Revised Syllabus

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. I & II Semester
CHEMISTRY

(Based on Choice Based Credit System)

SESSION : 2022-23

ESTD : 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

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Department of Chemistry

Govt. V.Y.T. PG Autonomous College, Durg (C.G.)

CBCS Syllabus (Revised Syllabus)

for

B.Sc. (Chemistry) Semester I & II

(Based on NEP-2020, UGC-LOCF& Revised according to CG Govt. HE Scheme)

Session 2022-23

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved Revised syllabus for
B.Sc. CHEMISTRY by the members of Board of Studies for Session 2022-23
Scheme and Syllabus for B.Sc. Year 1 (Semester I & II)

Scheme for B.Sc. Program with Chemistry - First Year
(with 3 Subjects A, B*, C*Subject A-Chemistry)

Semester	Discipline Specific Course/ Core Course DSC (Credit-4)	Generic Elective Course GEC (Credit-4)	Skill Enhancement Course SEC (Credit-2)	Ability Enhancement Course AEC (Credit-2)	Value Added Course VAC (Credit-2)	Total Credits
1	Chemistry 1 **Fundamentals of Chemistry - I** (Th=3, P=1) SubjectB1 (Th=3, P=1) Subject C1(Th=3, P=1)	Choose any one course other than DSC (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1)	Hindi Language (Th-2)	Sports (for Bio Group)/ Yoga (for Maths Group (Th=1, P=1)	22
2	Chemistry 2 **Fundamentals of Chemistry - II** (Th=3, P=1) SubjectB2 (Th=3, P=1) Subject C2(Th=3,P=1)	Choose any one course other than DSC (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1)	English Language(Th -2)	Sports/Yoga (Th=1, P=1)	22
Students on exit shall be awarded undergraduate certificate (in the field of Multidisciplinary Study) after securing the requisite 44 credits in semester I and II						

*Maths/Physics/Botany/Zoology/Microbiology/Zoology/Geology/Biotechnology/Biochemistry/IndustrialChemistry/Anthropology

LIST OF COURSES OFFERED BY DEPARTMENT OF CHEMISTRY
For students opting B.Sc. with Chemistry (First Year)

Discipline Specific Courses/Core Papers DSC (Credits: 04 each; T= Theory. P = Practical)

1. BCHC 101: Fundamentals of Chemistry - I (T- 3, P- 1)
2. BCHC 201: Fundamentals of Chemistry - II (T- 3, P-1)

Skill Enhancing Courses SEC (Credits:02)

1. BCHS 01: Good lab practices in Chemistry (T- 1, P- 1)
2. BCHS 02: Water remediation and conservation studies (T- 1, P- 1)

For students opting UG without Chemistry

Generic Electives Courses GEC (Credits: 04 each; T= Theory. P = Practical)

1. BCHC 101: Fundamentals of Chemistry - I (T- 3, P- 1)
2. BCHC 201: Fundamentals of Chemistry - II (T- 3, P-1)

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved Revised syllabus for
B.Sc. CHEMISTRY by the members of Board of Studies for the Session 2022-23
Scheme and Syllabus for B.Sc. Year 1 (Semester I & II)

Courses and Marking Scheme for First-year B.Sc. with Chemistry

Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits	Marks	Sem End	IA
Certificate in Science								
Discipline Specific Courses – DSC (Core Courses)								
1	I	BCHC 101	Fundamentals of Chemistry - I	Theory	3	75	60	15
		BCHL 101	Lab Course - 1	Practical	1	25		
	II	BCHC 201	Fundamentals of Chemistry - I	Theory	3	75	60	15
		BCHL 201	Lab Course -2	Practical	1	25		
	Skill Enhancement Courses - SEC							
	I	BCHS 01	Good lab practices in Chemistry	Theory	1	25	20	05
				Practical	1	25		
	II	BCHS 02	Water remediation and conservation studies	Theory	1	25	20	05
				Practical	1	25		

