knowledge Level (Bloom's Level)	POs	PSOs
1	**Formulate** drug discovery, design and development; Basic Retrosynthetic approach.	**L6:** Creating	1, 3, 4, 5,6, 7, 8, 9	**1, 2, 3**
2	**Design** the **s**ynthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti- inflammatory agents, antibiotics, antibacterial and antifungal agents etc.	**L6:** Creating	1, 2, 3, 4, 5, 7, 8, 9	**1, 2, 3**
3	**Develop** the Knowledge about the application of different types medicine specifically.	**L3:** Applying	1, 2, 3 , 5, 6, 8, 9	**1, 2, 3**
4	**Illustrate** the production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.	**L4:** Analyzing	1, 2, 4, 6, 7, 8, 9	**1, 2, 3**

Programme Articulation Matrix (CO-PO Matrix)

CO	Program Outcome (PO) & Program Specific Outcome (PSO)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3
1	3	3	2	-	2	-	-	-	2	3	2	2
2	3	3	2	2	2	-	2	-	2	3	2	2
3	2	2	3	3	3	2	3	-	3	2	3	3
4	3	3	3	3	3	-	3	2	3	3	3	3
Average	2.8	2.8	2.5	2.6	2.5	2.0	2.6	2.0	2.5	2.8	2.5	2.5