

SYLLABUS

CHEMISTRY

As per NEP-2020

B.Sc. I YEAR I SEMESTER EXAMINATION, 2024-25



JAI NARAIN VYAS UNIVERSITY
JODHPUR

INTRODUCTION

Jai Narain Vyas University, Jodhpur was established in July 1962. It is a regional University now and operates in the limits of Jodhpur, Jalore, Barmer, Pali and Jaisalmer districts. The Department of Chemistry is located in the New Campus of the University, near the Bhagwati-Kodli Railway Station, Pali Road. (The Department runs post graduate course in chemistry and has various research laboratories). More than 700 candidates have been awarded with degree of Ph.D. and three candidates have been awarded D.Sc. degree. About 1700 research papers from various faculty members and research scholars have been published in the International and National Scientific Journals. The Department has received research projects from different agencies like U.G.C., C.S.I.R., D.S.T., D.B.T., I.C.A.R., DRDO, DAE etc from time to time. In 1983, U.G.C. has formulated a programme under which certain departments, selected on the basis of their achievements in the field of teaching and research, they were provided with infrastructure for raising the standard of their post-graduate education and research to international level. The programme was formulated as Committee on Strengthening of Infrastructure of Science and Technology (COSIST) of U.G.C.

The Department is one among the three departments of chemistry in the country, which were selected for this programme. M.Sc. was awarded under COSIST programme from 1995 to 2003. There after department was identified by the UGC under SAP (Special Assistance Programme) in 2010 for research support to the department. Thereafter DST awarded II level FIST programme to the department in 2010.

GRCS scheme for post graduate course (M.Sc. Chemistry) was implemented from the session 2015 onwards. Now from the session 2023-24 the course curriculum for both UG & PG has been revised as per the National Education Policy 2020.

Awards

Apart from the university gold medal for securing highest marks in M.Sc. Sc., following awards have been instituted in the Department of Chemistry for the meritorious students:

1. Professor R.C. Kapoor Gold Medal for securing highest marks in M.Sc. (Chemistry)
2. Professor J.P. Saxena Award for excellence in Organic Chemistry
3. Sushila Bhanuvar Upam Kanwar Bhandari Memorial Abhay-II Award for excellence in Physical Chemistry
4. Dr. Kamla Tandon Memorial Award for excellence in Inorganic Chemistry.
5. B.M.Gang Memorial Award for excellence in Analytical Chemistry


Prof. R. Hood
Department of Chemistry,
J.N.V. University, Jodhpur

Academic and Research Programme

Under Special Assistance Program (SAP), Department of Chemistry offers a two year (4 semesters) integrated programme leading to the Master's degree in Chemistry in two sections of 40 students each. Syllabus is designed to cover all four branches of chemistry viz. Inorganic Chemistry, Organic Chemistry, Physical Chemistry and Analytical Chemistry. And in IVth semester offers a choice of eight electives each to strengthen diverse field of interdisciplinary nature.

Department of Chemistry has advanced facilities for research in major areas of Chemistry leading to Ph.D. The major research interests of the faculty members includes: Nanotechnology, Bioinorganic, Electrochemistry & Electroanalytical Chemistry, Chemical Dynamics & Reaction Mechanism, Mineral Beneficiation, Oil & Iron, Natural Products, Synthetic Heterocycles, Chemical Spectroscopy, Synthesis & Structural Organic & Organometallic Chemistry, Effluent Treatment, Environmental Chemistry, Synthetic Organic Chemistry, Photocatalysis, Solar Energy Conversion & Storage, Co-ordination Chemistry, Green Chemistry and Applied Chemistry.

ADMISSION

The minimum qualification for admission to M.Sc. course is B.Sc. (10+2+3) degree with Chemistry as a major subject. The details of the eligibility conditions and admission procedure is available on University official Website. The admission for M.Sc. Chemistry is done strictly as per the university rules. Reservation for SC, ST, OBC, MBC & EWS quota would also be done as per J.N.V. University, Jobapur rules.

ATTENDANCE

Candidates are required to attend minimum 75% of the classes in theory and practicals both.

EXAMINATION SCHEME

Detailed examination scheme will be as per the common guidelines at faculty/University level.

FACILITIES

The Department of Chemistry possesses several sophisticated, advanced and modern equipments required for teaching and research. The specialized instruments includes Electrochemical Analyzers, Surface Plasmon Resonance Spectrometer, Fluorescence Spectrophotometer, FTIR, UV-VIS Spectrophotometers, Stopped-Flow Spectrophotometer, HPLC, Low temperature thermostat, Flame photometers, Ion meters, Centrifuge and computers for networking. In addition, certain facilities related to equipments are also available with USIC in the Faculty of Science.