Note: Semester End – 80% and Internal Assessment (IA) – 20% (Weightage of marks internal examinations will be included as per guidelines of Autonomous Examination Cell)
The revised syllabus for B.Sc. (Chemistry) Semester I & II is hereby approved for 2022-23

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D	1.....	8.....
Subject Expert ..... (University Nominee)	2.....	9.....
Subject Expert.....	3.....	10.....
Representative ..... (Industry)	4.....	11.....
Representative ..... (Alumni)	5.....	12.....
	6.....	13.....
Representative ..... (Professor Science Faculty Other Dept.)	7.....	14.....

कार्यालय प्राचार्य

शासकीय विश्वनाथ यादव तामस्कर स्नातकोत्तर स्वशासी महाविद्यालय, दुर्ग (छ.ग.)

फोन नं./फैक्स नं. 0788-2359688, स्वशासी प्रकोष्ठ फोन नं.-0788-2212030

वेबसाइट : www.govtsciencecollegedurg.ac.in

(राष्ट्रीय मूल्यांकन एवं प्रत्यायन परिषद (NAAC) द्वारा A^+ ग्रेड प्रदत्त महाविद्यालय)

क्रमांक / Ref. No. 1583/Auto

दुर्ग / Durg / दिनांक / Date : 11.02.22

आदेश

स्वशासी योजनांतर्गत विभिन्न विभागों के अध्ययन मंडल का गठन

महाविद्यालय में स्वशासी योजना के अंतर्गत रसायन विज्ञान विभाग के अध्ययन मंडल का गठन निम्नानुसार किया जाता है। अध्ययन मंडल का कार्यकाल आगामी दो वर्षों तक होगा –

रसायन विज्ञान अध्ययन–मंडल

क्रं.	श्रेणी	मनोनीत सदस्य का नाम
1	अध्यक्ष	संबंधित विभागाध्यक्ष
2	सदस्य	संबंधित विभाग के समस्त सदस्य
3	विषय विशेषज्ञ	1. डॉ. ए. एल. एम. चंदेल, शा. ई. आर. आर. विज्ञान महाविद्यालय, बिलासपुर (छ.ग.)
		2. डॉ. सुशीलचंद्र तिवारी, प्राचार्य, शासकीय, कन्या महाविद्यालय दुर्ग (छ.ग.)
		3. डॉ. हेमलता मोहबे, पूर्व प्राचार्य राजनांदगांव (छ.ग.)
		4. डॉ. अंजू झा, शासकीय, नागार्जुन स्नातकोत्तर स्वशासी विज्ञान महाविद्यालय रायपुर (छ.ग.)
4	कुलपति द्वारा मनोनीत सदस्य	डॉ. अरूण मिश्रा, प्राध्यापक एवं विभागाध्यक्ष रसायन विज्ञान, शासकीय, नागार्जुन स्नातकोत्तर स्वशासी विज्ञान महाविद्यालय रायपुर (छ.ग.)
5	उद्योग / निगमित क्षेत्र प्रतिनिधि	श्री दिलीप सिंह, म.न. 600, स्ट्रीट 33, स्मृति नगर, भिलाई
6	स्नातकोत्तर कक्षा का मेधावी पूर्व छात्र	डॉ. भावना जैन, रसायन विभाग, शा. वि.या.ता. स्नात. स्वशासी, महाविद्यालय, जिला–दुर्ग (छ.ग.)
7	विशेष पाठ्यक्रम विषय विशेषज्ञ	डॉ. मृगेन्द्र द्विवेदी, जीवरसायन विभाग, शासकीय, नागार्जुन स्नातकोत्तर स्वशासी विज्ञान महाविद्यालय रायपुर (छ.ग.)
8	समान संकाय के अन्य विभाग के प्राध्यापक	डॉ. एस.डी. देशमुख, विभागाध्यक्ष भूगर्भ विज्ञान, शा. वि.या. ता. स्नात. स्वशासी, महाविद्यालय, जिला–दुर्ग (छ.ग.)

