

# SYLLABUS

## CHEMISTRY

As per NEP-2020

**B.Sc. I YEAR I SEMESTER EXAMINATION, 2025-26**



**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 Bhagat-ki Kothi 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 1985 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.

CBCS 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/B.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 Bhandari Ugam 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

## **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. IInd and 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, Biosensors; Electrochemistry & Electroanalytical Chemistry, Chemical Dynamics & Reaction Mechanism; Mineral Beneficiation; Oil & Fats; Natural Products; Synthetic Heterocyclics; Chemical Spectroscopy; Synthetic & Structural Organo & Organometallic Chemistry; Effluent Treatment; Environmental Chemistry; Synthetic Organic Chemistry; Photochemistry; 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, Jodhpur 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 Analysers, Surface plasmon Resonance Spectrometer, Fluorescence Spectrophotometer, FTIR, UV-VIS spectrophotometers, Stopped-flow spectrophotometers, HPLC, Low temperature thermostats, 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**

Our mission is to provide high quality application oriented scientific education and research to younger generation through a blend of science, engineering and technology.

## **FACULTY MEMBERS**

## **RESEARCH AREA**

### **PROFESSOR & HEAD**

Dr. Vikal Gupta

Environmental Chemistry, Applied Chemistry;

Ph.D.

Effluent Treatment Studies

### **PROFESSORS**

Dr. Kishna Ram. Genwa

Solar energy conversion technologies

Ph.D.

Dr. (Mrs.) Pallavi Mishra

Organic Reaction Mechanism

Ph.D.

Dr. Pooran Koli

Organic Chemistry and Solar Conversion and Storage

Ph.D.

Dr. Rajendra Mathur

Polymer Science, Nano Science & Natural Materials

Ph.D.

Dr. Ramesh Chand Meena

Photochemistry (Solar energy Conversion technologies)

Ph.D.

Dr. Sangeeta Loonker

Polymers, Environmental and applied Chemistry

Ph.D.

Dr. Vimla Chowdhary

Co-ordination Chemistry, Environmental Chemistry

Ph.D.

## **ASSOCIATE PROFESSOR**

Dr. S.L. Meena

Photo Electrochemistry, Corrosion & its prevention

Ph.D.

## **ASSISTANT PROFESSORS**

Dr. Amita Dhariwal

Analytical Chemistry

Ph.D.

Dr. Anita Meena

Physical Chemistry

Ph.D.

Dr. Anurag Choudhary

Chemical Kinetics

Ph.D.

Dr. Jayshree Rathore

Organic Chemistry

Ph.D.

Dr. Meenakshi Jonwal

Inorganic Chemistry and Solar Conversion and storage

Ph.D.

Dr. Om Prakash

Chemical Kinetics

Ph.D.

Dr. Priyanka Purohit

Chemical Kinetics, Analytical & Biochemistry

Ph.D.

Dr. Rajni Bais

Green/Nano Chemistry

Ph.D.

Dr. R.L. Saini

Organic Chemistry

Ph.D.

Dr. Sangeeta Parihar

Environmental Chemistry

Ph.D.

Dr. Seema Parveen

Organic and Phytochemistry

Ph.D.

