YBN UNIVERSITY
Established by the Act of Government of Jharkhand Act 15, 2017
Gazette Notification No. 505, Dated 17th July 2017
As per Section 2(f) of UGC Act. 1956

NEP-2020

SCHOOL OF SCIENCE

CHEMISTRY COURSE / STRUCTURE

For

FOUR-YEAR UNDERGRADUATE PROGRAMMES

(FYUGP)

UNDER YBNU RANCHI JHARKHAND

Implemented in

Semester-I,II,III,IV

from

Academic Session-2023

RAJAULATU, NAMKUM, RANCHI, JHARKHAND-834010

COURSES OF STUDY OF FOUR-YEAR UNDERGRADUATE PROGRAMME FOR (2) YEARS-2023 onwards

AIMS OF BACHELOR'S DEGREE PROGRAMME IN CHEMISTRY

The broad aims of bachelor's degree programme in Chemistry are:

The aim of bachelor's degree programme in chemistry is intended to provide:

(i) Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles, and theories.

(ii) To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems.

(iii) To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.

(iv) To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects

(v) To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A chemistry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.

(vi) To mold a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.

(vii) To enable the graduate, prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

PROGRAM LEARNING OUTCOMES

The broad aims of bachelor's degree programme in Chemistry are:

The student graduating with the Degree B.Sc. (Honours/Research) in Chemistry should be able to understand:

(i) Core competency: Students will acquire core competency in the subject Chemistry, and in allied subject areas.

(ii) Systematic and coherent understanding of the fundamental concepts in Physical chemistry,

Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, and all other related allied chemistry subjects.

(iii) Students will be able to understand use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis.

(iv) The students will be able to understand understand the characterization of materials.

(v) Students will be able to understand understand the basic principle of equipment, instruments used in the chemistry laboratory.

(vi) Students will be able to understand demonstrate the experimental techniques and methods of their area of specialization in Chemistry.

(vii) Disciplinary knowledge and skill: A graduate student are expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest like Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Material Chemistry, etc. Further, the student will be capable of using of advanced instruments and related soft-wares for in-depth characterization of materials/chemical analysis and separation technology.

(viii) Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

(ix) Critical thinker and problem solver: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic chemistry knowledge and concepts.

(x) Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.

(xi) Team player: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field-based situation and industry.

(xii) Skilled project manager: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

(xiii) Digitally literate: The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work.

(xiv) Ethical awareness/reasoning: A graduate student requires to understand and develop ethical awareness/reasoning which the course curriculum adequately provide.

(xv) Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity

Semester-1

Semester	Common, Introductory, Major, Minor, Vocational & Internship Course		Examination Structure				
	Code	Paper	Credits	Theory	Internal assessment	Practical	Total
I	1Y4CC-1	Language and Communication Skills (Modern Indian Language including TRL)	6	75	25	--	100
	1Y4CC-2	Understanding India	2	75	25	--	100
	1Y4CC-3	Health & Wellness, Yoga Education, Sports & Fitness	2	50	25	25	100
	1Y4CHEIRC-1	Introductory Regular Course-1 **Introductory Chemistry**	3	50	25	25	100
	1Y4IVS-1A	Introductory Vocational Studies-I	3	50	25	25	100
	1Y4CHEMJ-1	Major paper-1 (Disciplinary/Interdisciplinary Major) **Inorganic Chemistry - I**	6	50	25	25	100

LANGUAGE & COMMUNICATION SKILLS
Course code-1Y4CC-1

Total Marks: 100

OBJECTIVES:

To equip students effectively to acquire skills in reading, writing, comprehension and communication for English language & Communication.

COURSE OUTCOMES:

- Students will improve their speaking ability in English both in terms of fluency and comprehensibility
- Students will give oral presentations and receive feedback on their performance
- Students will increase their reading speed and comprehension of academic articles
- Students will strengthen their ability to write academic papers, essays and summaries using the process approach.
- Students will enlarge their vocabulary. They will also heighten their awareness of correct usage of English grammar in writing and speaking

Unit I:

Communication – Meaning, Types, Channels, Barriers. Skills of Language learning: Listening, Speaking, Reading & Writing.

Unit II:

English as a Global Language Growth & Status of English language in India

Unit III:

Class-presentation – Introduction, Conversation, Greetings, Likes and Dislikes, Opinion, Agreeing, Disagreeing, Complaint, Apology

Unit IV:

Writing skills –, notice writing, précis writing, essay writing, letter writing resume writing.

Unit V:

Vocabulary building: One word substitution, synonyms and antonyms, idioms and phrases, Common Errors, Prefix, Suffix, Homophones, Confusing words

Suggested Reading:

1. *Technical Communication,* M.H. Rizvi, Tata McGrawhill
2. *Everyday Smart English,* Dr. Arti Gupta, I.D. Publishers
3. *Effective Business Communication,* Asha Kaul
4. *Developing Communication Skills,* Krishnamohan
5. *Functional Grammar and Spoken and Written Communication in English,* Bikram K. Das,Orient Blackswan
6. *Precis, Paraphrase and Summary,*P.N. Gopalkrishnan, Authors Press
7. *Communication Skills,* Sanjay Kumar and Pushplata, Oxford Publication

UNDERSTANDING INDIA

Course code-1Y4CC-2

Total Marks: 100

OBJECTIVES:

This course is designed: to expose the students to our social, economic and cultural heritage

COURSE OUTCOMES:

On successful completion of this course, the student will be able to have a knowledge regarding

1. Contemporary India with its historical perspective
2. Constitutional obligations: fundamental rights and duties.
3. Indian knowledge systems
4. India's struggle for freedom

Unit I: Background of India's culture:

1. Harappan civilisation and Vedic age
2. Buddhism, Jainism, Sanatan (Hinduism) and Islam

Unit II: Growth and development of Indian Education and literature:

1. Bharat's Natyashastra, Kalidas, Panini, Patanjali
2. Taxila, Nalanda, Vishwa Bharati, BHU, AMU, IIT, IISC, AIIMS

Unit III: Leaders of India's freedom struggle:

1. Mahatma Gandhi
2. Jawaharlal Nehru
3. Subhash Chandra Bose
4. Freedom fighters of Jharkhand (Tilka Manjhi, Sidho-Kanho, Birsa Munda & Jatra Bhagat)

Unit IV: Geographical features of India

1. India on the map of world and its neighbouring Countries.
2. Physical features of India including mountain, plateau, plain, coast, island, vegetation, rivers, soils and climate.

Unit V:

The People of India: Racial diversities, Population, its growth, distribution, Migration.

Unit VI: Indian Constitution:

1. Preamble
2. Salient features
3. Fundamental rights
4. Fundamental duties

Unit VII: Political ideas:

Non-violence, Satyagraha and Social Justice

Unit VIII: The Indian Economy:

The Indian Economy through the Ages (Agriculture, Industry and Trade-Transport)

HEALTH AND WELLNESS, YOGA EDUCATION

Course code-1Y4CC-3

Total Marks: 100

OBJECTIVES:

- To raise awareness towards fitness among the students.
- To develop the individual as a fit citizen in the society.
- To acquire knowledge about yoga and health & wellness.