VISION

To develop and nurture a strong spirit for strengthening unexplored scientific heritage for better and greener society

MISSION


Prof. & Head
Department of Chemistry,
J.N.V. University,
Jobapur

FACULTY MEMBERS**RESEARCH AREA****PROFESSOR & HEAD**

Dr. (Mrs.) S. Loocher

Ph.D.

Polymers, Environmental and applied Chemistry

PROFESSORS

Dr. (Mrs.) V. Choudhary

Ph.D.

Co-ordination Chemistry,
Environmental Chemistry

Dr. (Mrs.) S. Gaur

Ph.D.

Co-ordination Chemistry

Dr. V. Gupta

Ph.D.

Environmental Chemistry, Applied Chemistry

Dr. (Mrs.) P. Mishra

Ph.D.

Organic Reaction Mechanism

Dr. K.S. Geeta

Ph.D.

Solar energy conversion technologies

Dr. R.C. Meena

Ph.D.

Photochemistry (Solar energy
Conversion technologies)

Dr. Rajendra Mathur

Polymer Science, Nano Science & Natural Materials

Organic Chemistry and Solar Conversion and Storage

Dr. P. Koli

Ph.D.

ASSOCIATE PROFESSOR

Dr. S.T. Mishra

Ph.D.

Photo Electrochemistry, Corrosion & its prevention

ASSISTANT PROFESSORS

Dr. Jashree Rathore

Ph.D.

Organic Chemistry

Dr. Meenukshi Jaiswal

Ph.D.

Inorganic Chemistry and Solar Conversion and Storage

Dr. Anita Meena

Ph.D.

Physical Chemistry

Dr. Priyanka Purohit

Ph.D.

Chemical Kinetics

Dr. Rajni Bora

Ph.D.

Green/Nano Chemistry

Dr. Sangana Parihar

Ph.D.

Environmental Chemistry



Prof. S. Head
Department of Chemistry,
J.N.V. University,
Jobipur

Dr. Om Prakash

Ph.D.

Chemical Kinetics

Dr. R.L. Saini

Ph.D.

Organic Chemistry

Dr. Anurag Choudhary

Ph.D.

Chemical Kinetics

Dr. Seema Parveen

Ph.D.

Organic and Photochemistry

Dr. Anam Dharwal

Ph.D.

Analytical Chemistry

Department of Chemistry, JMV University, Jodhpur
UG: Proposed Course Scheme as Per NEP-2020 (CBCS)

| Semester | Nature of Course | Course Code | Title | Credits |
|----------|---|-------------|--|---------|
| I | Ability Enhancement Compulsory Course-1 | | English | 2 |
| | Discipline Centric Core (DCC) | CHE5001T | Fundamentals of Chemistry-I | 4 |
| | Discipline Centric Core - Practical | CHE5001P | Practical Chemistry-I | 2 |
| | Ability Enhancement Compulsory Course-1 | | Hindi | 2 |
| II | Discipline Centric Core (DCC) | CHE5002T | Fundamentals of Chemistry II | 4 |
| | Discipline Centric Core- Practical | CHE5002P | Practical Chemistry-II | 2 |
| | Skill Enhancement Course -1 | | Water Analysis | 2 |
| | Discipline Centric Core [DCC] | CHE6001T | Advanced Chemistry-I | 4 |
| III | Discipline Centric Core- Practical | CHE6001P | Practical Chemistry III | 2 |
| | Skill Enhancement Course -2 | | Food Adulteration and Testing | 2 |
| | Discipline Centric Core [DCC] | CHE6002T | Advanced Chemistry-II | 4 |
| | Discipline Centric Core - Practical | CHE6002P | Practical Chemistry-IV | 2 |
| IV | Skill Enhancement Course -3 | | Ores & Smelting | 2 |
| | Discipline Specific Elective1(DSE1) | CHE7101T | Materials | 4 |
| | Discipline Specific Elective1(DSE1) | CHE7101P | Quantitative Analysis | 2 |
| | Discipline Specific Elective2(DSE2) | CHE7102T | Practical Chemistry V | 4 |
| V | Discipline Specific Elective2(DSE2) | CHE7102P | Bio-molecules | 2 |
| | Discipline Specific Elective3(DSE3) | CHE7103T | Practical Chemistry V | 4 |
| | Discipline Specific Elective3(DSE3) | CHE7103P | Molecular Spectroscopy | 2 |
| | Discipline Specific Elective4(DSE4) | CHE7104T | Practical Chemistry-V | 2 |
| VI | Skill Enhancement Course -4 | | Conservation and Management of Cultural Heritage | 2 |
| | Discipline Specific Elective4(DSE4) | CHE7104P | Industrial Inorganic Materials | 4 |
| | Discipline Specific Elective5(DSE5) | CHE7105T | Practical Chemistry-VI | 2 |
| | Discipline Specific Elective5(DSE5) | CHE7105P | Organic Spectroscopy | 4 |


