SYLLABUS

Choice-Based Credit System (CBCS)

Maharaja Ganga Singh University

Bachelor of Science (B.Sc.) Chemistry

(Semester) 2025-26

Semester I

Department of Chemistry

Undergraduate Programme

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

Background

Considering the curricular reforms as instrumental for desired learning outcomes, all the academic Department of Maharaja Ganga Singh University made a rigorous attempt to revise the curriculum of postgraduate programmes in alignment with National Education Policy-2020 and UGC Quality Mandate for Higher Education Institutions-2021. The process of revising the curriculum could be prompted with the adoption of "Comprehensive Roadmap for Implementation of NEP". The roadmap identified the key features of the Policy and elucidated the Action Plan with well-defined responsibilities and indicative timeline for major academic reforms.

The process of revamping the curriculum started with the series of webinars and discussions conducted by the University to orient the teachers about the key features of the Policy, enabling them to revise the curriculum in sync with the Policy. Few research has also been carried out by the faculty members about the assessment, evaluation and significance of the NEP 2020. Proper orientation of the faculty about the vision and provisions of NEP-2020 made it easier for them to appreciate and incorporate the vital aspects of the Policy in the revised curriculum focusing on creating holistic, thoughtful, creative and well-rounded individuals equipped with the key 21st century skills 'for the development of an enlightened, socially conscious, knowledgeable, and skilled nation'.

With NEP-2020 in background, the revised curricula articulate the spirit of the Policy by emphasising upon- integrated approach to learning; innovative pedagogies and assessment strategies; multidisciplinary and cross-disciplinary education; creative and critical thinking; ethical and Constitutional values through value-based courses; 21st century capabilities across the range of disciplines through life skills, entrepreneurial and professional skills; community and constructive public engagement; social, moral and environmental awareness; Organic Living and Global Citizenship Education (GCED); holistic, inquiry-based, discovery-based, discussion-based, and analysis-based learning; exposure to Indian knowledge system, cultural traditions and classical literature through relevant courses offering 'Knowledge of India'; fine blend of modern pedagogies with indigenous and traditional ways of learning; flexibility in course choices; student-centric participatory learning; imaginative and flexible curricular structures to enable creative combination of disciplines for study; offering multiple entry and exit points, alignment of Vocational courses with the International Standard Classification of Occupations maintained by the International Labour Organization; breaking the silos of disciplines; integration of extra-curricular and curricular aspects; exploring internships with local industry, businesses, artists and crafts persons; closer collaborations between industry and higher education institutions for technical, vocational and science progammes; and formative assessment tools to be aligned with the learning outcomes, capabilities, and dispositions as specified for each course. The University has also developed consensus on adoption of Blended Learning with 10% component of online teaching and 90% face to face classes for each programme.

Choice Based Credit System (CBCS)

The Choice Based Credit System (CBCS), a part of academic reform process to enhance quality of education and facilitate transferability of students from one University/institution to another at the national and international level, provides substantive autonomy to teachers to formulate their own curricula and enable them to introduce innovations in teaching and learning process and upgrade overall quality of higher education. The CBCS provides scope for Comprehensive and Continuous Evaluation (CCE) of students and encourages them to learn. The CBCS provides a cafeteria type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

The grading system is widely regarded as an improvement over the traditional marks system, which is why leading institutions in India and abroad have adopted it. Thus, there's a strong rationale for establishing a consistent grading system. This would facilitate seamless student mobility among institutions within the country and abroad, while also allowing prospective employers to accurately assess students' performances. To achieve the desired standardization in the grading system and the method for calculating the Cumulative Grade Point Average (CGPA) based on students' examination results, the UGC has devised these comprehensive guidelines.

Outline of Choice Based Credit System

(https://www.ugc.gov.in/pdfnews/8023719_guidelines-for-cbcs.pdf)

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 **Discipline Specific Elective (DSE) Course: Elective** courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3 **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; i. Environmental Science and ii. English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/MIL Communication.

3.2 Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

4. Research Component in Under-Graduate Courses

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analysing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Chemistry Semester I

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks		Total Marks	**Minimum Passing Marks (%)
							Internal marks	External marks		
CHY4.5AECT11	Environment Studies	AEC	2	0	0	2		100	100	36 S/NS
CHY4.5DCCT12	CHEMISTRY - I	DCC	3	1	0	4	20	80	100	36
CHY4.5DCCP12	CHEMISTRY LAB - 1	DCC	0	0	2	2	10	40	50	36
									Total Credits (Semester-I all subjects)	20
									Total Marks (Semester-I all subjects)	450

- S/S/ NS*=Satisfactory or Not satisfactory. A candidate shall be required to obtain 36% marks to pass in theory, practical and internals separately.
- The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.). However, the marks of internal assessment will only be submitted once with the term end examination.
- For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination and both the examiners will be appointed at Institute level. For semester I, III and V no external examiner will be appointed by University. Instead, the examiners will be appointed by the Head of the institute / Principal of the college and both marks, term end practical and internal examination will be submitted to the university.

Chemistry Semester II

Paper Code	Paper Name	Code	L	T	P	Total Credits	Maximum Marks		Total Marks	**Minimum Passing Marks (%)
							Internal marks	External marks		
ENG4.5AECT21 HIN4.5AECT21	General English or Hindi	AEC	2	0	0	2		100	100	36 S/NS
CHY4.5DCCT12	CHEMISTRY - II	DCC	3	1	0	4	20	80	100	36
CHY4.5DCCP12	CHEMISTRY LAB - 2	DCC	0	0	2	2	10	40	50	36
									Total Credits (Semester-I all subjects)	20
									Total Marks (Semester-I all subjects)	450

- S/S/ NS*=Satisfactory or Not satisfactory. A candidate shall be required to obtain 36% marks to pass in theory, practical and internals separately.
- The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.). However, the marks of internal assessment will only be submitted once with the term end examination.
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Semester I Chemistry

Total 6 credits ; 150 marks

Type of Course	**Course Code**	**Title**	**Credit**	**Marks (External + Internal**	**Hours in a week**
Paper I Core course (DCC) (Theory) **[CHY-T-1]**	**CHY-T-1-** 4.5DCC**T**13	CHEMISTRY - I	4	100 (80 + 20)	6
Paper II Core course (DCC) (Lab) **[CHY-L-1]**	**CHY-L-1-** 4.5DCC**P**13	CHEMISTRY LAB - 1	2	50 (40 + 10)	4
	Total		**6**	**150 (120 + 30)**	**10**

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.).

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination and both the examiners will be appointed at Institute level.

For semester I, III and V no external examiner will be appointed by University. Instead, the examiners will be appointed by the Head of the institute / Principal of the college and both marks, term end practical and internal examination will be submitted to the university.

Course Code	**CHY-T-1-**4.5DCC**T**13
Type of the course	Core course (DCC) (Theory) course I of Semester I
Title of the Course	CHEMISTRY - I
Level of the Course	NHEQF4.5
Credit of the Course	**4**
Delivery sub-type of the course	Theory 6h Lecture per week
Pre-requisites and requisites of the course	Student enrolled and registered in UG Programme first semester.
Course Objectives	➢ To develop a basic understanding about the structure of atoms and compounds among students ➢ To develop mathematical concept which are useful for chemical understanding
Course Outcome	➢ After completion of course student will able to apply the principles of atomic structure on different atoms of periodic table. ➢ Students will able to understand and explain the structure and properties of various molecules and different states viz solid, liquid and gas. ➢ Student will be able to understand bondings in organic compounds, basic reaction mechanism, stereochemistry, etc.

Semester I

PAPER-I –

90 Hours (6 Hour/ week)

Unit-I

Atomic Structure: Idea of De-Broglie matter/waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of psi(ψ) and psi*(ψ*), quantum numbers, radial and angular wave function and probability distribution curves, shapes of s, p,d, f orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge.

Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity, methods of determination of electronegativity, trends in periodic table and applications in predicting and explaining the chemical behavior.

Unit-II

Structure and Bonding: Hybridization, bond lengths and bond angles. Bond energy, localized and delocalized chemical bond, vanderwaals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen

bonding, Valence bond theory and its limitations, Valence shell electron pair repulsion (VESPR) theory to NH_3, H_3O^+, SF_4, ClF_3, $ICl_2^-$and H_2O etc. **MO theory**-Homonuclear and heteronuclear (CO and NO) diatomic molecules,

Unit-III

Mathematical Concepts: Logarithmic relations, curve, sketching linear graphs and calculations of slopes, differentiation of functions like K_x, e^x, X^n, sin x, log x; maxima and minima, partial differentiation and reciprocity relations. Integrations of some useful/relevant functions; permutations and combinations, Factorials. Probability.

Gaseous States : Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander-waals equation of state, PV isotherms of real gases, continuity of states, the isotherms of Vander-waals equation, relationship between critical constants and Vander-waals constants, the law of corresponding states, reduced equation of state. Qualitative discussions of the Maxwell's distribution of molecular velocities, Liquification of gases (based on Joule - Thomson effect).