COURSE OUTCOMES:

- Students will understand and learn different dimension of active lifestyle
- Student will learn to apply knowledge and lead better quality life
- The students will be able to continue professional courses and research in health & wellness & yoga

HEALTH AND WELLNESS

Unit1:-Introduction

1. Meaning, Definition and Dimensions of Health and Wellness.

2. Factors affecting Fitness and Wellness

3. Role of Fitness in maintaining Health and Wellness

4. Importance of Health Education and Wellness

Unit2:-Methods to Maintain Health and Wellness

1. Role of Physical Activities and Recreational Games for Health and Wellness

2. Role of Yoga asanas and Meditation in maintaining Health and Wellness

3 Nutrition for Health & Wellness

Unit3:-Anxiety, Stress and Aging

1. Meaning of Anxiety, Stress and Aging

2. Types and Causes of Stress

3. Stress relief through Exercise and Yoga

Suggested Readings:

1. Reklau Marc (2019), "30 Days: Change your habits, Change your life", Rupa Publications, India

2. Russell, R.P.(1994).Health and Fitness Through Physical Education. USA Human Kinetics.

3. Scates Samantha (2019) " Healthy Habits for a Healthy Life" Samantha, Ireland

3. D.M Jyoti, Yogaand Physical Activities (2015) lulu.com3101, Hillsborough, NC2 7609,United States.

YOGA EDUCATION

Unit -1: Theory

Introduction to Health and Wellness

1. Meaning, definition and importance of Yoga

2. Types of Yoga, Introduction of Satkarma, definition of asana and Pranayama, it's physical and mental benefits

3. Stretching exercises

4. Warming up and limbering down

a) General warm up exercises

b) Specific warm up exercises

UNIT II Practical

A) Sukshma Vyayama

B) Suryanamaskara

(12 Poses are Compulsory 1. Ardhachakrasana 2.Padhastasana 3. Ashwasanchalasana 4. Dhandasana.5 Shasangasana 6.Astangasana7.

Bhujangasana8.Parvathasana 9. Shashangasana 10. Ashwasanchalasanal 11. Padhastasana 12. Ardhachakrasana)

C) Basic Set of Yoga Asanas -Sitting Poses

Padmasana, Sukhasana, Vajrasana, Gomukhasana,

Prone Position.	**Supine Position**	**Invert Position**
Noka asang	Ustrasana	Sarvangasana

Bhujangasang Salabhasana Marjariasana makarasana	Setu Bandhasana chakrasana	halasana Salambha Sarvangasana Sirsasana

Relaxing Pose → Shavasana

D) Basic Set of Pranayama, Meditation & Mudra

Pranayama- Anulom-Vilom Pranayama, Bhramari Pranayama, Ujjai Pranayama, Bhastrika Pranayama, Sitali Pranayama

Meditation- Omkar meditation

Mudra – Pranav mudra, Gyan mudra, Hridaya mudra

Suggested Readings:

1. Nagendra, H.R.&Nagarathna, R. (2002).Samagra Yoga Chikitse. Bengaluru: Swami Vivekananda Yoga Prakasana.

2. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana

3. Shanti KY(1987)"The Science of Yogic Breathier" (Pranayama) DB

Bombay

4. Iyengar B.K.S.(2006) " Light on Yoga" Thorsons (Publ.) India

INTRODUCTORY CHEMISTRY

Course code: (1Y4CHEIRC-1)

Total Marks: 100

OBJECTIVES:

After completion of the course, the learner can be able to understand:

1. To expose the students to the basic principles of Chemistry.

2. Exposure of all three major branches of Chemistry.

3. Concept of molecular framework and chemical bonding

4. Representative elements and their chemistry.

5. Atomic theory and its evolution.

6. Learning scientific theory of atoms, concept of wave function.

7. Elements in periodic table, physical and chemical characteristics, periodicity.

8. Hybridization and shapes of atomic, molecular orbitals, bond parameters, bond- distances and energies.

9. Valence bond theory incorporating concepts of hybridization predicting geometry of molecules.

10. Basic of organic molecules, structure, bonding, reactivity and reaction mechanisms.

11. Stereochemistry of organic molecules – conformation and configuration, asymmetricmolecules and nomenclature.

12. Aromatic compounds and aromaticity, mechanism of aromatic reactions.

13. Reactivity, stability of organic molecules, structure, stereochemistry.

14. Mechanism of organic reactions (effect of nucleophile/leaving group, solvent),substitution vs. elimination.

COURSE OUTCOMES:

1. Application of course objectives stated above.

Course Content: Section A: Inorganic Chemistry

Atomic Structure: Bohr's theory and its limitations. Need of a new approach to Atomic structure. Shape of s, p and d atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configuration of atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energy of atomic orbitals, Anomalous electronic configurations. Chemical Bonding and Molecular Structure: Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

s- and p-Block Elements:

Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity. Inert pair effect, diagonal relationship and anomalous behavior of first member of each group. Compounds of s- and p-Block Elements: Hydrides and their classification (ionic, covalent and interstitial), structure and properties with respect to stability of hydrides of p- block elements. Concept of multicentre bonding (diborane). Transition Elements (3d series): (2 classes each of 60 minutes duration) General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes. Coordination Chemistry: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, and Ni (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.

Crystal Field Theory**:**

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of Δo. Spectrochemical series. Comparison of CFSE for Oh and Td complexes.

Section B: Organic Chemistry

Fundamentals of Organic Chemistry:

Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Aromaticity: Benzenoids and Hückel's rule. Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation Alkenes: Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule), Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. Alkynes: Preparation: Acetylene from CaC2 and conversion into higher alkynes, by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: Formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. KMnO4. Aromatic hydrocarbons: Preparation of benzene: from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions of benzene: Electrophilic substitution: nitration, halogenation and sulphonation. Friedel- Craft's reaction (alkylation and acylation). Alkyl Halides: Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Section C: Physical Chemistry

Chemical Energetics:

Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations. Calculation of bond energy, bond dissociation energy from thermochemical data.

Chemical Equilibrium:

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^o, Le Chatelier's principle.

Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Critical phenomena.

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

PRACTICALS:

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO4.
3. Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.
4. Estimation of Cu (II) ions iodometrically using Na2S2O3.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.

a. Benzoylation of amines/phenols

b. Oxime and 2,4 dinitrophenyl hydrazone of aldehyde/ketone

Section C: Physical Chemistry

Thermochemistry

1. Determination of heat capacity of calorimeter.
2. Determination of integral enthalpy of solution of salts (KNO3, NH4Cl).
3. Determination of enthalpy of hydration of copper sulphate.

Ionic equilibria pH measurements

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
2. Preparation of buffer solutions:

a. Sodium acetate-acetic acid

b. Ammonium chloride-ammonium hydroxide

Reference Books:

- Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
- F. G. Mann & B. C. Saunders, Practical Organic Chemistry, Orient Longman (1960).
- B.D. Khosla, Senior Practical Physical Chemistry, R. Chand & Co.

ENTREPRENEURSHIP AND MANAGEMENT CONCEPTS

Course Code: 1Y4IVSEMC-1A

Total Marks: 100

Course Content:

Unit-I:

System Concepts: Types, definition & characteristics; supra & subsystems, key component; boundary & interface complexity; feedback (pull) & feed forward (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Alter's nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

Unit-II:

Management: Importance, definition and functions; schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps in decision making, structured and unstructured decision; dimensions of organizations, size/specialization, behavior formalization, authority centralization, departmentalization, spam and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination

by task force, business process reengineering and process of change management, HR planning placement and training, MIS; attitudes and personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two

factor theory, expectation theory, learning process, team work and stress management.

Unit-III:

Marketing: Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction (goods and services) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research.

Unit-IV:

Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

INORGANIC CHEMISTRY-I

Course Code: 1Y4CHEMJ-1

Total Marks: 100

OBJECTIVES:

On completion of this course, the students will be able to understand understand

1. Atomic theory and its evolution.

2. Learning scientific theory of atoms, concept of wave function.

3. Elements in periodic table, physical and chemical characteristics, periodicity.

4. To predict the atomic structure, chemical bonding, and molecular geometry based on accepted models.

5. To understand atomic theory of matter, composition of atom.

6. Defining isotopes, isobar and isotone.

7. Hybridization and shapes of atomic, molecular orbitals, bond parameters, bond- distances and energies.

8. Valence bond theory incorporating concepts of hybridization predicting geometry of molecules.

9. Oxidation-Reductions and their use in metallurgy.

10. Inorganic polymers

COURSE OUTCOMES:

On successful completion of this course the student should know:

1. Electronic configuration of various elements in periodic table

2. Predicting structure of molecules

3. How hydrogen bonding, metallic bonding is important in common materials' scientific applications to material fabrication

Course Content:

Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom. 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. Normalized and orthogonal wave functions. Sign of wave functions. 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 rule of maximum multiplicity, Aufbau's principle and its limitations. Periodicity of Elements: (10 classes each of 60 minutes duration) s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements.

a. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

b. Atomic radii (van der Waals)

c. Ionic and crystal radii.

d. Covalent radii (octahedral and tetrahedral)

e. Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

f. Electron gain enthalpy, trends of electron gain enthalpy.

g. Electronegativity, Pauling, Mullikan, Allred Rachow scales, electronegativity and bond order, partial charge, hybridization, group electronegativity.