प्राचार्य,
शा. वि.या.ता. स्नातकोत्तर स्वशासी महाविद्यालय
दुर्ग (छ.ग.)

Principal
Govt.V.Y.T.P.G. Autonomous
College.Durg.(C.G.)

BOS Ltr.14

B.Sc. Semester - I (CHEMISTRY)

B.Sc. (with CHEMISTRY)

Programme Specific Outcome (PSO):

Upon completion of the B.Sc. Degree (with Chemistry), the students will be able to:

PSO1: Understand the fundamentals/concepts/theories in various branches of chemistry.

PSO2: Compare and justify various aspects, deduce and derive expressions, reaction mechanisms.

PSO3: Apply the principles/concepts and rules in finding their solutions.

PSO4: Carry out experiments, record the observations, understand handling of apparatus/instruments.

B. Sc. Semester - I (CHEMISTRY)

2022-23

Core Course - I (Theory)

BCHC 101: FUNDAMENTALS OF CHEMISTRY - I

Course Outcome (CO):

After completion of the course, students would be able to:

CO1: Explain atomic structure, wave mechanical concept and electronic configuration and discuss about periodic properties and their variations along periods and groups.

CO2: Explain chemical bonding involved in ionic and covalent compounds.

CO3: Discuss the basic concepts of organic reactions, reaction mechanism, reaction intermediates, various types of organic reactions, define terminology associated with stereochemistry, impact of chirality on optical activity and geometrical isomerism.

CO4: Describe the kinetic molecular model of a gas, laws related to ideal gases and interpret behaviour of real gases.

CO5: Discuss the chemistry of liquid state and solid state and its application.

B. Sc. Semester - I (CHEMISTRY)
2022-23
Core Course - 1 (Theory)
BCHC 101: FUNDAMENTALS OF CHEMISTRY - I

[Credits -03]

UNLT – I ATOMIC STRUCTURE AND PERIODICITY

Atomic Structure: Bohr's theory, its limitation and atomic spectrum of hydrogen atom. General idea of de-Broglie matter-waves, Heisenberg uncertainty principle, Schrödinger wave equation, significance of Ψ and Ψ^2, radial and angular wave functions and probability distribution curves, quantum numbers, atomic orbital and shapes of s, p, d- orbitals, Aufbau and Pauli exclusion principles, Hund's Multiplicity rule, electronic configuration of the elements.

Periodicity of Elements: The long form of periodic table. Detailed discussion of the following periodic properties of the elements, with reference to s and p- block. Trends in periodic table and applications in predicting and explaining the chemical behavior.

a) Atomic and ionic radii,
b) Ionization enthalpy,
c) Electron gain enthalpy,
d) Electronegativity, Pauling's, Mullikan's, Allred Rochow's scales.
e) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

UNIT – II CHEMICALBONDING

Ionic bond: Ionic Solids - Ionic structures, radius ratio & co-ordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy Born- Haber cycle, Solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule, Ionic character in covalent compounds: Bond moment and dipole moment, Percentage ionic character from dipole moment and electronegativity difference, Metallic bond-free electron, Valence bond & band theories. Intermolecular Forces – various types.

Covalent bond: Lewis structure, Valence bond theory and its limitations, Concept of hybridization, Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O, NH_3, PCl_3, PCl_5, SF_6. H_3O^+, SF_4, ClF_3, and ICl_2^- Molecular orbital theory. Bond order and bond strength, Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, F_2, CO, NO.

UNIT – III BASICS OF ORGANICCHEMISTRY

Fundamentals: Hybridization, Shapes of molecules, Influence of hybridization on bond

properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment. Electrophiles and Nucleophiles; Nucleophilicity and basicity; Homolytic and Heterolytic cleavage, Generation, shape and relative stability of Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes and Benzynes. Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.

