

SYLLABUS

CHEMISTRY

As per NEP-2020

B.Sc. III YEAR V 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 Analyzers, 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. (Mrs.) S. Loonker

Polymers, Environmental and applied Chemistry

Ph.D.

PROFESSORS

Dr. Kailash Daga

Co-ordination Chemistry , Applied and environmental
Chemistry

Ph.D.

Dr. (Mrs.) V. Choudhary

Co-ordination Chemistry ,

Ph.D.

Environmental Chemistry

Dr. (Mrs.) S. Gaur

Co-ordination Chemistry ,

Ph.D.

Dr. V. Gupta

Environmental Chemistry, Applied Chemistry;

Ph.D.

Effluent Treatment Studies

Dr. A.V. Singh

Physical Chemistry, Mineral beneficiation and

Ph.D.

Environmental Chemistry

Dr. (Mrs.) P. Mishra

Organic Reaction Mechanism

Ph.D.

Dr. K.R. Genwa

Solar energy conversion technologies

Ph.D.

Dr. R.C. Meena

Photochemistry (Solar energy

Ph.D.

Conversion technologies)

Dr. A. Arora

Ph.D.

Natural products, Oils and fats

Dr. Rajendra Mathur

Polymer Science, Nano Science & Natural
Materials

Ph.D.

Dr. P. Koli

Organic Chemistry and Solar Conversion and
Storage

Ph.D.

ASSOCIATE PROFESSOR

Dr. S.L. Meena

Photo Electrochemistry, Corrosion & its prevention

Ph.D.

ASSISTANT PROFESSORS

Dr. Jaishree Rathore

Organic Chemistry

Ph.D.

Dr. Meenakshi Jonwal

Inorganic Chemistry and Solar Conversion and
Storage

Ph.D.

Dr. Anita Meena

Physical Chemistry

Ph.D.

Dr. Priyanka Purohit

Chemical Kinetics

Ph.D.

Dr. Rajni Bais

Green/Nano Chemistry

Ph.D.

Dr. Sangeeta Parihar

Environmental Chemistry

Ph.D.

Dr. Om Prakash

Chemical Kinetics

Ph.D.

Dr. R.L. Saini

Organic Chemistry

Ph.D.

Dr. Anurag Choudhary

Chemical Kinetics

Ph.D.

Dr. Seema Parveen

Organic and Phytochemistry

Ph.D.

Dr. Amita Dhariwal

Analytical Chemistry

Ph.D.

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

Syllabus for V Semester DSE-1

CHE7101T: Qualitative and Quantitative Analysis:

UNIT-I: Qualitative Analysis-I

Theoretical basis of qualitative analysis, Systematic analysis of Acidic and Basic radicals (including interfering radicals). Separation of cations and anions into groups, identification of cations and anions, interfering anions and their removal, Chemical reactions involved.

UNIT-II Qualitative Analysis-II

Basic principles of qualitative analysis, Theory of ionization, Theory of precipitation Common-ion effect, complex ion formation, solubility product & their applications. Oxidizing and reducing agents and buffers used in analysis.

UNIT-III: Quantitative Analysis

Definition, types of quantitative analysis: Gravimetric and volumetric analysis.

Volumetric Analysis: Terms, Basic principle, standard solutions, types of standard solutions (Primary and Secondary), Cautions in Titrimetry.

Steps involved in gravimetric analysis: Precipitation, Digestion, Filtration, Washing, Drying, Ignition, Weighing. Advantages of gravimetric analysis, Cautions in Gravimetry, Co-precipitation and Post precipitation.

UNIT-IV: Qualitative organic Analysis

Special element detection (N, S & Halogens). Functional group analysis, Principles of separation of organic compounds, purification of organic compounds.

UNIT-V: Statistical analysis of experimental data

Errors in chemical analysis: types of error and their minimization;

Accuracy, Precision, Average deviation from mean, Standard Deviation, relative standard deviation, Difference between accuracy and precision.

Books Suggested

1. Vogel's Qualitative Inorganic Analysis (Pearson Pub.)
2. Vogel's Chemical Analyses (Pearson Pub.)
3. Vogel's Quantitative Inorganic Analysis (Pearson Pub.)
4. Basic Concepts of Analytical Chemistry by S.M. Khopkar (New Age International)

CHE7102T: Bio-molecules

UNIT-I: Amino Acids

Classification, structure and stereochemistry of amino acids; Acid-base behavior, isoelectric point, electrophoresis and separation of amino acids by chromatography. Preparation and reactions of α -amino acids. Distinctive properties of α -, β -, and γ -amino acids. analysis of amino acid. Glycine- preparation, physical & chemical properties.