Chemical Bonding:

(i) lonic bond: (5 classes each of 60 minutes duration)

General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Lande equation with derivation, expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

(ii) Covalent bond: (12 classes each of 60 minutes duration)

Lewis structure, Valence Shell Electron Pair Repulsion Theory (VSEPR), Shapes of simple molecules and ions containing lone and bond pairs of electrons multiple bonding, sigma and pi-bond approach, Valence Bond theory, (Heitler-London approach). Hybridization containing s, p and s, p, d atomic orbitals, shapes of hybrid orbitals, Bents rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of simple homonuclear and heteronuclear diatomic molecules: N2, O2, C2, B2, F2, CO, NO, and their ions. Covalent character in ionic compounds, polarizing power and polarizability. Fajan rules, polarization. Ionic character in covalent compounds: Bond moment and dipole moment. ionic character from dipole moment and electronegativities.

(iii) Metallic Bond: (6 classes each of 60 minutes duration)

Qualitative idea of free electron model, Semiconductors, Insulators.

(iv) Weak Chemical Forces: (2 classes each of 60 minutes duration)

Van'der Waals, ion-dipole, dipole-dipole, induced dipole dipole- induced dipole interactions, hydrogen bond, effects of hydrogen bonding on melting and boiling points, solubility, dissolution. Oxidation-Reduction and general principle of metallurgy: (7 classes each of 60 minutes duration) Redox equations, Standard Electrode Potential and its application to inorganic reactions. Occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon or carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy.

Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel de Boer process and Mond's process, Zone refining.

Inorganic Polymers: Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

Reference Books:

1. Lee, J. D. Concise Inorganic Chemistry, Wiley, 5th Edn.

2. Douglas, B.E., McDaniel, D.H., Alexander J.J., Concepts & Models of Inorganic Chemistry,(Third Edition) John Wiley & Sons,1999.

3. Atkins, P. W. and DePaula, J. Physical Chemistry, Tenth Edition, Oxford University Press,2014.s

4. Rodger, G. E. Inorganic and Solid State Chemistry, Cengage Learning, 2002.

5. Douglas, B.E, Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry3rd Ed., John Wiley Sons, N.Y. 1994.

6. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.6 Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry Fourth Ed., Pearson, 2010

CHEMISTRY PRACTICAL

(Experiment = 15 marks, Practical record notebook = 05 marks, Viva-voce = 05 marks)

PRACTICALS:

(A) Titrimetric Analysis

(i) Calibration and use of apparatus.

(ii) Preparation of solutions of different Molarity/Normality of titrants.

(iii) Use of primary and secondary standard solutions.

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

(ii) Estimation of carbonate and bicarbonate present together in a mixture.

(iii) Estimation of free alkali present in different soaps/detergents

(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe (II) using standardized $KMnO_4$ solution.

(ii) Estimation of oxalic acid using standardized $KMnO_4$ solution

(iii) Estimation of oxalic acid and sodium oxalate in a given mixture.

(iv) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Reference text:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis Sixth Edition, Pearson, 2009.

2. Svehala G. and Sivasankar I. B, Vogel's Qualitative Inorganic Analysis, Pearson, India, 2012.

SEMESTER II

II	2Y4CC-4	Language and Communication Skills (Hindi)	6	75	25	---	100
	2Y4CC-5	Mathematical and Computational Thinking Analysis	2	50	25	25	100
	2Y4CC-6	Global Citizenship Education & Education for Sustainable Development	2	50	25	25	100
	2Y4CHEIRC-2	Introductory Regular Course-2 **Introductory Chemistry**	3	50	25	25	100
	2Y4IVS-2B	Introductory Vocational Studies-2	3	50	25	25	100
	2Y4CHEMJ-2	Major paper-2 (Disciplinary/Interdisciplinary Major) **Organic Chemistry - I**	6	50	25	25	100

सेमेस्टर-II

हिंदी भाषा

(2Y4CC-4) **अंक: 100**

इकाई-1

हिन्दीव्याकरण और रचना, संज्ञा, सर्वनाम, विशष्ठाण, क्रिया, अव्यय, कारक, वचन, सठिय, उपसर्ग, प्रत्ययासमास, लिगनिर्णय शब्द लोग शब्द, अनेक शब्दों के लिए एक शब्द, शब्द-शुद्धि, वाक्य शुद्धि, मुहावरे ओर लोकोकिया, पल्लवन एवं संक्ष पण।

इकाई-2

निबंध, कला तथा समसामयिक एवं राष्ट्रीय विषय पर लेखन

इकाई-3

संप्रेषण (संचार)- संप्रेषण की अवधारण और महत्व, संप्रष्ठाण के लिए आवश्यक शर्त संप्रेषण के प्रकार, संप्रेषण की तकनीक, वाचनकला, समाचारवाचन, साक्षात्कारकला, रचनात्मक लेखनका लक्ष्य, रचनात्मक लघु का आधार, भारत की **भाव और विचारो की प्रस्तुति, वाक कला की उपयोहगता।**

अनुशंसितपुस्तकें:-

र्ृहतव्याकरणभास्कर े डाे 0 र्चनद र्कुमार
- र्ह तहनबधंे्् ाभास्कर डाे0 र्चनदर् कु मार
- आधुहनकहहन्दीव्याकरणऔररचना े डाे 0 र्ासुद र्नन्दनप्रसाद
- रचनामानस े प्रो0 राम श्वरनाथहतर्ारी
- व्यर्हाररकहहन्दी े डाे 0 जंग बहादुरपाण्ड य
- रचनात्मक खन े डाे 0 रमश्े ेागौतम
- राजहंसहहन्दीहनबंध े प्रो0 आर0 एन0 गौड़
- सफ हहन्दीहनबंध े रत्न श्वर
- हनबंध सहचर े डाे 0 क्ष्मणप्रसाद

- उपकारमहु ार्र और ाक ोहियाँ े पार् 0 राज श्वरप्रसादचतर्वु दी
- कहाहनयोंकहातंि की े प्रतापअनम
- सम्प्र षणपरकहहन्दीभाषाहशक्षण डाे 0 र्ैश्नानारंग
- शै ीहर्ज्ञान े डाे 0 सुर शकुमार
- शै ीहर्ज्ञानप्रहतमानऔरहर्श्ल षण डाे0 पाडं य शहशभषे् ूेाण „शीताशें् ाेा“ु
- शै ीहर्ज्ञानकाइहतहास े डाे0 पाडं ेय शहशभषे् ूेाण „शीताशंे् ाे“

Mathematical and computational Thinking and Analysis

Course code (1Y4CC-6)

Total Marks: 100

COURSE OUTCOMES:

This course will enable the students to:

a) Understand the notions of logic and Mathematical Induction.
b) Basic concepts of sets.
c) Analytic approach toward the solution of algebraic equations.
d) Connections of roots and coefficients.
e) Understand basic concept of Probability and statistics.
f) Understand and analyze the coordinate systems.

UNIT-1: Logic: statement, truth table, quantifiers, connectives and tautology, Mathematical induction.