Stereochemistry: Fischer Projection, Newman and Sawhorse Projection formulae and their inter-conversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

UNIT – IVGASEOUS STATE CHEMISTRY

Kinetic molecular model of a gas: Postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path; Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Joule Thomson effect, Liquification of gases.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor (Z), and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. Vander Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici); calculation of Boyle temperature. Isotherms of real gases and their comparison with Vander Waals isotherms, continuity of states, critical state, relation between critical constants and Vander Waals constants, law of corresponding states.

UNIT – V LIQUID AND SOLID-STATECHEMISTRY

Liquid state: Structure of liquids, Properties of liquids, viscosity and surface tension. Effect of addition of various solutes on surface tension and viscosity, Explanation of cleansing action of detergents.

Solid state: Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, crystal systems and Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Crystal defects.

RECOMMENDED BOOKS/REFERENCES

Inorganic Chemistry

1. Basic Inorganic Chemistry, F.A.Cotton, G. Wilkinson and P.L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J.D. Lee, ELBS.
3. Concepts of models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and Alexander, John Wiley.
4. Inorganic Chemistry, D.E.Shriver, P.W.Atkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield, Addison Wesley.
6. Inorganic Chemistry, A.G. Sharp, ELBS.
7. Inorganic Chemistry, G.L.Micssles and D.A.Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agrawal & Agrawal.
10. Advanced Inorganic Chemistry, Puri & Sharma, S. Chand.
11. Inorganic Chemistry, Madan, S.Chand.

Organic Chemistry

1.Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2.Organic Chemistry, L.G.Wade Jr. Prentice-Hall.
3.Fundamentals of Organic Chemistry, Solomons, john Wiley.
4. Organic Chemistry, Vol.-I, II & III S.M. Mukherjee, S.P.Singh and R.P.Kapoor, Wiley-Eastern (New-Age).
5.Organic Chemistry, FA Carey, MC Graw Hill.
6. Introduction to Organic Chemistry, Struiweisser, Heathock and Kosover, Macmillan.
7.Organic Chemistry, P.L.Soni.
8.Organic Chemistry, Bahl & Bahl.
9.Organic Chemistry, Joginder Singh.

Physical Chemistry

1. Physical Chemistry, R.A. Alberty, Wiley Eastern.
2. The elements of Physical Chemistry, P.W.Atkins, Oxford.
3. Physical Chemistry, Puri and Sharma, S. Chand.
4. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press(2006).
5. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
6. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
7. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
8. G. M. Barrow, Tata McGraw Hill (Fifth Edition) (2007)

Question Paper Format and Distribution of Marks

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (**No Multiple-choice questions, no 'Fill in the blank' type Questions**)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely, and the answer should not exceed the limit of 350 words.
5. The scheme of marks for **End Semester Exam** should be as follows :

Question Type	MM 60 (Marks x No. of Questions)
A (Very short Answer)	1 x10 = 10
B (Short Answer)	3 x5 = 15
C (Long Answer)	7 x5= 35
Total	60

6. The scheme of marks for **Assignment** should be as follows :

Question Type	MM 75 (Marks x No. of Questions)
A (Very short Answer)	1 x10 = 10
B (Short Answer)	4x5 = 20
C (Long Answer)	9x5= 45
Total	75

B.Sc. Semester - I (CHEMISTRY)
2022-23
Core Course - I (Practical)
LAB COURSE - 1

Course Outcome:

After completion of the course, the students would be able to:

CO1: Determine the concentration of unknown solution by titration.

CO2: Identify laboratory glass wares and apparatus and its uses and understand various scientific techniques in organic chemistry.

CO3: Perform experiments based on physical aspects and calculate parameters.

B.Sc. Semester - I (CHEMISTRY)

2022-23

Core Course - I (Practical)

LAB COURSE - 1

[Credits -01]

The following experiments are to be conducted during the curriculum.