UNIT-II: Peptides, Proteins and Nucleic Acids

Introduction, composition, and nature of proteins. Isolation of proteins.

Structure and nomenclature of peptides and proteins. Classification of proteins. selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Peptide structure determination, end group analysis, Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation. Analytical tests and uses of proteins. Estimation of free amino and carboxyl groups

Nucleic acids: introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT-III: Introduction to Carbohydrates

Classification and nomenclature. Monosaccharides, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. , mechanism of osazone formation, Formation of glycosides, ethers and esters. Cyclic structure of D(+)-glucose. Determination of ring size of monosaccharides, Mechanism of mutarotation.

UNIT-IV: Disaccharides and polysaccharides

Occurrence of sucrose, manufacture of sucrose, physical and chemical properties of sucrose, configurational structure of sucrose, uses and analytical test of sucrose, constitution of sucrose. Occurrence of maltose, physical and chemical properties of maltose. Occurrence of lactose, physical and chemical properties of lactose. Occurrence of starch, manufacture of starch, physical and chemical properties of starch, uses and structure of starch, An introduction to amylopectin, glycogen, dextrin, and inulin. Occurrence of cellulose, physical and chemical properties of cellulose, uses and structure of cellulose, role of cellulose in fibre industry (rayon formation). Paper, raw materials used for manufacture of paper, manufacture of paper

UNIT-V: Introduction to Medicinal Chemistry

Drug-Target Interaction, Basic retrosynthetic, structure-activity relationship(SAR), Mechanism of action of representative drugs (Analgesics: Aspirin, Paracetamol and Glyceryl Trinitrate)

Books Suggested

1. Principles of Biochemistry by Lehninger
2. Organic Chemistry Vol I & II by I.L. Finar
3. Chemistry (Elective Paper) By R.L. Madan (S. Chand & Co.)

CHE7103T: Molecular Spectroscopy

UNIT I: Spectroscopy

Introduction: electromagnetic radiation, regions of the spectrum, Basic features of different Spectrometers, Born-Oppenheimer approximation, degrees of freedom.

UNIT II:Rotational Spectrum Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect. Numericals.

UNIT III:Vibration Spectroscopy

Vibrational Spectrum:Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum

UNIT IV:Raman Spectroscopy: concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules. Numericals.

UNIT V:Electronic Spectrum: Origin of electronic spectrum, Selection rules, vibrational course structure and rotational fine structures considering no interaction of rotational and vibrational energies. qualitative description of selection rules and Franck-Condon principle.

Books Suggested

1. Molecular Spectroscopy by Banwell
2. Fundamentals of Molecular Spectroscopy by P.S. Sindhu (New Age Int.)
3. Molecular Structure and Spectroscopy by G. Aruldhs (PHI)

CHE7101P/CHE7102P/CHE7103P: Practical Chemistry-V

Excercise1:

Preparations:

Micro cosmic salt., Tetraammine copper(II) sulphate, Nickel ammonium sulphate, Sodium thiosulphate, Chrome Alum, Ferrous Sulphate, Ferrous Ammonium Sulphate

Excercise2:

(a) **Qualitative Analysis:** - Analysis of an organic mixture containing two solid components, using water, NaHCO_3 and NaOH for separation.

(b) **Synthesis of organic compounds:-**

- (i) Acetylation of salicylic acid, aniline and p-nitroacetanilide.
- (ii) Preparation of iodoform from ethanol and acetone.
- (iii) Diazotization/Coupling of primary aromatic amines (aniline).
- (iv) Preparation of methyl orange.

SKILL ENHANCEMENT COURSE

SEC-3

ORES AND BUILDING MATERIAL

Theory:

Ceramics- general properties and classification

Cement-classification, composition, basic constituents and their significance. manufacturing of Portland cement by rotary kiln method, setting and hardening of cement.

Lime- manufacture of lime, setting and hardening and lime mortar.

Plaster of paris-manufacture, setting and hardening of plaster of paris.

Ore- definition, basics of ores. Determination of % of Cu in Cu ore, estimation of calcium in lime stone, determine the amount of chromium in the chromite ore, analysis of cement.

List of books for Ores and Building Materials

Books Recommended:

1. Building Materials: S. K. Duggal
2. Industrial Chemistry: B K Sharma
3. Material Chemistry: S S Dara & S S Umare
4. Engineering Chemistry: Dr. Sunita Rattan
5. Engineering Chemistry: Jain & Jain
6. Experiments and Calculations in Engineering Chemistry: S S Dara
7. Laboratory Manual on Engineering Chemistry: S K Bhasin & Sudha Rani