UNIT-2: Sets and Number System: operations on sets, Elementary Properties, Decimal system, binary decimal, octal system, hexadecimal system, arithmetic, conversion from binary to decimal and decimal to binary.

UNIT-3: Theory of Equation: Relation between roots and coefficients, Transformation of equation, Symmetric functions of roots, Solutions of cubic and biquadratic equations.

UNIT-4: Statistics and Probability: Data collection and presentation using bar chart, column chart, line chart, pie chart, scatter chart, surface chart. Calculation of frequency. Measure of central tendency, Mean, Median and Mode, Definition of Probability, Elementary properties, addition theorem, multiplication theorem, independent events.

UNIT-5: Geometry: Cartesian, spherical polar and Spherical cylindrical coordinate systems; their interrelationship.

Suggested reading:

1. An introduction to the theory of Numbers, 4th Ed., G. H. HARDY AND E. M. WRIGHT, 1975, Oxford university Press.
2. An Introduction to The Modern Theory of Equations, Florian Cajori, The Macmillan Company ' London: Macmhian & Co., Ltd., 1904.
3. N. K. Singh, A text book of Probability and Statistics, 1st Edition, Pragati Publication, Meerut.
4. Probability and Statistics (4th Edition) 4th Edition,Morris H. DeGroot (Author), Mark J. Schervish, Pearsion Education limited 2014.
5.N. K. Singh, Theory of Equations, 1st Edition, Pragati Publication, Meerut.

6. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis(3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore,2002.
7.Discrete Mathematical Structure, 4th Ed., Kolman, Busby and Ross, Pearson Education Asia, 2002.

GLOBAL CITIZENSHIP EDUCATION

COURSE CODE: (1Y4CC-6)

Total Marks: 100

OBJECTIVE:

- To understand the concept and structure of global governance
- To empower learners to become aware of and understand global and sustainable development issues
- To become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies.
- Enabling students to embrace and practice constitutional, humanistic, ethical, and moral values in conducting one's life, including universal human values and citizenship values.
- To practice responsible global citizenship required for responding to contemporary global challenges

COURSE OUTCOMES:

- Enhance the capacity of the learners to acquire and demonstrate problem-solving skills involving the capacity to solve different kinds of problems in familiar and nonfamiliar contexts and apply one's learning to real-life situations.
- Promote critical thinking involving capability to apply analytical thought to a body of knowledge, including the analysis and evaluation of policies, and practices, as well as analyse and synthesize data related to global issues from a variety of sources and draw valid conclusions and support them with evidence and examples.
- Creativity characterized by the ability to create or think in different and diverse ways, deal with problems and situations that do not have simple solutions; view a problem or a situation from multiple perspectives; think 'out of the box' and generate solutions to complex problems in unfamiliar contexts.
- Communication Skills characterized by skills that enable a person to present complex information in a clear and concise manner to different groups/audiences; express thoughts and ideas effectively in writing and orally and communicate with 3 others using appropriate media, convey ideas, thoughts and arguments using language that is respectful and sensitive to gender and social groups.
- Coordinating/collaborating with others involving the ability to: work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group, act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

UNIT 1: Global Citizenship Education(GCE) and Education for Sustainable Development

1.1. Global Citizenship Education; its meaning, characteristics, scope and subject –matter emergence and development.

1.2. Rights and responsibilities of Global citizenship

1.3. Benefits, Importance and theories of Global Citizenship

1.4. Global governance – concept and structure

1.5. Global Citizenship: (a) General idea, (b) Multi cultureless & diversity, (c) tolerance &(d) Acharya Vinoba's ideas of 'Jai Jagat.'

UNIT2: Global Poverty, Inequalities and social change

2.1. Concept of Global Poverty and its impact on World economy

2.2. concept of social change, its types and theories.

2.3. Human Right Education: Special reference to Universal Declaration of Human Rights, 1943

2.4. Concept of Peace and Security: Special reference to United Nations Charter

UNIT 3: Sustainable Development – Global Issues and Sustainable Issues

3.1. Global environment Issue-Climate change mitigation and adaptation

3.2. Sustainable Development: Brief overview

3.4. Biodiversity loss, Global warming and carbon emission

3.5. Effect of Global Issue on Human Species

3.6. Environmental justice

UNIT 4: Citizenship Education & Culture, Globalization

4.1. Gender equality

4.2. Meaning of Globalization and its impact of world economy

4.3. Meaning of culture, crucial factors in the Globalization of culture

Suggested Readings:

1. Global Politics – Rupak Dattagupta
2. Understanding Global Politics – Chanchal Kumar
3. Global Citizenship Education for Young Children – Robin Elizabeth Hancock
4. A New-World Education: The Global Citizen – Roy Andersen

5. Global Citizenship Education, A Critical and International Perspectives Springer – Adeel Jalil, A.K. Kari, Kathrine Meleg
6. Citizenship in a Globalising World – Ashok Acharya
7. Redesign the World: A Global Call to Action – Sam Pitroda
8. Measuring the World – Daniel Kehlmann
9. Global Citizenship Education: Challenges and Successes – Eva Aboagye & S. Nomburo Dlamini
10. Global Citizenship Education - William Gaudelli
11. Multiculturalism: A very short Introduction – Ali Rattansi
12. Diversity and Inclusion Matters – Jason Thompson
13. Multiculturalism – C. W. Watson
14. Multiculturalism, Identity and Rights – Bruce Haddock and P

DIGITAL MARKETING – IRC-2
Course Code: 2Y4IVSDM-1B

(Credits: Theory-01 + Practical 02)

Course Content:

UNIT- I Social Media Marketing-I

1. What is Social Media?
2. Understanding the existing Social Media paradigms & psychology
3. How social media marketing is different than others
4. Forms of Internet marketing Facebook marketing Understanding Facebook marketing

UNIT- II Social Media Marketing-II

1. Linkedin Marketing What is LinkedIn? Understanding LinkedIn
2. Company profile vs Individual profiles Understanding Linkedin groups
3. How to do marketing on LinkedIn groups Linkedin advertising & it's best practicesIncreasing ROI from LinkedIn ads Linkedin publishing
4. Company pages Adv on linkedIn Display vs text Twitter Marketing
5. Understanding Twitter
6. Tools to listen & measure Influence on Twitter: Tweet Deck, Klout, Peer Index

UNIT- III Google Analytics

1. Introduction to Google Analytics
2. How Google analytics works
3. Understanding Google analytics account structure
4. Understanding Google analytics insights
5. Understanding cookie tracking
6. Types of cookie tracking used by Google analytics
7. Starting with Google analytics
8. How to set up analytics account
9. How to add analytics code in website
10. Understanding goals and conversions
11. How to setup goals

UNIT- IV Google Adwords & Online Display Advertising

1. Google AdWords Overview
2. Understanding inorganic search results
3. Introduction to Google Adwords & PPC
4. advertising
5. Overview of Microsoft Adcenter (Bing & Yahoo)

DIGITAL MARKETING PRACTICAL- IRC-2
Course Code: 2Y4IVSDM-1B-LAB

PRACTICALS:

1. How to do marketing on Twitter
2. Black hat techniques of twitter marketing
3. Advertising on Twitter
4. Creating campaigns
5. Types of ads
6. Tools for twitter marketing
7. Twitter Advertising
8. Twitter Cards
9. Using youtube for business
10. Developing youtube video marketing
11. Strategy
12. Bringing visitors from youtube videos to your website
13. Creating Video A Dgroups

ORGANIC CHEMISTRY- I

Course Code: 2Y4CHEMJ-2

Total Marks: 100

OBJECTIVES:

On successful completion of this course the student should be able to understand:

1. Basic of organic molecules, structure, bonding, reactivity and reaction mechanisms.

2. Stereochemistry of organic molecules – conformation and configuration, asymmetric molecules and their nomenclature.

3. Aromatic compounds and aromaticity, mechanism of aromatic reactions.

4. Reactivity, stability of organic molecules, structure, stereochemistry.

5. Mechanism of organic reactions (effect of nucleophile/ leaving group, solvent), substitution vs. elimination.

COURSE OUTCOMES:

On successful completion of this course the student should know:

1. Design and syntheses of organic molecules.

2. Structure identification through IR, NMR and Mass spectroscopic data.

3. Lab/ Instrumentation techniques used for analysing reaction mechanisms.

Course Content:

Basics of Organic Chemistry:

Organic Compounds: Classification and Nomenclature, Hybridization, shape of molecules, influence of hybridization on bond properties. Electron Displacement Effects: inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications, Dipole moment, Organic acids and bases, their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges, Electrophiles and Nucleophiles, Nucleophlicity and basicity, Types, shape and relative stability of reaction intermediates (Carbocations, Carbanions, Free radicals and Carbenes). Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

Concept of asymmetry, Fischer Projection, Newmann and Sawhorse projection formulae and their interconversions, Geometrical isomerism: cis–trans & syn-anti isomerism and 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 mixtures, Relative and absolute configuration: D/L and R/S configurations.