1. INORGANIC CHEMISTRY

[A] Acid-BaseTitrations

1. Standardization of sodium hydroxide by oxalic acid solution.
2. Determination of strength of HCl solution using sodium hydroxide as intermediate.
3. Estimation of carbonate and hydroxide present together in mixture.
4. Estimation of carbonate and bicarbonate present together in a mixture.
5. Estimation of free alkali present in different soaps/detergents

[B] RedoxTitrations

1. Standardization of $KMnO_4$ by oxalic acid solution.
2. Estimation of Fe(II) using standardized $KMnO_4$ solution.
3. Estimation of oxalic acid and sodium oxalate in a given mixture.
4. Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) as external indicator.

[C] Iodo / IodimetricTitrations

1. Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution iodimetrically.
2. Estimation of (a) arsenite and (b) antimony iodimetrically.
3. Estimation of available chlorine in bleaching powder iodometrically.
4. Estimation of Copper and Iron in mixture by standard solution$K_2Cr_2O_7$usingsodium thiosulphate solution as titrants.

2. ORGANIC CHEMISTRY

1. Demonstration of laboratory Glasswares and Equipments.
   - Calibration of the thermometer w.r.t. Naphthalene, Acetanilide, Urea, Water
2. Purification of organic compounds by crystallization using different solvents.
   - Phthalic acid from hot water (using fluted filter paper and stemless funnel).
   - Acetanilide from boiling water.
   - Naphthalene from ethanol.
   - Benzoic acid from water.
3. Determination of the melting points of organic compounds.
   Naphthalene, Benzoic acid, Urea, Succinic acid, Cinnamic acid, Salicylic acid, Acetanilide, m-Dinitrobenzene, p-Dichlorobenzene, Aspirin.

- Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.
- Urea – Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1).

4. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method).
   - Ethanol, Cyclohexane, Toluene, Benzene.

   i. Distillation (Demonstration)
   - Simple distillation of ethanol-water mixture using water condenser.
   - Distillation of nitrobenzene and aniline using air condenser.

   ii. Sublimation
   - Camphor, Naphthalene, Phthalic acid and Succinic acid.

   iii. Decolorisation and crystallization using charcoal.
   - Decolorisation of brown sugar with animal charcoal using gravity filtrations crystallization and decolorisation of impure naphthalene (100 g of naphthalene mixed with 0.3 g of Congo red using 1 g of decolorizing carbon) from ethanol.

3. PHYSICAL CHEMISTRY

1. Surface tension measurements.
   - Determine the surface tension by (i) drop number (ii) drop weight method.
   - Surface tension composition curve for a binary liquid mixture.

2. Colloids
   - To prepare colloidal solution of silver nanoparticles (reduction method) and other metal nanoparticles using capping agents.

Note: Experiments may be added/ deleted subject to availability of time and facilities

B.Sc. (CHEMISTRY)
2022-23
Skill Enhancement Course – 1
BCHS 01: GOOD LAB PRACTICES IN CHEMISTRY THEORY AND PRACTICAL

[Credits -02 (Th-01, Practical-01); 30 hrs.]

Course outcome:

After completing the course students will be able to:

CO1: Understand general laboratory practices
CO2: Prepare solutions
CO3: Handle glassware's and chemicals
CO4: Explore various research issues and their solutions
CO5: Apply practical skills in chemistry

THEORY

A. Common calculations in chemistry laboratories. Understanding the details on the label of reagent bottles.
Inorganicand organic reagents (Baeyer's reagent, Nessler's reagent, Fehling solution A and B, Shiff reagents,Tollen's reagent, Molish's reagent, Neutral ferric chloride, Nitrating Mixture, Aqua regia, Dimethyl glyoxime,H_2S gas); chemicals such as acids, bases, indicators, etc. used in chemistry lab for qualitative analysis .

B. Molarity and normality of common acids and bases. Preparation of solutions – solid and liquids, Molar, Molal and Normal solutions, Dilutions. Percentage solutions.