Unit-IV

Liquid State: Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid Crystals : Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven-segment cell.

Structure of Ionic Solids - Ionic Structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber Cycle, solvation energy and solubility of ionic solids, polarizaing power and polarizability of ions. Fajan's rule.

Unit-V

Mechanisms of Organic Reactions : Types of reagents-electrophiles and nucleophiles. Type of organic reactions, energy considerations. Reactive intermediates- carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples) Assigning, formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism

Stereochemistry of Organic Compounds-Concept of isomerism, types of isomerism. Optical isomerism- elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and recemization. Relative and absolute, configuration, sequence rules, D & L and R & S systems of nomenclature. Determination of configuration of geometric isomers E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational analysis of ethane and n-butane. Conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted

cyclohexane derivatives, Newman projection and sawhorse formulae, Fischer and flying wedge formulae.

इकाई –I

परमाणु संरचना : डी ब्रॉग्ली द्रव्य/तरंगों विचार हाइजेनबर्ग का अनिश्चितता का सिद्धान्त, परमाण्वींय कक्षक, श्रोडिंगर तरंग समीकरण, तरंगफलन व उसके वर्ग (व) की सार्थकता, क्वांटम संख्याए, त्रिज्य एवं कोणीय तरंग फलन, प्रायिकता वितरण वक्र, S, P, D, F कक्षाकों की आकृति, ऑफबौ एवं पाउली अपवर्जन सिद्धान्त, हुंड का अधिकतम बहुकता का नियम, तत्वों के इलेक्ट्रॉन विन्यास, प्रभावी नाभिकीय आवेश।

आवर्ती गुण : परमाणु व आयनिक त्रिज्या, आयनन ऊर्जा, विद्युतऋणता एवं इलेक्टॉन बंधुता की परिभाषा एवं निर्धारण की विधियां, आवर्त सारणी में प्रवृत्ति, रासायनिक व्यवहार की व्याख्या एवं अनुमान लगाने मे अनुप्रयोग।

इकाई –II

संरचना और बन्धनः संकरण, बन्ध लम्बाई, बन्ध कोण, बन्ध ऊर्जा, स्थानीकृत एवं विस्थानीकृत रसायन बन्ध, वाण्डरवाल्स अन्योन्यक्रया, समावेश यौगिक, क्लैथ्रेट्स कोश इलेक्ट्रॉन युग्म प्रतिकर्षण सिद्धान्त (VESRP) NH_3, H_3O^+, SF_4, ClF_3 ICl_2^-, H_2O आदि के लिए, अणुकक्षक, सिद्धान्त समनाभिकीय एवं विषमनाभिकीय (CO व NO) द्विपरमाणुक अणु।

इकाई – III

गणितीय अवधारणाएँ: लॉगरिदमिक संबंध, वक्र, रेखाचित्र रेखांकन और ढलानों की गणना, K_x, e^x, X^n, sin x, log x जैसे कार्यों का विभेदन; मैक्सिमाऔर मिनिमा, आंशिकभेदभावऔरपारस्परिकता संबंध।कुछउपयोगी/प्रासंगिक कार्यों का एकीकरण; क्रम परिवर्तनऔर संयोजन, फैक्टोरियल। संभावना।

गैसीय अवस्था : गैसों के अणुगति सिद्धान्त के अभिधारणाएं, आदर्श व्यवहार से विचलन, वाण्डर वाल्स की अवस्था समीकरण, वास्तविक गैसों के PV समतापी वक्र, अवस्था का सातत्य, वाण्डर वास्ल समीकरण के समपाती, क्रान्तिक स्थिरांकों एवं वाण्डर वाल्स स्थिरांकों में सम्बन्ध, संगत अवस्था का नियम, अवस्था की समानीत समीकरण, मैक्सवेल का आण्विक वेग वितरण का गुणात्मक चर्चा, गैसों का द्रवण (जूल थोमसन प्रभाव पर आधारित)

इकाई – IV

द्रव अवस्था : अन्तराण्विक बल, द्रवों की संरचना (एक गुणात्मक वर्णन) ठोस, द्रव एवं गैसों में संरचनात्मक भेद। द्रव क्रिस्टल : द्रव क्रिस्टल, ठोस एवं द्रव मे अन्तर। वर्गीकरण, निमैटिक तथा कोलेस्टीरिक प्रावस्थाओं की संरचना गणितीय अवधारणाएं : लघुगणकीय सम्बन्ध, वक्र खींचना, रेखीय ग्राफ एवं ढाल की गणना जैसे फलनों का अवकलन, उच्चिष्ठ व निम्निष्ठ, आंशिक अवकलन एवं

परस्परिक सम्बन्ध, कुछ उपयोगी/संगत फलनों का समाकलन, क्रमचय एवं संवय, क्रमगुणित, प्रायिकता।

आयनिक ठोस की संरचा : आयनिक संरचनाएं, त्रिज्या अनुपात प्रभाव व उपसहसंयोजन संख्या, त्रिज्या अनुपात नियम की सीमाएं, जालक दोष, अर्धचालक, जालक ऊर्जा एवं बॉर्न हेबर चक्र, विलायकन ऊर्जा एवं आयनिक ठोसों की विलेयता, ध्रुवण शक्ति एवं आयनों का ध्रुवण फायान्स के नियम।

इकाई – V

रासायनिक अभिक्रियाओं की क्रियाविधि : धुमावदार तीर संकेतन, कार्बनिक रासायनिक अभिक्रियाओं के क्रियाविधि प्रदर्शन में तीरों का महत्व, समांश एवं विषमाश बन्ध विदलन, नाभिकस्नेही एवं इलेक्टॉनस्नेही अभिकर्मक, कार्बनिक अभिक्रियाओं के प्रकार, ऊर्जा का चिन्तन, क्रियाशील मध्यवर्ती कार्बोकेटाउन, कार्बऋणायन, मुक्त मूलक, कार्बिन्स, एराईन्स तथा नाइट्रिन्स (उदाहरण सहित), मध्यवर्ती एवं अन्य आयनिक स्पीशीज पर औपचारिक आवेश दर्शाना, अभिक्रियाओं की क्रियाविधि ज्ञात करने की विधियां, गतिज एवं स्टीरियोकेमिकल अध्ययन।

कार्बनिक यौगिकों का त्रिविम रसायन विज्ञान : समावयवता की अवधारणा, समावयता के प्रकार, प्रकाशित समावयवता, सममिति के तत्व, आण्बिक किरैलता, प्रतिबिम्बरूप, स्टीरियोजेनिक केन्द्र, ध्रुवण धूर्णकता, प्रतिबिम्बरूपों के गुण, दो स्टीरियोजेनिक केन्द्र युक्त किरैल व अकिरैल अणु, विवरिम समावयवी, थ्रियों व एरिथ्रो विवरिम समावयवी, मीसो यौगिक, प्रतिबिम्बरूपों का वियोजन, प्रतीपन, अप्रतीपन तथा रेसमकरण, आपेक्षिक व निरपेक्ष विन्यास, अनुक्रम नियम, नामकरण की D व L तथा R व S पद्वति। ज्यामितीय समावयवों के विन्यासों का निर्धारण, नामकरण की E व Z पद्धति, ऑक्सिमों तथा एलिसाइक्लिक यौगिकों को ज्यामितीय समावयवता, संरूपीय समावयवता, ऐथेन व n-ब्यूटेन का संरूपीय विश्लेषण साइक्लोहेक्सेन के संरूपण, अक्षीय एवं भूमध्यीय बन्ध, एकल प्रतिस्थापी साइक्लोहेक्सेन व्युत्पन्नों के संरूपण, न्यूमान प्रक्षेपण एवं सॉहॉर्स सूत्र, फिशर एवं फ्लाइंग वेज सूत्र, संरूपण तथा विन्यास में अन्तर।

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12. I. L.Finar:*OrganicChemistry*(Vol.I&II),E.L.B.S.
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Course Code	**CHY-L-1-**4.5DCC**P**13
Type of the course	Core course (DCC) (Practical)
Title of the Course	CHEMISTRY LAB - 1
Level of the Course	NHEQF4.5
Credit of the Course	**2**
Delivery sub-type of the course	**Practical 4h Laboratory per week**
Course Objectives	➢ To develop a basic understanding about the laboratory techniques ➢ To develop safety sense and behavior in the laboratory work among students.
Course Outcome	➢ After completion of lab student will able to understand and apply basic laboratory techniques. ➢ Students will able to understand the laboratory behaviors, safety parameters and safe handling in the lab

Chemistry Lab 1

CHEMISTRY LAB – 1

PRACTICAL

60 hours (4 h per week)

A. Laboratory techniques:

(i) Determination of melting point &boiling point of simple organic and inorganic molecule

(ii) Mixed melting point determination

Urea-cinnamic acid mixture of various compositions(1:4,1:1,4:1)

(iii) Distillation – Various types of distillations

Simple distillation of ethanol-water using water condenser,

Distillation of nitrobenzene and aniline using air condenser

(iv) Green Chemistry - Identification of Safety Symbols

(v) Laboratory behaviors, safety rules and general ethics in the laboratory

(vi) Demonstration of general laboratory techniques, instruments and glasswares

(vii) Types of molecular models including R/S; E/Z

B. Purification Methods

(i).**Crystallization**

(ii) **Decolorisation & Crystallization using charcoal and or other adsorbing materials –** examples of jiggery, sugar, simple salts etc.