Chemistry of Aliphatic Hydrocarbons:

A. Alkanes: Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz- Fittig Reactions, Free radical substitutions: Halogenation - relative reactivity and selectivity.

B. Alkenes & Alkynes: 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), mechanism of oxymercuration- demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 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. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions.

C. Cycloalkanes and Conformational Analysis Cycloalkanes and stability, Baeyer strain theory, Conformation analysis, Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms.

D. Aromatic Hydrocarbons Aromaticity: Huckel'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. Directing effects of substituent groups.

E. Polynuclear Hydrocarbons:

Reactions of naphthalene, phenanthrene and anthracene: Structure, Preparation, structure elucidation and important derivatives of naphthalene and anthracene. Chemistry of Halogenated Hydrocarbons: Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc. Nucleophilic substitution vs. elimination. Aryl halides: Preparation from diazonium salts. nucleophilic aromatic substitution, SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. Organometallic compounds of Mg and Li and their use in synthesis.

Reference Books:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, 6th Edn., Dorling Kindersley (India)Pvt. Ltd. (Pearson Education).

2. Pine S. H. Organic Chemistry, Fifth Edition, McGraw Hill, (2007)

3. F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).

4. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), OxfordUniversitiy Press.

5. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure andmechanism, Kluwer Academic Publisher, (2000)

CHEMISTRY PRACTICAL

(Experiment = 15 marks, Practical record notebook = 05 marks, Viva-voce = 05 marks)

PRACTICALS:

1. Purification of organic compounds by crystallization using the following solvents:

a. Water b. Alcohol c. Alcohol-Water

2. Determination of the melting points of given organic compounds and unknown organic compounds (using Kjeldahl method and electrically heated melting point apparatus).

3. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.

4. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)

5. Chromatography

a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography

b. Separation of a mixture of two sugars by ascending paper chromatography

Reference Books

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry,5th Ed., Pearson (2012)

SEMESTER III

III	2Y4EVS CC-7	Environmental Studies/EVS	3	50	25	25	100
	2Y4CC-8	Digital Education (Elementary Computer Applications)	3	50	25	25	100
	2Y4CHE CC-9	Community Engagement & Service (NSS/NCC/Adult education)	3	50	25	25	100
	3Y4CHE IRC-3	Introductory Regular Course-3 **Introductory Chemistry**	3	50	25	25	100
	3Y4CHE IAP	Internship/Apprenticeship/Project	4	50	25	25	100
	3Y4CHE MJ-3	Major paper-3 (Disciplinary/Interdisciplinary Major) **Physical Chemistry - I**	6	50	25	25	100

Environment Studies

Course Code: 3Y4CC-7

Total Marks: 100

OBJECTIVES:

The course will seek to achieve the following objectives:

1. Generating the awareness about environmental problems among people and society.
2. To clarify modern environmental concept like how to conserve biodiversity.
3. Inculcating basic knowledge about the environment and its allied problems.
4. Developing an attitude of concern for the environment.
5. Motivating public to participate in environment protection and environment improvement.
6. Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
7. Striving to attain harmony with Nature.

COURSE OUTCOMES:

At the end of the course students will be able to:

1. Know the more sustainable way of living.
2. Use natural resources more efficiently.
3. Know the behaviour of organism under natural conditions.
4. Know the interrelationship between organisms in populations and communities.
5. Aware and educate people regarding environmental issues and problems at local, national and international levels.

Course Content:

Unit 1: Introduction to environmental studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the

following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources: Renewable and Non-renewable Resources

- Land resources and landuse change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests,biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts conflicts overwater (international & inter-state).
- Energy resources: Renewable and non-renewable energy sources, use of alternate energysources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation

- Levels of biological diversity: genetic, species andecosystem diversity; Biogeographic zones ofIndia; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biologicalinvasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic andInformational value.

Unit 5: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on humancommunities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act.International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmentalconservation.
- Environmental communication and public awareness, case studies (e.g. CNG vehicles in Delhi)

Environment Studies Field Work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river, Spring, etc.

References:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ.Press.
5. Room, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology.
6. Sunderland: Sinauer Associates, 2006.

7. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
8. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
9. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
10. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
11. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
12. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
13. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
14. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India. Tripathi 1992.
15. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
16. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
17. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
18. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
19. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
20. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.

World Commission on Environment and Development. 1987. Our Common Future. Oxford University

DIGITAL EDUCATION

Course code-3Y4DECC-8

Total Marks: 100

OBJECTIVES:

This course is specially designed for better understanding of digital education in India. Thecourse has been designed to introduce key concepts in digital education to the students to sharpen their understanding of importance and significance of digital education in India. The students need to develop a critical thinking about the development of India in the background of expanding digital networks and our constant dependence on them in our day-to-day life.

COURSE OUTCOMES:

- Students will understand the meaning of digital education and its importance.
- They will be able to focus on different digital platform, its utility and its applications.
- The students will be exposed to different tools of digital education available inIndia.
- They will understand the importance of E-Learning in the changing context of Digital India.
- They will come to know about their responsibility as citizen in digital growth inIndia.

UNIT I: Introduction to Digital Education

Meaning & Evolution of Digital Systems. Role & Significance of Digital Technology,digital education vs traditional education, advantages and disadvantages of digitaleducation.

UNIT II: Digital Education Tools

Information & Communication Technology & Tools

Interactive tools- Microsoft Teams, Google Classroom, Linkedin

Creative Tools - Google Slides, Google Spreadsheets, Google form, Youtube)

UNIT III: Digital Education in India

Government initiatives for Digital education in India: SWAYAM, E-Pathshala, National digital library of India (NDL India), DigiLocker. Advantages & challenges in digital education in India.

UNIT IV: E- Governance

Introduction of E-Governance in India, Types of E-Governance-G2C (Government to Citizen), G2E (Government to Employee), G2B (Government to Business), G2G (Government to Govrnment), E – Governance in Jharkhand.

Suggested Readings:

1. E-Governance in India: Initiatives and issues by R.P.Sinha
2. Information & Communication Technology (ICT) in Education by Dr. Vanaja M,Dr. S Rajasekar, Dr. 3. Arulsamy.
4. Digital India: Understanding Information, Communication and Social Change byPradip N.

References:

1. www.slideshare.net
2. www.lisportal.com/en/lis-blo

COMMUNITY ENGAGEMENT NCC/N.S.S

COURSE CODE: 3Y4CC-7

Total Marks: 100

OBJECTIVES:

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

Unit-I: NSS:

NSS : Introduction, Origin and growth of NSS, Objectives, Motto, Symbol, NSS, Import National Days, NSS Song, Environmental Awareness : Natural Resources – Conservation and Management, Water conservation and Rain water harvesting, Solid waste management, Pollution control: Water, Air, Noise and Soil; Energy conservation- Wildlife Conservation, Global warming.