PRACTICAL

A. Technique and uses of handling glass wares; calibrations, knowledge about common toxic chemicals and safety measures in their handling.

B. Qualitative test of CO_3^{2--}, CH_3COO^-, SO_4^{2-}, Cl^-, NO_3^-, NH_4^+, Cu_2^+, Fe^{3+},Ni^{2+} ,Ba^{2+},Mg^{2+}.

C. Qualitative elemental analysis for Nitrogen, Sulphur, Halogen in organic compounds.

Reference Books

1. Seiler, J.P. (2005). Good Laboratory Practices: the why and how. Springer-Verlag Berlin andHeidelberg GmbH & Co. K; 2nd ed.
2. Garner, W.Y., Barge M.S., Ussary. P.J. (1992). Good Laboratory Practice Standards: Application for field and Laboratory studies. Wiley VCH.

Distribution of Marks

Total Marks: 25 (80% End Semester Exam and 20% Internal Assessment)
Internal assessment – Assignment of 25 marks, Out of 10, five questions to be attempted

(Weightage of marks internal examinations will be included and Question Paper pattern as per guidelines of Autonomous Examination Cell)

B.Sc. Semester - II (CHEMISTRY)

2022-23

Core Course - 2 (Theory)

BCHC 201: FUNDAMENTALS OF CHEMISTRY - II

Course Outcome (CO):

After completion of the course, students would be able to:

CO1: Explain propertiesof s and p- block elements and noble gases.

CO2: Interpret the reactions, properties and mechanisms of reactions involved in alkanes, alkenes and alkynes and understand the conformation of alkanes and cycloalkanes, Baeyer's strain theory and conformations of substituted cycloalkanes.

CO3: Describe the aromaticity and mechanisms of typical aromatic reactions.

CO4: Classify different colloids and discuss the principles, properties and application of colloids, and liquid crystals adsorption and adsorption isotherms.

CO5: Define various terms associated with chemical kinetics, derive rate equations/rate laws and describe various theories of rate, types of catalysis, catalysts and its industrial applications.

B.Sc. Semester - II (CHEMISTRY)
2022-23
Core Course - 2 (Theory)
BCHC 201: FUNDAMENTALS OF CHEMISTRY - II

[Credits -03]

UNIT – I CHEMISTRY OF s-and p-BLOCKELEMENTS

s-block: General concepts on group relationships and gradation properties. Comparative study, salient features of hydrides, solvation & complexation tendencies including their function in biosystems and introduction to alkyl and aryls,

p-block: General concepts on group relationships and gradation properties. Halides, hydrides, oxides and oxyacids of Boron, Aluminum, Nitrogen and Phosphorus. Boranes, borazines, fullerenes.

Noblegases: Chemical properties of the noble gases, chemistry of xenon, structure, bonding in xenon compounds.

UNIT – II CHEMISTRY OF ALIPHATIC HYDROCARBONS

Carbon-Carbon sigma bonds: Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation

Carbon-Carbon pi bonds: Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.
Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), oxidation, ozonolysis, reduction (catalytic and chemical), 1,2- and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.
Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

Cycloalkanes and Conformational Analysis: Conformational analysis of alkanes, ethane, butane and cyclohexane. Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Theory of strainless rings, Chair, Boat and Twist boat conformation of cyclohexane with energy diagrams.

UNIT–III CHEMISTRY OF AROMATICHYDROCARBONSAND ALKYL/ARYL HALIDES

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution:

halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism.

Halogenated Hydrocarbons:
Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent, nucleophile and temperature; nucleophilic substitution vs. elimination.
Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; SNAr, Benzyne mechanism.

UNIT-IV COLLOIDS, LIQUID CRYSTALS AND SURFACE CHEMISTRY
Colloids: Classification, optical, kinetic and electrical properties of colloids, coagulation, Hardy Schulze law, flocculation value, protection, gold number, Emulsion, micelles and types, Gel. Application of colloids.

Liquid crystals: Types, structure and applications.