(iii) **Sublimation (Simple and Vacuum)**

C. Viscosity & Surface Tension

1. To determine the percentage composition of given mixture (non interacting system) by viscosity method.

2. To determine the viscosity of any mixture (e.g. amyl alcohol in water) at different concentrations and calculate the viscosity of these compositions.
3. To determine the percentage composition of a given binary mixture by surface tension method (e.g. acetone & ethyl- ketone)
4. Determination of surface tension and viscosity of edible / non edible oils

D. Spotting

Spotting will include Safety symbols, laboratory instruments, techniques, Indian knowledge system etc. During examination in spotting there should be 6 spots related with instruments, techniques, safety etc. from the syllabus ; time of spotting is 20 minutes and a separate copy may be used for the purpose.

प्रायोगिक पाठ्यक्रम

प्रयोगशाला 1

A. प्रयोगशाला तकनीके–

(i) सरल अकार्बनिक एवं कार्बनिक अणुओं का गलनांक तथा क्वथनांक मापन

(ii) मिश्र गलनाक मापन

यूरिया (सिरेमिक अम्ल के अलग–अलग संघटन के मिश्रण (1:4ए 1:1, 4:1)

(iii) आसवन

एथेनॉल का सरल आसवन – जल संधनित्र द्वारा जल का उपयोग वायुसधनित्र के द्वारा नाइट्रो बेन्जी एवं एनिलीन मिश्रण का आवसन

(iv) ग्रीन कैमिस्ट्री – सुरक्षा चिन्हों की पहचान

(v) प्रयोगशाला व्यवहार, सुरक्षा नियम, प्रयोगशाला में सामान्य नैतिकता

(vi) सामान्य प्रयोगशाला तकनीके, उपकरण, कांच के बने पदार्थ का प्रदर्शन

(vii) आण्विक मॉडल के प्रकार R/S, E/Z सहित

B. शुद्धिकरण तकनीकें

(i) क्रिस्टलीकरण

(ii) चारकोल के उपयोग द्वारा विरंजन एवं क्रिस्टलीकरण और अथवा दूसरे अधिशोषित पदार्थ – गुड़, शक्कर, सरल लवण आदि

(iii) ऊर्ध्वपातन (सरल एवं निर्वात)

C. विस्कॉसिता एवं पृष्ठ तनाव

(i) श्यानता मापन विधि द्वारा, अक्रियाशील तंत्रद्ध मिश्रणों के प्रतिशत संघटन का मापन

(ii) एमिल एल्कोहॉल की जल मे विभिन्न सांद्रताओं वाले मिश्रणों की श्यानताओं का मापन एवं इन विलयनों की श्यानताओं की गणना

(iii) (एसीटोन एवं एथिल–कटोन) द्वि अंगी मिश्रण के प्रतिशत संगठन की पृष्ठ तनाव विधि से मापन

(iv) खाद्य एवं गैर खाद्य तेलों का श्यानता एवं पृष्ठ तनाव

D. Spotting – 6 Spots

(सुरक्षा, चिन्ह, प्रयोगशाला तकनीके, उपकरण, आदि)

Spotting के लिए 20 मिनट का समय एवं अलग उत्तर पुस्तिका का उपयोग।

ReferenceBooks:

1. A.I.Vogel:TextbookofPracticalOrganicChemistry,PrenticeHall,5thEdn.
2. F.G.Mann&B.C.Saunders:PracticalOrganicChemistry, OrientLongman,1960.
3. B.D.Khosla:SeniorPracticalPhysicalChemistry, R.Chand&Co.
4. Ahluwalia,V.K.&Aggarwal,R.*ComprehensivePracticalOrganicChemistry,*UniversitiesPress.

PRACTICAL-SCHEME OF EXAMINATION

Max. Marks: 50 (including 10 marks of internal) **Min. Marks: 18** **Time: 5 Hours**

Exercise

Experiment	Marks
Laboratory techniques (any one)	**8**
Purification Methods (any one)	**8**
Viscosity & Surface Tension (any one)	**8**
Spotting (Six spots)	**6**
Viva	**5**
Record	**5**

Note :-

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination and both the examiners will be appointed at Institute level.

For semester I, III and V no external examiner will be appointed by University. Instead, the examiners will be appointed by the Head of the institute / Principal of the college and both marks, term end practical and internal examination will be submitted to the university.

Theory (term end paper)-SCHEME OF EXAMINATION

Max. Marks: 100 (including 20 marks of internal) **Min. Marks: 36** **Time: 3 Hours**

There will be three sections in each theory paper
Section A – 10 questions (two questions from each unit),
Section B – 5 question (two questions from each unit with an internal choice of attempting one),
Section C - five question (one from each unit and three questions are to be attempted)

Section	Types of questions	Number of question	Marks	Difficulty Level	Learning outcome
A	5 Objective questions and 5 one line answer questions *(Word limit – one line ; 10 words)*	5+5 = 10 (two questions will be asked from each unit and all questions are to be attempted)	10 (1 marks for each question)	3 Easy 4 moderate 3 Tough	Critical thinking, Analytical ability, Judgment and exploration ability
B	Subjective questions with short answer (50-100 words) and or Questions based on diagrams / equation / AR	5 questions are to be attempted out of 10 questions (from each unit two questions will be asked with internal choice)	25 (5 marks for each question)	2 Easy 2 moderate 1 Tough	Accuracy, Precision and Phrase understanding with summary writing skill
C	Subjective questions with long answer / Descriptive diagram questions / Model designing questions / Project designing questions (400-1000 words)	3 questions are to be attempted out of 5 questions (from each unit one question will be asked with overall choice)	45 (15 marks for each question)	1 Easy 1 moderate 1 Tough	Writing and understanding, Proposal designing, Analytical skill and writing

Note : The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, project work, student fest, association / club activities etc.

A proper record of each student should be maintained with the concerned faculty / department. The marks given for each activity will be uploaded only once with term end semester examination. (A tentative marks distribution scheme may be considered as – Total internal 20 marks (4 marks for internal tests conducted with a gap of 40 days may be termed as internal test I and internal test II, 4 marks for weekly / periodic class tests, 4 marks for seminars, 4 marks for quizzes / activities, 4 marks for projects etc.)

The marks of internal assessment should not be based on merely two term tests.

SYLLABUS

Choice-Based Credit System (CBCS)

Maharaja Ganga Singh University

Bachelor of Science (B.Sc.) Chemistry

(Semester) 2025-26

Semester II

Department of Chemistry

Undergraduate Programme

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

Semester II Chemistry

Total 6 credits ; 150 marks

Type of Course	**Course Code**	**Title**	**Credit**	**Marks (External + Internal**	**Hours in a week**
Paper I Core course (DCC) (Theory) **[CHY-T-2]**	**CHY-T-2-** 4.5DCC**T**23	CHEMISTRY - II	4	100 (80 + 20)	6
Paper II Core course (DCC) (Lab) **[CHY-L-2]**	**CHY-L-2-** 4.5DCC**P**23	CHEMISTRY LAB - 2	2	50 (40 + 10)	4
	Total		**6**	**150 (120 + 30)**	**10**

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination.

Course Code	**CHY-T-2-**4.5DCC**T**23
Type of the course	Core course (DCC) (Theory) course I of Semester II
Title of the Course	**CHEMISTRY - II**
Level of the Course	NHEQF4.5
Credit of the Course	**4**
Delivery sub-type of the course	Theory 6h Lecture per week
Pre-requisites and requisites of the course	Student enrolled and registered in UG Programme second semester.
Course Objectives	➢ To develop a basic understanding about the elemental framework of periodic table ➢ To develop understanding about chemical, physical properties of different elements of periodic table
Course Outcome	➢ After completion of course student will able to understand and apply the properties of block elements of periodic table. ➢ Students will able to understand and explain the uses of properties of block elements in different fields. ➢ Students will able to understand Reaction kinetics ➢ Students will able to understand procedures of preparation of various alkanes, alkenes, alkynes, ethers, aldehydes, ketones, etc

Semester II

PAPER-I –

90 Hours (6 Hour/ week)

Unit-I

Chemistry of s and p Block Elements including **Noble Gases -** Comparative study (Including diagonal relationship. Salient features of hydrides, solvation and complexation tendencies including their function in biosystems and introduction to alkyls and aryls. Special emphasis on hydrides, oxides, oxyacids and halides of groups 13-18.