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

Semester	Nature of Course	Course Code	Title	Credits
I	Ability Enhancement Compulsory Course-I		English	2
	Discipline Centric Core (DCC)	CHE5001T	Fundamentals of Chemistry-I	4
	Discipline Centric Core - Practical	CHE5001P	Practical Chemistry-I	2
II	Ability Enhancement Compulsory Course-I	-	Hindi	2
	Discipline Centric Core (DCC)	CHE5002T	Fundamentals of Chemistry-II	4
	Discipline Centric Core- Practical	CHE5002P	Practical Chemistry-II	2
III	Skill Enhancement Course -1	-	Water Analysis	2
	Discipline Centric Core (DCC)	CHE6001T	Advanced Chemistry-I	4
	Discipline Centric Core- Practical	CHE6001P	Practical Chemistry-III	2
IV	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
V	Skill Enhancement Course -3		Ores & Building Materials	2
	Discipline Specific Elective1(DSE1)	CHE7101T	Qualitative & Quantitative Analysis	4
	Discipline Specific Elective1(DSE1)Practical	CHE7101P	Practical Chemistry-V	2
	Discipline Specific Elective2(DSE2)	CHE7102T	Bio-molecules	4
	Discipline Specific Elective2(DSE2)Practical	CHE7102P	Practical Chemistry-V	2
	Discipline Specific Elective3(DSE3)	CHE7103T	Molecular Spectroscopy	4
	Discipline Specific Elective3(DSE3)Practical	CHE7103P	Practical Chemistry-V	2
VI	Skill Enhancement Course -4		Conservation and Management of Cultural Heritage	2
	Discipline Specific Elective4(DSE4)	CHE7104T	Industrial Inorganic Materials	4
	Discipline Specific Elective4(DSE4)Practical	CHE7104P	Practical Chemistry-VI	2
	Discipline Specific Elective(DSE5)	CHE7105T	Organic Spectroscopy & Industrial Organic Materials	4
	Discipline Specific Elective5(DSE5)Practical	CHE7105P	Practical Chemistry-VI	2
	Discipline Specific Elective(DSE6)	CHE7106T	Electrochemistry	4
	Discipline Specific Elective2(DSE6)Practical	CHE7106P	Practical Chemistry-VI	2

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

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

Syllabus of I semester DCC:

### CHE5001T: Fundamentals of Chemistry-I

#### UNIT-I: Chemical Bonding and Molecular Structure

**Ionic Bonding:** General characteristics of ionic bonding. Energy 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. 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 theory and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, 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 idea of s-p- mixing) and heteronuclear diatomic molecules such as CO, NO and NO', Comparison of VB and MO approaches. Banana Bonding (3C-2e<sup>-</sup> 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.

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

#### Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, 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:** (Upto 5 Carbons): **Preparation:** Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. **Reactions:** Free radical Substitution: Halogenation.

**Alkenes:** (Upto 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<sub>4</sub>) 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, Vander Waals equation of state and its discussion.

Critical Phenomena: PV isotherms of real gases, critical phenomenon continuity of states, relationship between critical constants and Vander 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. Liquification 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. Lavania
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 Naginchand & Co.
6. Bhotic Rasayan, K.R. Genwa, RBD Jaipur
7. Chemistry-Semester-I by R.L. Madan (S. Chand & Co.)

## Practical Chemistry-I-CHE5001P:

**Exercise1.** Qualitative analysis of inorganic mixture containing 5-radicals (anions and cations), separation and identification of (group 0, I, II, III, IV, V and VI) and anions including interfering radicals and special combination of acidic radicals ( $\text{CO}_3^{2-}$ ,  $\text{SO}_3^{2-}$ ;  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ;  $\text{NO}_3^-$ ,  $\text{Br}^-$ ;  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ;  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ )

### Exercise2:

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

## Skill Based Course

### B.Sc. I Semester

#### SEC-CH (A) Environmental Studies

**Unit-I** Environmental spheres: Lithosphere, Hydrosphere, Biosphere and atmosphere.

Atmosphere: Composition, Chemical and photochemical reactions in atmosphere. Biogeochemical cycles (Carbon Cycle, Nitrogen Cycle).

**Unit-II** Basic chemistry involved in Green house effect, Global warming, Ozone layer depletion and Acid rain.

**Unit-III** Analytical methods for monitoring oxides of nitrogen ( $\text{NO}_x$ ): spectrophotometric method, colorimetric method. Determination of lead in petrol by atomic absorption spectroscopy.

#### Books recommended:

1. Fundamental concepts in environmental studies. S.Chand, New Delhi.
2. Environmental Chemistry by H. Kaur, Pragati Prakashan.
3. Environmental Chemistry, A.K. De, New Age International Publishers.