Adsorption: Physical adsorption, chemisorption, adsorption isotherms (Langmuir and Freundlich). Nature of adsorbed state.

UNIT – V CHEMICAL KINETICS AND CATALYSIS
Chemical kinetics: Rate of reaction, factors influencing rate of reaction, rate law, rate constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions, Rate and Rate Law, methods of determining order of reaction, Chain reactions. Temperature dependence of reaction rate, Arrhenius theory, Physical significance of Activation energy, collision theory, demerits of collision theory.

Catalysis: Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristic of catalyst, Enzyme catalyzed reactions, Industrial applications of catalysis.

RECOMMENDED BOOKS/REFERENCES

Inorganic Chemistry

1. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J.D. Lee, ELBS.
3. Concepts of models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and Alexander, John Wiley.
4. Inorganic Chemistry, D.E.Shriver, P.W. Atkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield, Addison Wesley.
6. Inorganic Chemistry, A.G. Sharp, ELBS.
7. Inorganic Chemistry, G.L.Micssles and D.A.Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agrawal & Agrawal.
10. Advanced Inorganic Chemistry, Puri & Sharma, S. Chand.
11. Inorganic Chemistry, Madan, S.Chand.

Organic Chemistry

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.

2.Organic Chemistry, L.G.Wade Jr. Prentice-Hall.
3.Fundamentals of Organic Chemistry, Solomons, john Wiley.
4. Organic Chemistry, Vol.-I, II & III S.M. Mukherjee, S.P.Singh and R.P.Kapoor, Wiley-Eastern (New-Age).
5.Organic Chemistry, FA Carey, MC Graw Hill.
6. Introduction to Organic Chemistry, Struiweisser, Heathock and Kosover, Macmillan.
7.Organic Chemistry, P.L.Soni.
8.Organic Chemistry, Bahl & Bahl.
9.Organic Chemistry, Joginder Singh.

Physical Chemistry

1. Physical Chemistry, R.A. Alberty, Wiley Eastern.
2. The elements of Physical Chemistry, P.W. Atkins, Oxford.
3. Physical Chemistry, Puri and Sharma, S. Chand.
4. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press.
5. Ball, D. W. Physical Chemistry Thomson Press, India.
6. Castellan, G. W. Physical Chemistry 4th Ed. Narosa.
7. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA.
8. G. M. Barrow, Tata McGraw Hill (Fifth Edition).

Question Paper Format and Distribution of Marks

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (**No Multiple-choice questions, no 'Fill in the blank' type Questions**)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely, and the answer should not exceed the limit of 350 words.
5. The scheme of marks for **End Semester Exam** should be as follows :

Question Type	MM 60 (Marks x No. of Questions)
A (Very short Answer)	1 x10 = 10
B (Short Answer)	3 x5 = 15
C (Long Answer)	7 x5= 35
Total	60

6. The scheme of marks for **Assignment** should be as follows :

Question Type	MM 75 (Marks x No. of Questions)
A (Very short Answer)	1 x10 = 10
B (Short Answer)	4 x5 = 20
C (Long Answer)	9 x5= 45
Total	75

B.Sc. Semester - II (CHEMISTRY)

2022-23

Core Course - 2 (Practical)

LAB COURSE - 2

Course Outcome:

After completion of the course, the students would be able to:

CO1: Apply the various aspects of qualitative analysis in inorganic mixture.

CO2: Identify functional groups present in organic compounds.

CO3: Perform experiments based on physical aspects and calculate parameters.

B.Sc. Semester - II (CHEMISTRY)
2022-23
Core Course - 2 (Practical)
LAB COURSE - 2

[Credits -01]

The following experiments are to be conducted during the curriculum.