Chemistry of d block elements: Oxidation states, magnetic properties and spectral properties of d block elements. Binary compounds and complexes, illustrating the relative stabilities. Coordination number and geometry. Chemistry of elements belonging to II and III transition series comparative study of post lanthanide transition metals with the members of 4d series. Stereochemistry of their compounds.

Unit-II

Chemical kinetics: Chemical kinetics and its scope, rate of reaction, factors influencing the rate of reaction-concentration, temperature, pressure, solvent, light, catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions: zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction-differential method,

method of integration, method of half life period and isolation method. Radioactive decay as a first order phenomenon.

Unit-III

Chemical Equilibrium: Equilibrium constant and free energy. Thermodynamic derivation of law of mass action, Le Chatelier's principle. Reaction isotherm and reaction Isochore-Clapeyron equation and Clausisus-Clapeyron equation, applications. **Phase Equilibrium:** Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems. Phase equilibria of two component system-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaCI-H_2O$), ($FeCl_3-H_2O$) and ($CuSO_4-H_2O$) system. Freezing mixtures, acetone-dry ice.

Unit-IV

Alkanes, Akenes, Alkynes and dienes : *Preparation, Properties and application.* Few name reactions such as - Wurtzreaction,Kolbe'ssynthesis, ozonolysis, Diels- Alder reaction etc.

Alkyl and Aryl Halides- Reaction and Mechanism of nucleophilic substitution reactions. Relative reactivates of alkyl vs allyl, vinyl and aryl halides.

Alcohols: Dihydric alcohols -Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement. Trihydric alcohols-Nomenclature and methods of formation, chemical reactions of glycerol.

Unit V

Ethers and Epoxides: Nomenclature of ethers and methods of their formation, physical properties.Chemical reactions-cleavage and autoxidation, Ziesels method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Aldehydes and Ketones: Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties.Mechanism of nucleophilic addition to carbonyl group with particular emphasis on benzoin, Aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction.

इकाई–I

s-ब्लॉक व p-ब्लॉक तत्वों का रसायन : तुलनात्मक अध्ययन, विकर्णी सम्बन्ध हाइड्राइडों के प्रमुख लक्षण, जैविकतन्त्र में उनके कार्यों सहित विलायकन एवं संकुलन प्रवृत्तियां, ऐल्किल एवं ऐरिलों का परिचय। वर्ग 13–17 समूहों का तुलनात्मक अध्ययन (विकर्णी सम्बन्ध सहित) वर्ग 13–17 के तत्वों

के हाइड्राइट, ऑक्साइड, ऑक्सीअम्ल एवं हैलाइड जैसे यौगिक। उत्कृष्ट गैसों का रसायनः उत्कृष्ट गैसों के रासायानिकगुण, जीनॉन का रसायन, जीनॉन यौगिकों की संरचना व बन्धन।

d-ब्लॉक तत्वों का रसायन : : d ब्लॉक तत्वों के गुण, उनके द्वि अंगी यौगिक एवं संकुल, आक्सीकरण अवस्था का आपेक्षिक स्थायित्व का चित्रण, ज्यामिति एवं समन्वय संख्या। द्वितीय तथा तृतीय संक्रमण श्रेणी के तत्वों का रसायन : II व III संक्रमण श्रेणी में आने वाले तत्वों का रसायन, 4d श्रेणी । के तत्वों के साथ लैन्थेनाइडों के बाद आने वाले तत्वों की तुलना में आयनिक त्रिज्याएं आक्सीकरण अवस्था, चुम्बकीय एवं स्पेक्ट्रमी व्यवहार का अध्ययन, उनके यौगिकों का त्रिविम रसायन।

इकाई–II

रासायनिक गतिकी: रासायनिक गतिकी और उसका दायरा, प्रतिक्रिया की दर, प्रतिक्रिया-सांद्रण की दर को प्रभावित करने वाले कारक, तापमान, दबाव, विलायक, प्रकाश, उत्प्रेरक, दरों की एकाग्रता निर्भरता, सरल रासायनिक प्रतिक्रियाओं की गणितीय विशेषताएं: शून्यक्रम, प्रथमक्रम, दूसराक्रम, छद्मक्रम, आधा जीवन और औसत जीवन। प्रतिक्रिया के क्रम का निर्धारण-विभेदक विधि, एकीकरण की विधि, अर्धजीवन काल की विधि और पृथक्करण विधि। प्रथम क्रम की घटना के रूप में रेडियोधर्मी क्षय।

इकाई–III

रासायनिकसंतुलन :संतुलन स्थिरांक और मुक्त ऊर्जा। सामूहिक कार्रवाई के नियम की थर्मोडायनामिक व्युत्पत्ति ,लेचेटेलियर का सिद्धांत। प्रतिक्रिया इज़ोटेर्म और प्रतिक्रिया आइसोकोर-क्लैपेरॉन समीकरण और क्लॉसिसस-क्लैपेरॉन समीकरण ,अनुप्रयोग। चरण संतुलन :शब्दों का विवरण और अर्थ-चरण ,घटक और स्वतंत्रता की डिग्री ,गिब्स चरण नियम की व्युत्पत्ति ,एक घटक प्रणाली का चरण संतुलन-ज CO 2और S प्रणाली। दो घटक प्रणाली का चरण संतुलन-ठोस-तरल संतुलन, सरलयूटेक्टिक-बीआई-सीडी ,पीबी-एजीसिस्टम ,सीसेकाडीसिल्वराइजेशन। ठोस समाधान-अनुरूपगलनांक (Mg-Zn) और असंगत गलनांक ,(NaCI-H2O) ,(FeCI3-H2O (और) CuSO4-H2O) प्रणाली के साथ यौगिक निर्माण। जमने वाला मिश्रण ,एसीटोन-सूखीबर्फ।

इकाई–IV

ऐल्केन, ऐल्कीन ऐल्काइन एवं डाईन : विरचन की विधियां, गुणधर्म एवं उपयोग । नाम अभिक्रियाएं: वुर्ट्ज संश्लेषण, कोल्बे संश्लेषण, ओजोनीकरण डील्स–ऐल्डर अभिक्रियाएं आदि।

ऐल्किन एवं ऐरिलहैलाइड : रासायनिक अभिक्रियाएं, एल्किल हैलाइडों के नाभिक स्नेही प्रतिस्थापन अभिक्रियाओं की क्रियाविधि?, ऊर्जा अवस्था चित्रों के साथ SN^2 एवं SN^1अभिक्रियाएं। एल्किल हैलाइडों की ऐलिल, वाईनिल एवं ऐरिलहैलाइडों के सापेक्ष अभिक्रियाशीलता।

ऐल्कोहॉल : हाइहाड्रिक ऐल्कोहॉल : नामरण, विरचन की विधियां समीपवर्ती ग्लाइकॉलों की रासायनिक अभिक्रियाएं, ऑक्सीकरण युक्तविखण्डन[$Pb(OAc)_4$तथाHIO_4 एवं पिनैकॉल–पिनैकॉलान पुनर्विन्यास। ट्राइहाइड्रिक ऐल्कोहॉलः नामकरण, विरचन की विधियां, ग्लिसरॉल की रासायनिक अभिक्रियाएं

इकाई–V

ईथर और एपॉक्साइड: ईथर का नामकरण और उनके गठन के तरीके, भौतिक गुण। रासायनिक प्रतिक्रियाएं-क्लीवेजऔरऑटोऑक्सीडेशन, ज़ीसेल्सविधि।
एपॉक्साइड्स का संश्लेषण। एपॉक्साइड्स का एसिड और बेस-उत्प्रेरितरिंग ओपनिंग, एपॉक्साइडरिंगओपनिंग का ओरिएंटेशन, एपॉक्साइड्स के साथ ग्रिग्नार्ड और ऑर्गेनोलिथियम अभिकर्मकों की प्रतिक्रियाएं।
ऐल्डिहाइड एवं कीटोन : नामकरण तथा कार्बोनिक समूह की संरचना, ऐल्डिहाइड व कीटोनों के बनाने की विधियां–विशेषतः ऐसिडक्लोराइड से ऐल्डिहाइडों का संश्लेषण, डइथायऐन के उपयोग से ऐल्डिहाइड व कीटोनों का संश्लेषण, नाइट्राइलों एवं कार्बोक्सिलिक अम्लों से कीटोनों का संश्लेषण, भौतिकगुण। कार्बोनिल समूह पर नाभिक स्नेही योग की क्रियाविधि विशेषतः निम्न अभिक्रियाओं का अध्ययन– बेन्जोइन, ऐल्डोल, पार्किन तथा नोवेनैजेल संघनन, अमोनिया तथा उसके व्युत्पन्नों का संघनन, विटिग अभिक्रिया।