Unit-II: Special Programme:

Legal Awareness – Health awareness –Blood Donation Camp, First –Aid –Career Guidance –Leadership. Training cum –Cultural Programme –Globalization ant its Economic Social and Cultural Impacts. Planning and Preparation of special Camping Programme. Planning at institutions level – Guidelines for the success of camp- Importance of successful camping programme – Guiding principles – organization of camp – Administration of camp.

Unit-III: Social Awareness:

Basics and Social Service, Weaker Section of our society and their needs – NGOs : Role and Contribution –Civic responsibility – causes and Prevention; role of y uth – Drug Abuse and Trafficking –awareness of IV / AIDS.. National Integration : Impo tance and Necessity – Freedom Struggle and Nationalistic movement in India – National interests, Objectives, Threats and Opportunities – Unity in Diversity –

Contribution of Youth in Nation Building.

Unit-IV: First Aid:

Artificial Respiration – Control of Bleeding – Fractures – Burns – Shock – Wounds – Eye Injures – Heat Stroke – Snake Bite – Dog Bites – Poisoning., Disaster Management : Characteristics andtypes of Disasters (Geological and Mountain Area Disaster , Wind and Water Related natural Disaster, Man made Disaster) , Causes and effects, Assistance during Natural / Other Calamities

Flood / Cyclone / Earth Quake / Accident etc.

Unit-V: N.S.S. Regular Activities

NSS Programme Officer – NSS Volunteer – Community – Aims of NSS Programme /Activities – Classification of NSS Programme – Adoption of Villages – Contacting Villages / Area Leaders – Survey of the Villages / Area Identification of Problem(s) Completion of Projects – Evaluation of Project – Adoption of Slums – Survey of the Slum – Services in Slums - Coordinatio n with Voluntary – Organizations.

REFERENCES:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. University of Mumbai National Service Scheme Manual 2009.
3. Avhan Chancellor's Brigade-NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012.
4. Rashtriya Seva YojanaSankalpana- Prof. Dr. SankayChakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya,
6. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
7. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
8. Case material as a Training Aid for Field Workers, Gurmeet Hans.
9. Social service opportunities in hospita's, Kapil K. Krishnan, TISS
10 New Trends in NSS, Research papers published by University of Pune.
11. ANOOGUNJ Research Journal, published by NSS Unit C. K. Thakur college
12. Training Manual for Field Work published by RGNIYD, Shreeperumbudur

13. Prof. Ghatole R.N. Rural Social Science and Community Development.
14. PurushottamSheth, Dr. Shailaja Mane, National Service Scheme

Related Online Contents :

1. *https://en.wikipedia.org/w/index.php?search=National-service-scheme&title=Special%3ASearch&fulltext=1&ns0=1*
2. *https://nss.gov.in*
3. *https://twitter.com/nssybnuranchi1*
4. *https://twitter.com/nssybnuranchi2*
5. *https://www.facebook.com/profile.php?id=100083943787477*

INTRODUCTORY CHEMISTRY

Course code: 3Y4CHEIRC -3

Total Marks: 100

OBJECTIVES:

After completion of the course, the learner can be able to understand:

1. To expose the students to the basic principles of Chemistry.

2. Exposure of all three major branches of Chemistry.

3. Concept of molecular framework and chemical bonding

4. Representative elements and their chemistry.

5. Atomic theory and its evolution.

6. Learning scientific theory of atoms, concept of wave function.

7. Elements in periodic table, physical and chemical characteristics, periodicity.

8. Hybridization and shapes of atomic, molecular orbitals, bond parameters, bond- distances and energies.

9. Valence bond theory incorporating concepts of hybridization predicting geometry of molecules.

10. Basic of organic molecules, structure, bonding, reactivity and reaction mechanisms.

11. Stereochemistry of organic molecules – conformation and configuration, asymmetricmolecules and nomenclature.

12. Aromatic compounds and aromaticity, mechanism of aromatic reactions.

13. Reactivity, stability of organic molecules, structure, stereochemistry.

14. Mechanism of organic reactions (effect of nucleophile/leaving group, solvent),substitution vs. elimination.

COURSE OUTCOMES:

1. Application of course objectives stated above.

Course Content:

Section A: Inorganic Chemistry

Atomic Structure: Bohr's theory and its limitations. Need of a new approach to Atomic structure. Shape of s, p and d atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configuration of atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energy of atomic orbitals, Anomalous electronic configurations. Chemical Bonding and Molecular Structure: Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

s- and p-Block Elements:

Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity. Inert pair effect, diagonal relationship and anomalous behavior of first member of each group. Compounds of s- and p-Block Elements: Hydrides and their classification (ionic, covalent and interstitial), structure and properties with respect to stability of hydrides of p- block elements. Concept of multicentre bonding (diborane). Transition Elements (3d series): (2 classes each of 60 minutes duration) General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes. Coordination Chemistry: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, and Ni (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.

Crystal Field Theory:

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of Δo. Spectrochemical series. Comparison of CFSE for Oh and Td complexes.

Section B: Organic Chemistry

Fundamentals of Organic Chemistry:

Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Aromaticity: Benzenoids and Hückel's rule. Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation Alkenes: Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule), Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. Alkynes: Preparation: Acetylene from CaC2 and conversion into higher alkynes, by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: Formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. KMnO4. Aromatic hydrocarbons: Preparation of benzene: from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions of benzene: Electrophilic substitution: nitration, halogenation and sulphonation. Friedel- Craft's reaction (alkylation and acylation). Alkyl Halides: Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Section C: Physical Chemistry

Chemical Energetics:

Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations. Calculation of bond energy, bond dissociation energy from thermochemical data.

Chemical Equilibrium:

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔGo, Le Chatelier's principle.

Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Critical phenomena.

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

PRACTICALS:

Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO4.
3. Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.
4. Estimation of Cu (II) ions iodometrically using Na2S2O3.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.

a. Benzoylation of amines/phenols

b. Oxime and 2,4 dinitrophenyl hydrazone of aldehyde/ketone

Section C: Physical Chemistry

Thermochemistry

1. Determination of heat capacity of calorimeter.
2. Determination of integral enthalpy of solution of salts (KNO3, NH4Cl).
3. Determination of enthalpy of hydration of copper sulphate.

Ionic equilibria pH measurements

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

2. Preparation of buffer solutions:

a. Sodium acetate-acetic acid

b. Ammonium chloride-ammonium hydroxide

Reference Books:

- Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
- F. G. Mann & B. C. Saunders, Practical Organic Chemistry, Orient Longman (1960).
- B.D. Khosla, Senior Practical Physical Chemistry, R. Chand & Co.

PHYSICAL CHEMISTRY- I

Course code: 3Y4CHEMJ -3

Total Marks: 100

OBJECTIVES:

On completion of this course, the students will be able to understand understand:

1. Familiarization with various states of matter.
2. Physical properties of each state of matter and laws related to describe the states.
3. Calculation of lattice parameters.
4. Understanding Kinetic model of gas and its properties.
5. Maxwell distribution, mean-free path, kinetic energies.
6. Liquid state and its physical properties related to temperature and pressure variation.
7. Properties of liquid as solvent for various household and commercial use.
8. Solids, lattice parameters – its calculation, application of symmetry, solid characteristicsof simple salts.

COURSE OUTCOMES:

On successful completion of this course the student shall know:

1. Determination of lattice parameters of given salt.
2. Study of X-Ray diffraction pattern and finding out reference from JCPDI file.
3. Numerical related to salt hydrolysis, ionic equilibria.

Course Content:

Behaviour of real gases: Deviation from ideal gas behaviour, compressibility factor and its variation with pressure for different gases. Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour. Boyle's temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, critical and van der Waals constants, law of corresponding states.

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation, collision frequency, collision diameter, mean free path and viscosity of gases, their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η, variation of viscosity with temperature and pressure. 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.