1. INORGANIC CHEMISTRY
   Qualitative analysis (using H_2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding interfering, insoluble salts) out of the following:

   Cations : NH^{4+}, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^{+}

   Anions : CO_3^{2-}, SO_3^{2-}, SO_4^{2-}, S^{2-}, NO_3^{-}, CH_3COO^{-}, Cl^{-}, Br^{-}, I^{-}, $NO2^{-}$, (Spot tests may be carried out wherever feasible)

2. ORGANIC CHEMISTRY
   Qualitative Analysis

   Detection of elements (N, S and halogens) and functional groups (Phenolic, Carboxylic, Carbonyl, Esters, Carbohydrates, Amines, Amides, Nitro and Anilide) in simple organic compounds.

3. PHYSICAL CHEMISTRY

1. Viscosity measurement using Ostwald's viscometer.
   - Determination of viscosity of aqueous solutions of (i) sugar (ii) ethanol at room temperature.
   - Study of the variation of viscosity of sucrose solution with the concentration of solute.
   - Viscosity Composition curve for a binary liquid mixture.

2. Chemical Kinetics
   - To determine the specific rate of hydrolysis of methyl/ethyl acetate catalysed by hydrogen ions at room temperature.
   - To study the effect of acid strength on the hydrolysis of an ester.
   - To compare the strengths of HCl & H_2SO_4 by studying the kinetics of hydrolysis of ethylacetate.

Note: Experiments may be added/ deleted subject to availability of time and facilities.

The Revised syllabus of the Core Courses for B.Sc. (Chemistry) Semester I & II is hereby approved for the session 2022-23

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D		
Subject Expert ..... (University Nominee)	1.....	8.....
Subject Expert.....	2.....	9.....
Representative ..... (Industry)	3.....	10.....
Representative ..... (Alumni)	4.....	11.....
Representative ..... (Professor Science Faculty Other Dept.)	5.....	12.....
	6.....	13.....
	7.....	14.....

B.Sc. (CHEMISTRY)
2022-23
Skill Enhancement Course – 2
BCHS 02: WATER REMEDIATION AND CONSERVATION STUDIES THEORY AND PRACTICAL

[Credits -02 (Th-01, PR-01) 30 hrs.]

Course outcome:

After completing the course students will be able to:

CO1: Understand about Sources and Effect of Water Pollution
CO2: Learn about various control technique

THEORY:

Water Pollution
Sources of water pollutants, pollutants, Industrial and human contribution, WHO recommendation about potable water, current scenario of drinking water quality.

Remediation Techniques
Remediation, techniques involved such as adsorption, coagulation-filtration, Nalgonada techniques, reverse osmosis, activated charcoal detoxification, mechanisms of detoxification, bio-remediation, need of green chemistry, future scope.

Water Conservation
Introduction to water conservation and erosion of soil, forms of water erosion, factors affecting water erosion, types of water erosion, mechanics of water erosion control,

PRACTICAL:
Water analysis (pH, Conductivity, hardness, Acidity, Alkalinity etc.)

Case study/Project
Case study/Project on water pollution, water conservation and water quality.

Recommended Books/references:
1. Cittenden J. C. , Trussell J. R., Hand D. W., Howe K. J., Tchobanoglous G. , Water treatment: Principles and Design MWH publication.
2. De A. K. Environmental Chemistry, Wiley Eastern
3. Clarson D., Dara S. S. A text book of Environmental chemistry and pollution control, S Chand Co. Soil and water analytical method
4. Edzwald J., Water Quality & Treatment: A Handbook on Drinking Water (Water Resources and Environmental Engineering Series)

Distribution of Marks

Total Marks: 25 (80% End Semester Exam and 20% Internal Assessment)
Internal assessment – Assignment of 25 marks, Out of 10, five questions to be attempted

(Weightage of marks internal examinations will be included and Question Paper pattern as per guidelines of Autonomous Examination Cell)

The Revised syllabus of the Core Courses for B.Sc. (Chemistry) Semester I & II is hereby approved for the session 2022-23

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D		
Subject Expert ..... (University Nominee)	1.....	8.....
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	6.....	13.....
	7.....	14.....