ReferenceBooks:

1. B.H.Mahan: *UniversityChemistry*3rdEd.Narosa(1998).
2. R.H.Petrucci:*GeneralChemistry*5thEd. MacmillanPublishingCo.:NewYork(1985).
3. J.D. Lee: *ANewConciseInorganicChemistry*,E.L.B.S.
4. F.A.Cotton&G.Wilkinson:*BasicInorganicChemistry*, JohnWiley.
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7. T.W.GrahamSolomon:*OrganicChemistry*,*JohnWileyand Sons*.
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9. I. L.Finar:*OrganicChemistry*(Vol.I&II),E.L.B.S.
10. R.T.Morrison&R. N. Boyd:*OrganicChemistry*, PrenticeHall.
11. ArunBahlandB.S.Bahl:*AdvancedOrganicChemistry*,S.Chand

Course Code	**CHY-L-2-**4.5DCC**P**23
Type of the course	Core course (DCC) (Practical)
Title of the Course	CHEMISTRY LAB - 2
Level of the Course	NHEQF4.5
Credit of the Course	**2**
Delivery sub-type of the course	**Practical 4h Laboratory per week**
Course Objectives	➢ To develop a basic understanding about the qualitative and quantitative analysis. ➢ To develop an understanding towards the protocols of chemical analysis.
Course Outcome	➢ After completion of lab student will able to understand and apply basic analysis procedures. ➢ Students will able to apply basic qualitative and quantitative analysis procedures on simple commercial samples.

Chemistry Lab 2

CHEMISTRY LAB - 2

PRACTICAL

60 hours (4 h per week)

A Qualitative Inorganic analysis

Semi micro and Macro analysis, Separation and Identification of Four radicals - two acidic and two basic in a given mixture which may include any one interfering radical and/or combinations of radicals.

B Qualitative Organic analysis

Identification of an organic compound through the functional group analysis, determination of melting point , specific tests and preparation of suitable derivatives

C Volumetric Analysis

(i) Determination of acetic acid in commercial vinegar using NaOH.

(ii) Determination of alkali content-antacid tablet using HCI.

(iii) Estimation of calcium content in chalk as calcium oxalate

(iv) Estimation, of hardness of water by EDTA.

(v) Estimation of ferrous and ferric by dichromate method,

(vi) Estimation of copper using thiosulphate.

D. Spotting

General analytical instruments / procedures / protocols related with water analysis, food analysis etc. should be demonstrated. Spotting will include Safety symbols, laboratory instruments, techniques etc.

During examination in spotting there should be 6 spots related with instruments, techniques, safety etc. from the syllabus ; time of spotting is 20 minutes and a separate copy may be used for the purpose.

प्रयोगशाला 2

A. मात्रात्मक अकार्बनिक विश्लेषणः सूक्ष्म तथा स्थूल विश्लेषण–दा अम्लीय एवं दो क्षारकीय कूलचारमूलाकों का परीक्षण एवं पृथक्करण (बाधक मूलक एवं युग्मक मूलक दिये जाये।

B. मात्रात्मक कार्बनिक विश्लेषण : कार्बनिक यौगिकों की क्रियात्मक समूह विश्लेषण द्वारा पहचान, गलनांक का निर्धारण एवं यौगिकों के व्युत्पन्न का निर्माण।

C. आयतनी विश्लेषणः

(i) NaOHकी सहायता से व्यावसायिक सिरकेमें एसिटिक अम्ल की मात्रा ज्ञातकरना।

(ii) HCLकी सहायता से एण्टि एसिड टेबलेट में एल्कली की मात्रा का निर्धारण।

(iii) परमेंगनामिति द्वारा चॉक में कैल्सियम की मात्रा केल्स्यिम ऑक्सलेट के रूप में ज्ञात करना।

(iv) EDTA द्वारा जल की कठोरता ज्ञात करना।

(v)डाइक्रोमेटविधि द्वारा फेरस व फेरिक का आकलन।

(vi) थायोसल्फेट के उपयोग से कॉपर का आंकलन।

D. Spotting – 6 Spots

(सुरक्षा, चिन्ह, प्रयोगशाला तकनीके, उपकरण, आदि)

Spotting के लिए 20 मिनट का समय एवं अलग उत्तरपुस्तिका का उपयोग।

ReferenceBooks:

1. A.I.Vogel,QualitativeInorganicAnalysis,PrenticeHall,7thEdn.
2. A.I.Vogel,QuantitativeChemicalAnalysis,PrenticeHall,6thEdn.
3. B.D.Khosla,SeniorPracticalPhysicalChemistry,R.Chand&Co.

PRACTICAL-SCHEME OF EXAMINATION

Max. Marks: 50 (including 10 marks of internal) **Min. Marks: 18** **Time: 5 Hours**

Exercise

Experiment	Marks
Qualitative Inorganic analysis	**8**
Qualitative Organic analysis	**8**
Volumetric Analysis	**8**
Spotting (Six spots)	**6**
Viva	**5**
Record	**5**

Note :-

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination.

Theory (term end paper)-SCHEME OF EXAMINATION

Max. Marks: 100 (including 20 marks of internal) **Min. Marks: 36** **Time: 3 Hours**

There will be three sections in each theory paper
Section A – 10 questions (two questions from each unit),
Section B – 5 question (two questions from each unit with an internal choice of attempting one),
Section C - five question (one from each unit and three questions are to be attempted)

Section	Types of questions	Number of question	Marks	Difficulty Level	Learning outcome
A	5 Objective questions and 5 one line answer questions *(Word limit – one line ; 10 words)*	5+5 = 10 (two questions will be asked from each unit and all questions are to be attempted)	10 (1 marks for each question)	3 Easy 4 moderate 3 Tough	Critical thinking, Analytical ability, Judgment and exploration ability
B	Subjective questions with short answer (50-100 words) and or Questions based on diagrams / equation / AR	5 questions are to be attempted out of 10 questions (from each unit two questions will be asked with internal choice)	25 (5 marks for each question)	2 Easy 2 moderate 1 Tough	Accuracy, Precision and Phrase understanding with summary writing skill
C	Subjective questions with long answer / Descriptive diagram questions / Model designing questions / Project designing questions (400-1000 words)	3 questions are to be attempted out of 5 questions (from each unit one question will be asked with overall choice)	45 (15 marks for each question)	1 Easy 1 moderate 1 Tough	Writing and understanding, Proposal designing, Analytical skill and writing

Note : The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, project work, student fest, association / club activities etc.

A proper record of each student should be maintained with the concerned faculty / department. The marks given for each activity will be uploaded only once with term end semester examination. (A tentative marks distribution scheme may be considered as – Total internal 20 marks (4 marks for internal tests conducted with a gap of 40 days may be termed as internal test I and internal test II, 4 marks for weekly / periodic class tests, 4 marks for seminars, 4 marks for quizzes / activities, 4 marks for projects etc.)

The marks of internal assessment should not be based on merely two term tests.

SYLLABUS

Choice-Based Credit System (CBCS)

Maharaja Ganga Singh University

Bachelor of Science (B.Sc.) Chemistry

(Semester) 2025-26

Semester III

Department of Chemistry

Undergraduate Programme

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

Semester III Chemistry

Total 6 credits ; 150 marks

Type of Course	**Course Code**	**Title**	**Credit**	**Marks (External + Internal**	**Hours in a week**
Paper I Core course (DCC) (Theory) **[CHY-T-3]**	**CHY-T-3-** 5.0DCC**T**33	**CHEMISTRY - III**	4	100 (80 + 20)	6
Paper II Core course (DCC) (Lab) **[CHY-L-3]**	**CHY-L-3-** 5.0DCC**P**33	CHEMISTRY LAB - 3	2	50 (40 + 10)	4
	Total		**6**	**150 (120 + 30)**	**10**

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination and both the examiners will be appointed at Institute level.

For semester I, III and V no external examiner will be appointed by University. Instead, the examiners will be appointed by the Head of the institute / Principal of the college and both marks, term end practical and internal examination will be submitted to the university.

Course Code	**CHY-T-3-**5.0DCC**T**33
Type of the course	Core course (DCC) (Theory) course I of Semester III
Title of the Course	**CHEMISTRY - III**
Level of the Course	NHEQF5.0
Credit of the Course	**4**
Delivery sub-type of the course	Theory 6h Lecture per week
Pre-requisites and requisites of the course	Student enrolled and registered in UG Programme third semester.
Course Objectives	➢ To develop a basic understanding about the aromatic compounds ➢ To develop a basic understanding about the thermodynamics
Course Outcome	➢ After completion of course student will able to understand basic laws of thermodynamics and its application ➢ student will able to understand bonding in complex inorganic compounds ➢ student will able to understand basics of cyclo/aromatic compounds

Semester III

90 Hours (6 Hour/ week)

Unit-I

Thermodynamics-I: Definition of thermodynamics terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: statement, definition and internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry : Standard state, standard enthaply of formation-Hess's'Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutrilization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoffs equation.