Liquid state: Structure and physical properties of liquids, vapour pressure, surface tension, viscosity, and their dependence on temperature. Effect of addition of various solutes on surface tension, cleansing action of detergents.

Ionic equilibria:

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di- and tri-protic acids.

Salt hydrolysis, hydrolysis constants, degree of hydrolysis and pH of different salt solutions. Buffer solutions, Henderson equation, buffer capacity, buffer range, buffer action, applications of buffers in

analytical chemistry, Solubility and solubility product. Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) and applications of HSAB principle. Qualitative treatment of acid–base titration curves (calculation of pH at various stages). Theories of indicators, selection of indicators and their limitations. Multistage equilibria in polyelectrolytes.

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, seven crystal systems and fourteen 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. Various types of defects in crystals, Glasses and liquid crystals.

Reference Books:

1. Atkins, P. W. & Paula, J. de Atkin’s Physical Chemistry 8th Ed., Oxford University Press(2006).

2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).

3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).

4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).5 G. M. Barrow, Tata McGraw Hill (Fifth Edition) (2007)

5. Roy, B. N. Fundamentals of Classical and Statistical Thermodynamics Wiley, 20016 Commonly Asked Questions in Thermodynamics. CRC Press, 2011

CHEMISTRY PRACTICAL

(Experiment = 15 marks, Practical record notebook = 05 marks, Viva-voce = 05 marks)

PRACTICALS:

1. Surface tension measurements.

a. Determine the surface tension by (i) drop number (ii) drop weight method.

b. Study the variation of surface tension of detergent solutions with concentration.

2. Viscosity measurements using Ostwald's viscometer.

a. Determination of viscosity of aqueous solution of (i) polymer (ii) ethanol and (iii) sugar at room temperature.

b. Viscosity of sucrose solution with the concentration of solute.

3. pH metry

a. Effect on pH of addition of HCl/ NaOH to solutions of acetic acid, sodium acetate and their mixtures.

b. Preparation of buffer solutions of different pH

i. Sodium acetate-acetic acid

ii. Ammonium chloride-ammonium hydroxide

c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.

Reference Books

1. Khosla, B. D., Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.:New Delhi (2011).

2. Garland, C. W., Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.,McGraw- Hill: New York (2003).

3. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed., W.H. Freeman &Co.: New York (2003).

4. Athawale V. D. amd Mathur P. Experimental Physical Chemistry, New Age Intenational (2001)

SEMESTER IV

IV	4Y4CHE MJ-4	Major paper-4 (Disciplinary/Interdisciplinary Major) **Organic Chemistry - II**	6	50	25	25	100
	4Y4CHE MJ-5	Major paper-5 (Disciplinary/Interdisciplinary Major) **Physical Chemistry - II**	6	50	25	25	100
	4Y4CHE MN-1	Minor paper-1 (Disciplinary/Interdisciplinary Minor) **Chemistry in everyday life**	6	50	25	25	100
	4Y4VS-1	Vocational Studies-1 (Minor)	4	50	25	25	100

ORGANIC CHEMISTRY-II

Course code: 4Y4CHEMJ-3

Total marks: 100

OBJECTIVES:

After completion of the course, the learner shall be able to understand understand:

1. Familiarization about classes of organic compounds and their methods of preparation.
2. Name reactions, uses of various reagents and the mechanism of their action.
3. Use of reagents in various organic transformation reactions.
4. Nitrogen containing functional groups and their reactions.
5. Heterocyclic compounds and their reactions.

COURSE OUTCOMES:

On successful completion of this course the student should know:

1. Elucidating reaction mechanisms for organic reactions.
2. Organometallic compounds and their uses.
3. Use of benzene diazonium salt in organic synthesis.
4. Applications of heterocyclic compounds in pharmaceutics/drugs and the mechanism of actions.
5. Pharmaceutics/Biomedical applications of alkaloids and terpenes.

Course Content:

Alcohols, Phenols, Ethers and Epoxides:

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3°- alcohols, Bouvaelt-Blanc Reduction, Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement.

Phenols: Preparation and properties, Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism. Ethers and Epoxides: Preparation and reaction with acids. Reaction of epoxides with alcohols, ammonia derivatives and LiAlH4 Carbonyl Compounds: Structure, reactivity and preparation, Nucleophilic additions, Nucleophilic addition-elimination reactions

with ammonia derivatives with mechanism, Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen, Wolff- Kishner, LiAlH4, NaBH4, MPV, PDC and PGC), Addition reactions of unsaturated carbonyl compounds: Michael addition. Carboxylic Acids and their Derivatives: Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids, Preparation and reactions of acid chlorides, anhydrides, esters and amides, Comparative study of nucleophilic substitution at acyl group, Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement.

Sulphur containing compounds: Preparation and reactions of thiols, thioethers and sulphonic acids. Nitrogen Containing Functional Groups, Preparation and important reactions of compounds of nitro, nitrile and isonitrile groups. Amines: Effect of substituent and solvent on basicity, Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction, Distinction between 1°, 2° and 3°- amines with Hinsberg reagent and nitrous acid. Diazonium salts: Preparation and synthetic applications.

Heterocyclic Compounds: Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom, Synthesis, reactions and mechanism of substitution reactions of Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction Derivatives of furan: Furfural and furoic acid.

Reference Books:

1. P Sykes, A Guide Book to Mechanism in Organic Chemistry, 6th Edition (1997), Orient Longman, New Delhi.

2. Morrison, R. T., Boyd, R. N., Bhatterjee, S.K., Organic Chemistry, 7th Edn., Pearson.

3. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly & Sons(1976).

4. Solomons, T.W., Fryhle Craig, Organic Chemistry, John Wiley & Sons, Inc (2009).

5. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition,2013.

6. Kalsi, P. S. Organic reacations and their mechanisms, New Age Science (2010).

7. Clayden, J., Greeves, N., Warren, S., Wothers, P., Organic Chemistry, Oxford University PressInc., New York (2001)

CHEMISTRY PRACTICAL

(Experiment = 15 marks, Practical record notebook = 05 marks, Viva-voce = 05 marks)

PRACTICALS:

1. Identification of elements (N, S, and halogen) and Functional group tests for alcohols, phenols, carbonyl, carboxylic acid and amine group of compounds.

2. Organic preparations: i. Acetylation of one of the following compounds: amines (aniline, o-, m-, p-toluidines and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method: (Using conventional method and using green chemistry approach)

ii. Benzolyation of one of the amines (aniline, o-, m-, p-toluidines and o-, m-, p-anisidine) and one of the phenols (β-naphthol, resorcinol, p-cresol) by Schotten-Baumann reaction.

iii. Nitration:

a. Acetanilide/nitrobenzene by conventional method

b. Salicylic acid by green approach (using ceric ammonium nitrate).

iv. Hydrolysis of amides and esters.

v. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.

3. Collected solid samples may be used for recrystallization, melting point and TLC.

4. Qualitative analysis of unknown organic compounds containing monofunctional groups

(carbohydrates, nitro compounds, amines and amides).

6. Preparation of methyl orange.

Reference Books

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)

3. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000)

4. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

5. Vogel, A.I. Quantitative Organic Analysis, Part 3, Pearson (2012).

6. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

7. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry,5th Ed., Pearson (2012)

8. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

PHYSICAL CHEMISTRY- II

COURSE CODE: 4Y4CHEMJ -5

Total Marks: 100

OBJECTIVES:

After completion of the course, the learner shall be able to understand understand:

1. First & second laws of thermodynamics.
2. Concept of enthalpy & resonance energy.
3. Understanding the use of thermochemistry to calculate Bond energy.
4. Development of Quantum Chemistry.
5. Schrodinger equation.
6. Spherical polar coordinate.
7. LCAO-MO and VB treatments.

COURSE OUTCOMES:

On successful completion of this course the student should know the:

1. use of thermochemistry to calculate Bond energy
2. use of quantum chemistry in elucidation of atomic structure.
3. Concept of molecular orbitals and their interaction to form bonds.