 Prof. & Head
 Department of Chemistry
 J.N.V. University
 Jodhpur

| | | | |
|---|----------------------|--|--------|
| Discipline Specific: Elective5(DSE5)Practical | CHE7105P | & Industrial Organic Metals | 2 |
| Discipline Specific Elective(DSE6) Discipline Specific Elective2(DSE6)Practical | CHE7105T CHE7105P | Practical Chemistry-VI Electrochemistry Practical Chemistry-VI | 4 2 |

Note: Candidates shall have to select any one of the specified DSE for each of the V and VI semester.

SYLLABUS OF B.Sc. 1 year 1 semester (Chemistry) CBCS as per NEP-2020

Syllabus of 1 semester DCC:

CHE5001I: Fundamentals of Chemistry-I

UNIT-I: Chemical Bonding and Molecular Structure

Ionic Bonding: General characteristics of ionic bonding. Factors considerations in ionic bonding, lattice energy, solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy. Born-Haber cycle and its applications, polarizing power and polarizability. Lutz's rule, 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 theory and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, octahedral, trigonal bipyramidal and octahedral arrangements.

Concept of resonance and resonating structures in various inorganic and organic compounds.

UNIT-II: Molecular Orbital Approach

Rules for the LCAO method, bonding and antibonding MOs and their characteristics for $s-s$, $s-p$ and $p-p$ combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including key of $s-p$ mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+ . Comparison of VB and MO approaches. Banana Bonding ($3C-2e$ Bond) in diboranes.

Hydrogen Bonding: Types and impact of inter and intra molecular hydrogen bonding.

UNIT-III: Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structures, shape and reactivity of organic molecules: Nucleophiles and electrophiles, Reactive Intermediates: Carbocations, Carbanions and free radicals.

Meterechnistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wulky Formula, Newman, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical Isomerism, Enantiomerism, Diastereomerism and Meso compounds. Threo and erythro, D and L, cis-trans nomenclature, CIP Rules: R/S (for upto 2 chiral carbon atoms) and E/Z Nomenclature (for upto two C-C systems).

UNIT-IV: Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes (Up to 5 Carbons): Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe synthesis, from Grignard reagent. **Reactions:** Free radical Substitution: Halogenation

Alkenes (Up to 5 Carbons): Preparation: Elimination reactions. Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule), cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). **Reactions:** cis-addition (alk. KMnO_4) and trans-addition (bromine),

Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation

UNIT-V: Gaseous State

Deviation from ideal behavior, Van der Waals equation of state and its discussion.

Critical Phenomena: PV isotherms of real gases, critical phenomenon, continuity of states, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities (No derivation). Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquidification of gases (based on Joule-Thomson effect). Numericals.

Books Suggested:

1. Inorganic Chemistry by B.R. Puri and L.R. Sharma
2. Inorganic Chemistry by G.C. Shivhare and V.P. Laxman
3. A Text Book of Organic Chemistry by R.K. Bansal
4. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall
5. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Nigalchansal & Co.
6. Inorganic Chemistry, K.R. Ganes, RBD Jaipur
7. Chemistry Semesta-1 by R.L. Madan (S. Chaud & Co)

Practical Chemistry-I-CHE5001P:

Quantitative analysis of inorganic mixture containing Sulfide (acetons and acetins), separation and identification of group II, III, IV, V and VI and anions including interfering radicals and special combination of acidic radicals (CO_3^{2-} , SO_3^{2-} , NO_2^- , NO_3^- , Br^- , Cl^- , Br^- , I^- , S^{2-} , SO_3^{2-} , SO_4^{2-})

Exercises:

Organic Models (Using Ball and Stick Model Box):

R and S configuration of optical isomers

D and L configuration of optical isomers

E/Z configuration of geometrical isomers

Conformational isomerism of ethane and n-butane

Exercises: Calibration of a Thermometer

Prof. & Head
Department of Chemistry
J.N.V. University,
Jodhpur