Unit-II

Thermodynamics –II : Second law of Thermodynamics, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy: Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third Law of Thermodynamics :Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Variation of G with A and P, V and T.

Theories of chemical kinetics: Effect of temperature on rate of reaction, Arhenius concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis, characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

Unit-III

Chemistry of f-block Elements: Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds. General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Coordination Compounds: Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds. Isomerism in coordination compounds, Valence bond theory of transition metal complexes.

Organometallic Chemistry: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and Aryls of Al, Zn, Hg and Ti a brief account of metal- ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Unit-IV

Carboxylic Acid & their derivatives : Nomenclature, structure and bonding, physical properties, of Carboxylic acids and their derivatives. Eeffect of substituents on acid strength. Preparation, properties and uses of carboxylic acids, acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Methods of formation and chemical reactions of halo acids, hydroxy acids: malic, tartaric, citric acids, unsaturated monocarboxylic acids and Dicarboxylicacids.

Cycloalkanes & Cycloalkenes - Nomenclature, methods of formation, chemical reactions. Baeyer's strain theory and its limitations, ring strains in small rings (cyclopropane and cyclobutane), Theory of strainless rings, the case of cyclopropane ring: banana bonds. Methods of formation, confirmation and chemical reactions of Cycloalkenes.

Unit-V

Arenes and Aromaticity-Nomenclature of Benzene derivatives. The aryl group. Aromatic nucleus and side chain structure and properties of fused and bicyclic aromatic compounds like naphthalene, anthracene, phenanthrene, di benzene etc.

Aromatic electrophilic substitution- General pattern of the mechanism, role of sigma(σ) and pie(π) complexes. Mechanism of nitration, halogenation sulphonation, mercuration and Friedal- Craft's reactions, energy profile diagrams. Activating & deactivating substituents, orientation and ortho / para ratio, side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkyl benzenes, alkynyl benzenes and biphenyl.

इकाई–1

ऊष्मागतिकी पदों की परिभाषाएं : तंत्र परिपार्श्व, आदि। तंत्र के प्रकार, सीमित–मात्रा एवं स्वतंत्र–मात्रा गुणधर्म, अवस्था एवं पथ फलन एवं उनके अवकलन। उष्मागतिक प्रक्रम, उष्मा एवं कार्य संकल्पना।

ऊष्मागतिकी का प्रथम नियम :– प्रक्कथन, आन्तरिक ऊर्जा एवं पूर्ण ऊष्मा (एन्थैल्पी) की परिभाषा, ऊष्मा–धारिता, स्थिर आयतन एवं दाब पर ऊष्मा–धारिताएं एवं उनके मध्य सम्बन्ध। जल का नियम, जूल–थामसन गुणांक, व्युत्क्रम ताप। उत्क्रमणीय प्रक्रमों के लिये समतापीय एवं रूद्वोष्म प्रक्रम अवस्था में आदर्श गैस प्रसार के लिये w,q,dU एवं dH की गणनाएं।

ऊष्मा – रसायन :–

मनक अवस्था, मानक सम्भवन एन्थैल्पी, ऊष्मा संकलन का हेस का नियम व उसके अनुप्रयोग। स्थिरप दाब व स्थिर आपतन पर अभिक्रिया ऊष्मा। उदासीनीकरण की एन्थैल्पी। बन्ध–वियोजन ऊर्जा एवं उसकी ऊष्मा–रसायनिक आकड़ों से गणना, एन्थैल्पी की ताप पर निर्भरता। कर्चिोफ समीकरण।

ईकाई–II ऊष्मागतिकी–II :–

ऊष्मागतिकी का द्वितीय नियम :–

नियम की आवश्यकता नियम के विभिन्न कथन, कार्नोट चक्र एवं उसकी दक्षता। कार्नोट प्रमेय।

ताप का ऊष्मागतिकीय पैमाना, एन्ट्रॉपी की अवधारणा

रासायनिक बलगतिकी के सिद्धान्त :–

अभिक्रिया की दर पर ताप का प्रभाव, आहॅनिअस समीकरण अवस्था सिद्धान्त (साम्य संकल्पना) गतिज स्थिरांक आधारित साम्य स्थिरांक एवं ऊष्मागतिकी अवधारणाओं के व्यंजक। उत्प्रेरक, उत्प्रेरित अभिक्रियाओं के अभिलक्षणों, उत्प्रेरको के वर्गीकरण विभिन्न उदाहरण। साम्यावस्था निर्धारण में एन्ट्रापी की भूमिका। आदर्श गैसों एवं गैसों के मिश्रण में एन्ट्रॉपी परिवर्तन।

ऊष्मागतिकी का तृतीय नियम :– नेन्स्ट ऊष्मा सद्धान्त, अवशेष एन्ट्रॉपी कथन एवं धारणा, ऊष्माधारिता आकड़ों से निरपेक्ष एन्ट्रॉपी की गणना। गिब्ज एवं हेल्महोल्ट्ज फलन, ऊष्मागतिकी राशियों के रूप में गिब्स फलन (G) व हेल्महोल्ट्ज फलन (A)। ऊष्मागतिकी साम्य एवं स्वतः प्रक्रम परिवर्तन में A व G की भूमिकायें व एन्ट्रॉपी की तुलना में उसके लाभ। P, V एवं T के साथ G व A में परिवर्तन।

यूनिट III

F ब्लॉक तत्व के रसायन, इलेक्ट्रॉनिक विन्यास ऑक्सीकरण अवस्थायें, आयनिक त्रिज्या एवं लैन्थेनाईड संकुचन, संकुल निर्माण, लैन्थेनाईड तत्वों की उपस्थिति एवं निष्कर्षण, एक्टिनाइड तत्वों के सामान्य गुण, U से NP, Pu एवं Am के पृथ्क्करण का रसायन लैन्थेनाईड एवं ऐक्टिनाईड के बाद के तत्वों में समानतायें।

उपसहसंयोजन यौगिक : वर्नर सिद्धान्त, वर्नर सिद्धान्त का प्रायोगिक सत्यापन, प्रभावी परमाणु क्रमांक की अवधारणा, कीलेट, उपसहसंयोजक यौगिकों का नामकरण, उपसहसंयोजक यौगिकों में समावयक्ता, संक्रमण धातु संकुलो का संयोजकता बन्ध सिद्धान्त।

कार्बधात्विक रसायन : परिभाषा कार्बधात्विक यौगिको का नामकरण एवं वर्गीकरण में विरचन, गुण AL, Zn, Hg, Ti के ऐल्किल एवं ऐरिल के बन्धन एवं अनुप्रयोग 1 धातु ऐथिल संकुलों का संक्षिप्त विवरण, समांगी हाइड्रोजेनीकरण मोनानाभिकीय कार्बोनिल एवं धातु कार्बोनिलों के प्रकृति व बन्धन।

यूनिट IV

कार्बोक्सिलक अम्ल एवं उनके व्युत्पन्न : नामकरण, संरचना व बन्धन, कार्बोक्सिलिक अम्ल एवं व्युत्पन्न के भौतिक गुण, अम्लीय सार्मथ्य पर प्रतिस्थापियों का प्रभाव, कार्बोक्सिलिक अम्ल, अम्ल ऐनाहाइड्राठड, ऐमाइड (यूरिया) ऐस्टर, ऐरिड क्लोराइड के विरचन, गुण एवं अनुप्रयोग, ऐसिल व्युत्पनों का आपेक्षिक स्थायित्व, भौतिक गुण, नाभिक स्नेही ऐसिल प्रतिस्थापन द्वारा अम्ल व्युत्पन्नों का अन्तपरिवर्तन, हैलो अम्ल हाइड्राक्सी अम्ल, टॉटकरिक अम्ल, सिट्रिक अम्ल के विरचन एवं असंतृप्त मोनो कार्बोक्सालिक अम्ल, द्विक्षारकी अम्ल के विरचन की विधि एवं रसायनिक अभिक्रियाएं।

अभिक्रियाएं बेयर का विकृतिवाद सिद्धान्त एवं इनकी सीमायें, छोटे वलयो में वलय तनाव (साइक्लोप्रोपेन एवं साइक्लो ब्यूटेन), विकृतिहीन वलयों का सिद्धान्त, साइक्लो प्रोपेन वलय केला बन्ध। साइक्लो ऐलकीन के बनाने की विधियों, संरूपण, एवं रसायनिक अभिक्रियाऐं।

यूनिट V

ऐरीन एवं ऐरोमैटिकता : बेंजीन व्युत्पन्न के नामकरण, ऐरिल समूह, संलयन और द्विचक्रीय ऐरोमैटिक यौगिक जैसे नफ्थलीन, ऐथ्रासीन, फेनान्थ्रीन एवं डाई बेजीन आदि के ऐरोमैटिक नाभिक व पाश्व श्रृंखला की संरचना एवं गुण।