Course Content:

Introduction to thermodynamics:

Intensive and extensive variables, state and path functions, isolated, closed and open systems, zeroth law of thermodynamics. First law: Concept of heat, q, work, w, internal energy, U, and 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.

Thermochemistry:

Heat of reactions: standard states, enthalpy of formation of molecules and ions and enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and

resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions.

Second Law: Concept of entropy, thermodynamic scale of temperature, statement of the second law of thermodynamics, molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Introduction to Quantum Chemistry: Introduction to black-body radiation and distribution of energy, photo-electric effect, concept of quantization, wave particle duality (de-Broglie's hypothesis), The uncertainty principle, The wave function: wave function and its interpretation, conditions of normalization and Orthogonality and its significance. Basic idea about operators, Eigen function and values, Schrodinger equation and application to free-particle and particle in a box, boundary conditions, wave functions and energies, degeneracy, hydrogen atom, Schrodinger equation in polar coordinates, radial and angular parts of the hydrogenic orbitals, degeneracies, spherical harmonics, representations of hydrogenic orbitals. Quantitative treatment of simple harmonic oscillator model, setting up of Schrodinger equation and discussion of solution of wave functions. Rigid rotator model and discussion of application of Schrodinger equation: idea about transformation to spherical polar co-ordinate, discussion on solution, Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus. Chemical bonding: Valence bond and Molecular orbital approaches, LCAO-MO treatment of H2, H2+, bonding and anti-bonding orbitals, Comparison of LCAO-MO and VB treatments of H2 (only wave functions, detailed solution not required) and their limitations.

Reference Books:

1. Laideler K. J. and Meiser J. M. Physical Chemistry Third Edition (International)1999

2. Levine I. N., Physical Chemistry, Fourth Edition), McGraw-Hill (International), 1995.

3. McQuarrie D. A. and Simon J. D. Physical Chemistry- A Molecular Approach, University Science Books, 1998.

4. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).

5. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004)

CHEMISTRY PRACTICAL

(Experiment = 15 marks, Practical record notebook = 05 marks, Viva-voce = 05 marks)

PRACTICALS:

1. Determination of water equivalent of calorimeter.

2. Determination of heat of neutralization of HCl and NaOH.

3. Determination of heat of neutralization of acetic acid and NaOH.

4. Determination of heat of solution of ammonium chloride.

5. Determination of critical solution temperature (CST of phenol-water system).

6. Determination of effect of impurity (NaCl) on critical solution temperature of phenol-water system.

7. Determination of molecular weight of volatile compound by Victor Meyer method.

Reference Books:

1. Khosla, B. D., Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.:New Delhi (2011).

2. Garland, C. W., Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.,McGraw- Hill: New York (2003).

3. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed., W.H. Freeman &Co.: New York (2003).

4. Athawale V. D. amd Mathur P. Experimental Physical Chemistry, New Age Intenational(2001)

CHEMISTRY IN EVERYDAY LIFE

COURSE CODE: 4Y4CHEMN-I

Total marks: 100

OBJECTIVES:

This course is designed:

1. Chemical aspects of some common health hazards.

2. Chemistry of some common useful materials

Course Learning Outcomes:

On successful completion of this course the student should be able to understand:

1. Explore significance of chemistry in daily life.

2. Explore common chemicals of daily use.

3. Learn about food

Course Content:

Respiration and energy production in human body:

Respiration, Respiratory enzymes, brief outline of hemoglobin and myoglobin, oxygen transport mechanism in body, co-operativity, Respiration in lower animals, hemocyanine, hemerythrine. Energy production in body, ATP, enzyme responsible for food digestion, mechanism of food digestion, active site of cytochrome c-oxidase.

Chemical aspects of some common health hazards: Anemia, sickle cell anemia, leukemia, blood pressure irregulation, blood sugar, arthritis, carbon monoxide poisoning in mines, cyanide poisoning, fluorosis etc.

Vitamins and minerals:

Need for vitamin in body, types of vitamins, water soluble and fat-soluble vitamins, Vitamin B 12, vitamin C (Cyanocobalamine), vitamin D, Vitamin K. Role of minerals in body, iodine deficiency and remedy.

Significance of Radical chemistry in living system: (8 classes each of 60 minutes duration)

Radical production in environment, superoxide and peroxide, health impact, action of radicals, cell mutation, diseases caused by free radical, cancer, radical quencher, anti-oxidants, natural anti-oxidants like vegetables, beverages like tea and coffee, fruits.

Radical destroying enzymes: superoxide dismutase, catalase, peroxidase, mechanism of action.

Chemistry of Materials:

Soaps and Detergents – their action, Biofuels – production of biofuels and its utility as alternative fuel source, Fibers: natural fibers, cotton, wool, silk, rayon, artificial fibers, polyamides, acrylic acid, PVC, PVA, Examples of natural biodegradable polymers, cellulose, cellulose acetate, cellophane, soya protein, corn, zein protein, wheat gluten protein, synthetic biodegradable polymers. Use of polymeric materials in daily life.

Organic farming:

Green manuring and organic fertilizers, Recycling of bio- degradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

Fermentation technology:

Scope and opportunities of fermentation technology. Principles of fermentation: Submerged, solid state, batch, fed-batch and continuous culture. Fermentative production of vinegar, alcohol (ethanol, wine, beer), acids (citric acid and gluconic acid), amino acids (lysine and glutamic acid) and antibiotics

Reference Books:

1. Srilakshmi B (2017): Nutrition Science,6th Multicolour Ed. New Age International (P) Ltd.

2. Roday S (2012): Food Science and Nutrition, 2nd Ed. Oxford University Press.

3. Mann J and Truswell S (2017): Essentials of Human Nutrition, 5th Ed. Oxford University Press.

4. Wilson K and Walker J (2000): Principles and Techniques of Practical Biochemistry, 5th Ed.Oxford University Press.

5. Sadasivan S and Manikam K (2007): Biochemical Methods, 3rd Ed. New Age International (P)Ltd.

6. Oser B L (1965). Hawk's Physiological Chemistry, 14th Ed. McGraw-Hill Book

7. Gopalan C , Rama Sastri BV and Balasubramanian SC(2016): Nutritive value of Indian Foods,Indian Council of Medical Research.

8. Subalakshmi, G and Udipi, SA (2006): Food processing and preservation, 1st Ed. New Age International (P)Ltd.

9. Srilakshmi B (2018): Food Science, 7th Colour Ed. New Age International (P) Lt

10. Potter NN and Hotchkiss JH (1999): Food science,5th Ed, Spinger.

11. Kaim W, Bioinorganic Chemistry, Vol 4, Brigitte Scwederski, Wiley, 1994.

12. Crichton R. H. Biological Inorganic Chemistry – An Introduction, Elsevier, 2008.

13. Berg J. M., Tymoczeko J. L., Stryer l. Biochemistry, W. H. Freeman, 2008.

14. Bertini, I., Gray, H. B., Lippard, S. J. and Valentine, J. S. (1994) BioinorganicChemistry. University Science Books (1994)

15. Lippard S., Berg J. M. Principles of Bioinorganic Chemistry, University Science Books1994.

16. Polymer science, V. R. Gowariker, N. V. Viswanathan, J. Sreedhar, New AgeInternational.

17. NIIR Board. (2012). The complete Technology Book on Biofertilizer and organic farming. 2nd Edition.

NIIR Project Consultancy Services.

18. Sathe, T.V. (2004) Vermiculture and Organic Farming. Daya publishers.

19. Subba Rao N.S. (2017). Biofertilizers in Agriculture and Forestry. Fourth Edition. Medtech.

20. Vayas, S.C, Vayas, S. and Modi, H.A. (1998). Bio-fertilizers and organic Farming Akta Prakashan, Nadiad