ऐरोमैटिक यौगकों में इलेक्ट्रान स्नेही प्रतिस्थापन : सामान्य क्रियाविधि एवं त्र संकुलो का कार्य, नाईट्रीकरण एवं फ्रीडल क्रफ्ट्स अभिक्रियाओं की क्रियाविधि, ऊर्जा अवस्था चित्र, सक्रिय कारक एवं निष्क्रियकारक प्रतिस्थापन, अभिविन्यास एवं आर्थे/पैरा अनुपात, बेन्जीन व्युपन्नों की पार्श्व श्रृंखला, अभिक्रिमायें बर्च अपचयन। ऐल्किल बेन्जीन ऐल्काईनिल बेन्जीन एवं वाइफेनिल के विरचन की विधियां तथा रासायनिक अभिक्रियाएं।

Course Code	**CHY-L-3-**5.0DCC**P**33
Type of the course	Core course (DCC) (Practical)
Title of the Course	CHEMISTRY LAB - 3
Level of the Course	NHEQF5.0
Credit of the Course	**2**
Delivery sub-type of the course	**Practical 4h Laboratory per week**
Course Objectives	➢ To develop a basic understanding about the chromatographic analysis ➢ To develop an understanding towards the experimental importance of Kinetics and Thermodynamics.
Course Outcome	➢ After completion of lab student will able to understand and apply basic separation procedures. ➢ Students will able to apply basic thermodynamic and kinetic principles on simple commercial samples.

Chemistry Lab 3

CHEMISTRY LAB – 3

PRACTICAL

60 hours (4 h per week)

A Qualitative Analysis & Chromatography

Analysis of given organic mixture containing two solid components Using water , $NaHCO_3$ or NaOH for separation and preparation of suitable derivatives. **Chromatography: Determination of R_f values and identification of organic compounds.**

(i) Preparation and separation of 2, 4-dinitrophenylhydrozone of acetone, 2-butanone, hexan-2- and 3-one using toluene and light petroleum (40 :60). (Thin layer chromatography)

(ii) Separation of a mixture of dyes using cyclohexane and ethyl acetate(8.5 : 1.5). (Thin layer chromatography)

(iii) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent-ninhydrin.

(Paper chromatography : Ascending and Circular),

(iv) Separation of a mixture of D, L-alanine, glycine and L-Leucine using n-butanol: acetic acid : water (4:1:5), spray reagent-ninhydrin.

(Paper chromatography : Ascending and Circular).

(v) Separation of monosachharides-a mixture of D-galactose and D-frutose using n-butanol: acetone: water (4:5:1) spray reagent-aniline hydrogen phthalate.

(Paper chromatography: Ascending and Circular).

B C**hemical Kinetics**

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.

2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strengths of HCI and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.
4. To study kinetically the reaction of decomposition of iodide by H_2O_2.

C Thermodynamics

1. Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. $MnCl_2.2H_2O/SrBr_22H_2O$.)
2. To study the effect of a solute (e.g. NaCI, suecinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol water system.
3. To construct the phase diagram of two component (e.g. diphenylamine-benzophenone) system by cooling curve method.
4. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
5. To determine the enthalpy of neutralisation of weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
6. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Note : Similar exercise may be set in question paper as per availability

PRACTICAL-SCHEME OF EXAMINATION

Max. Marks: 50 (including 10 marks of internal) **Min. Marks: 18** **Time: 5 Hours**

Exercise

Experiment	Marks
Qualitative Analysis & Chromatography	**10**
C**hemical Kinetics**	**10**
Thermodynamics	**10**
Viva	**5**
Record	**5**

Note :-

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination and both the examiners will be appointed at Institute level.

For semester I, III and V no external examiner will be appointed by University. Instead, the examiners will be appointed by the Head of the institute / Principal of the college and both marks, term end practical and internal examination will be submitted to the university.

Theory (term end paper)-SCHEME OF EXAMINATION

Max. Marks: 100 (including 20 marks of internal) **Min. Marks: 36** **Time: 3 Hours**

There will be three sections in each theory paper
Section A – 10 questions (two questions from each unit),
Section B – 5 question (two questions from each unit with an internal choice of attempting one),
Section C - five question (one from each unit and three questions are to be attempted)

Section	Types of questions	Number of question	Marks	Difficulty Level	Learning outcome
A	5 Objective questions and 5 one line answer questions *(Word limit – one line ; 10 words)*	5+5 = 10 (two questions will be asked from each unit and all questions are to be attempted)	10 (1 marks for each question)	3 Easy 4 moderate 3 Tough	Critical thinking, Analytical ability, Judgment and exploration ability
B	Subjective questions with short answer (50-100 words) and or Questions based on diagrams / equation / AR	5 questions are to be attempted out of 10 questions (from each unit two questions will be asked with internal choice)	25 (5 marks for each question)	2 Easy 2 moderate 1 Tough	Accuracy, Precision and Phrase understanding with summary writing skill
C	Subjective questions with long answer / Descriptive diagram questions / Model designing questions / Project designing questions (400-1000 words)	3 questions are to be attempted out of 5 questions (from each unit one question will be asked with overall choice)	45 (15 marks for each question)	1 Easy 1 moderate 1 Tough	Writing and understanding, Proposal designing, Analytical skill and writing

Note : The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, project work, student fest, association / club activities etc.

A proper record of each student should be maintained with the concerned faculty / department. The marks given for each activity will be uploaded only once with term end semester examination. (A tentative marks distribution scheme may be considered as – Total internal 20 marks (4 marks for internal tests conducted with a gap of 40 days may be termed as internal test I and internal test II, 4 marks for weekly / periodic class tests, 4 marks for seminars, 4 marks for quizzes / activities, 4 marks for projects etc.)

The marks of internal assessment should not be based on merely two term tests.

SYLLABUS

Choice-Based Credit System (CBCS)

Maharaja Ganga Singh University

Bachelor of Science (B.Sc.) Chemistry

(Semester) 2025-26

Semester IV

Department of Chemistry

Undergraduate Programme

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

Semester IV Chemistry

Total 6 credits ; 150 marks

Type of Course	**Course Code**	**Title**	**Credit**	**Marks (External + Internal**	**Hours in a week**
Paper I Core course (DCC) (Theory) **[CHY-T-4]**	**CHY-T-4-** 5.0DCC**T**43	**Chemistry- IV**	4	100 (80 + 20)	6
Paper II Core course (DCC) (Lab) **[CHY-L-4]**	**CHY-L-4-** 5.0DCC**P**43	CHEMISTRY LAB - 4	2	50 (40 + 10)	4
	Total		**6**	**150 (120 + 30)**	**10**

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination.

Course Code	**CHY-T-4-**5.0DCC**T**43
Type of the course	Core course (DCC) (Theory) course I of Semester IV
Title of the Course	**CHEMISTRY - IV**
Level of the Course	NHEQF5.0
Credit of the Course	**4**
Delivery sub-type of the course	Theory 6h Lecture per week
Pre-requisites and requisites of the course	Student enrolled and registered in UG Programme fourth semester. He/she should have biology background.
Course Objectives	➢ To develop a basic understanding about coordination compounds, complexes and aromatic reactions ➢ To develop a basic understanding about the electrochemistry
Course Outcome	➢ After completion of course student will able to understand basic laws of electrochemistry and its application ➢ student will able to understand metal – ligand bonding inorganic compounds ➢ student will able to understand basics of aromatic nucleophilic reactions

Semester IV

PAPER-I

90 Hours (6 Hour/ week)

Unit-I

Metal-ligand Bonding in Transition Metal Complexes: Limitation of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors. affecting the crystal Field Parameters

Thermodynamic and Kinetic Aspect of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit-II

Magnetic Properties of Transition Metal Complexes: Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of $\square_s$and $\square$eff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Electron Spectra of **Transition Metal Complexes:** Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6J^{3+}$ complex ion.

Unit-III

Electrochemistry: Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, meas+urement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrahusch law, Arrehenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only).

Transport number- Definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements : Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Electrolytic and Galvanic cells-reversible and irreversible cells, EMF of a cell and its measurements. Computation of cell EMF. Concentration cell with and without transport, liquid junction potential, application of concentration cells.

Corrosion-Types, theories and methods of combating it.

Unit-IV

Aryl halides: Nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophillic aromatic substitution reactions. Synthesis and uses of D.D.T. and B.H.C.

Phenols: Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis; Hauben-Hooesch reaction, Lederer-Manasse reaction and Reimeer-Tiemann reaction.

Unit-V

Aromatic nucleophilic substitution: Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.

Halonitroarenes: Reactivity; Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity, of amines. Amines salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic andketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthesis, transformation of aryl diazonium salts, azo coupling.

यूनिट I

संक्रमण धातु संकुलों में धातु–लिगक्ड बन्धन।

संयोजकता बन्ध सिद्धान्त की सीमाएं, क्रिस्टल क्षेत्र सिद्धान्त का प्रारम्भिक अभिप्राय, ऊष्टफलकीय, चतुफलकीय तथा वर्ग समतलीय संकुलो में क्रिस्टल क्षेत्र विभाजन, क्रिस्टल क्षेत्र पैरामीटर को प्रभावित करने वाले कारक।

धातु संकलो के ऊषगतिकीय एवं गतिकीय पहलू :– धातु संकलो के ऊष्मागतिकीय स्थायित्व की संक्षिप्त रूपरेखा और स्थायित्व को प्रभावित करने वाले कारक, वर्ग समतल संकुलो की प्रतिस्थापन अभिक्रियाएं।

इकाई II

संक्रमण धातु संकुलो के चुम्बकीय गुण :– चुम्बकीय व्यवहार के प्रकार, चुम्बकीय प्रवृति के

निर्धारण की विधियां, चक्रण मात्र सूत्र, L-S युग्मन, u, तथा Mv मानो में अन्तसम्बन्ध, चुम्बकीय आपूर्ण में कक्षकीय योगदान, उन संकुलो केलिये चुम्बकीय आपूर्ण आंकड़ो के अनुप्रयोग। संक्रमण धातु संकुलो के इलेक्ट्रान स्पेक्ट्रा। इलेक्ट्रानिक संक्रमण के प्रकार, वन्व संक्रमण के लिये चयन के नियम, स्पेक्ट्रोस्कोपक निम्नतम अवस्था, स्पेब्ट्रोरासायनिक श्रेणी, वे एवं तं अवस्थाओं के लिये आर्गल ऊर्जा अवस्था आरेख [II)H2O)6]3+ संकुल, आयन के इलेक्ट्रॉनिक स्पेक्ट्र की व्याख्या।

इकाई III

विद्युत रसायन :– विद्युत का अभिगमन, धातुओं एवं विद्युत वलयनों में चालकता, विशिष्ट चालकता एवं तुल्यांकी चालकता तुल्यांकी चालकता का मापन, तनुता के साथ तुल्याकी चालकता एवं विशिष्ट चालकता का परिवर्तन, आयनों का अभिगमकन एवं कोलराऊश का नियम, विद्युत वियोजन का आर्हीनियस सिद्धान्त एवं उसकी सीमाएं, दुर्बल एवं प्रबल विद्युत अपघट्य, ओस्टवाल्ड का तनुता नियम, उसके उपयोग एवं सीमाएं, प्रबल विद्युत अपघट्यो के लिये डिकाई हवल ऑन्सेगर सीमाकरण (लेवल प्रारम्भिक उपचार) ।

अभिगमनांक :– परिभाषा एवं हिटॉर्फ विधि एवं चल सीमा विधि द्वारा इसका मापन। चालकता मापन के अनुप्रयोग, वियोजन की मात्रा का निर्धारण, अम्लों के Ka का निर्धारण,

अभिगमनांक :– परिभाषा एवं हिटॉर्फ विधि एवं चल सीमा विधि द्वारा इसका मापन। चालकता मापन के अनुप्रयोग, वियोजन की मात्रा का निर्धारण, अम्लों के Ka का निर्धारण, अल्पविलयशील लवणों के विलेयता गुजन फल का निर्धारण, चालकता मूलक अनुमापन विद्युत अपघटनी एवं गैल्टोनिक सेल, उत्क्रमणीय या अनुत्क्रमणीय सेल का EMF एवं मापन, सेल EMF की गाना, अभिगमन रहित सान्द्रता सेल एवं अभिगमन युक्त सान्द्रता सेल, द्रव सन्धि विभव।

संक्षारण :– प्रकार, सिद्धान्त एवं संघर्ष विधियां।

इकाई IV

ऐरिल हैलाइड :– नाभिकीय एवं पार्श्व श्रृंखला अभिक्रियाएं नाभिक स्नेही ऐरोमेटिक प्रतिस्थापन के विलोपन – यौगात्मक, योगत्मक–विलीयन अभिक्रियाओं की क्रिया विधि, DDT एवं BHC के संश्लेषण एवं उपयोग।

फीनॉल :– ऐल्कोहौलो तथा फीनालो के अम्ल सामर्ध्य की तुलना, अनुवाद एवं फीनाक्साइड आयन का स्थायित्व, फीनाल की अभिक्रियाएं – इलेक्ट्रान स्नेही ऐरोमैटिव प्रतिस्थापन, ऐसिटिलीकरण, कार्बोक्सिलीकरण फाइज पुनर्विन्यास, ब्लेजन पुर्वान्यास, गॉटरमान संश्लेषण हाइबेन हॉश अभिक्रिया, लेडेरर – मनासे अभिक्रियेा एवं राइमन टाइमन अभिक्रियाओं की क्रिया विधि।

इकाई V

ऐरोमेटिक नाभिकीय स्नेही प्रतिस्थापन :– नाईट्रो ऐरिन में नभिक स्नेही प्रतिस्थापन की क्रियाविधि एवं अमनीय, क्षारीय एवं उदासीन माध्यम में अपचमन, पिक्रिक अम्ल। हेलोनाट्रोऐरीन – क्रियाशीलता, ऐमीन के भौतिक गुण संरचना एवं नामकरण ऐमीन की क्षिविम समावयवता, प्राथकि, द्वितीयक एवं तृतीयक ऐीन के मिश्रण का पृथक्करण, सेमीनो की क्षारकीय प्रकृति पर संरचना का प्रभाव, ऐमीन लवणों का प्रवस्था स्थानान्तरण उत्प्रेरक के रूप में उपयोग, ऐलिवल एवं ऐरिलऐमीन बनाने की विधियां (नाईट्रो एवं नाइट्रिल यौगिको का अपचयन), ऐल्डिहाइडी एवं कीटोनी यौगिको का अपचयनी ऐमीनीकरण, गेब्रियल थैलिमाइड अभिक्रिया, हॉफमैन ब्रोमऐमाइड अभिक्रिया, ऐमिन की अभिक्रियाएं, ऐरिल ऐमीन में इलेक्ट्रॉन स्नेही ऐरामेटिक प्रतिस्थापन, ऐमीन की नाइट्रस अम्ल से अभिक्रिया, ऐटिल डाइजोनियम लवण के सांश्लेषिक रूपान्तरण ऐजो युम्मन।

Course Code	**CHY-L-4-**5.0DCC**P**43
Type of the course	Core course (DCC) (Practical)
Title of the Course	CHEMISTRY LAB - 4
Level of the Course	NHEQF5.0
Credit of the Course	**2**
Delivery sub-type of the course	**Practical 4h Laboratory per week**
Course Objectives	➢ To develop a basic understanding about the gravimetric analysis and inorganic synthesis ➢ To develop an understanding towards the experimental importance of electrochemistry and distribution laws.
Course Outcome	➢ After completion of lab student will able to understand and apply basic gravimetric and synthesis procedures. ➢ Students will able to apply basic electrochemical and distribution principles on simple commercial samples.

Chemistry Lab 4

CHEMISTRY LAB – 4

PRACTICAL

60 hours (4 h per week)

A Gravimetric Analysis

Gravimetric estimation of Cu, Ba, Mg, Fe etc.

B Inorganic Synthesis

(a) Sodium trioxalato ferrate (III), Na_3 $[Fe(C_2O_4)_3]$

(b) Ni-DMG complex, $[Ni\ (DMG)_2]$

(c) Copper tetrammine complex $[Cu(NH_3)]_4\ SO_4$.

(d) Cis-and trans-bisoxalato diaqua chromate (III) ion.

C Electrochemical studies : pH metric studies, conductometric studies of simple solutions**.** Preparation of few simple cells and batteries.

D Colloids & Distribution Law

1. To study the distribution of iodine between water and CCl_4
2. To study the distribution of benzoic acid between benzene and water

3. **Preparation of few colloidal systems viz** arsenious sulphide sol and compare the precipitating power of mono- ,bi- and trivalent anions.

Note : Similar exercise may be set in question paper as per availability

PRACTICAL-SCHEME OF EXAMINATION

Max. Marks: 50 (including 10 marks of internal) **Min. Marks: 18** **Time: 5 Hours**

Exercise

Experiment	Marks
A Gravimetric Analysis	**8**
B Inorganic Synthesis	**8**
C Electrochemical studies	**8**
A Colloids & Distribution Law	**6**
Viva	**5**
Record	**5**

Note :-

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination.

Theory (term end paper)-SCHEME OF EXAMINATION

Max. Marks: 100 (including 20 marks of internal)**Min. Marks: 36** **Time: 3 Hours**

There will be three sections in each theory paper
Section A – 10 questions (two questions from each unit),
Section B – 5 question (two questions from each unit with an internal choice of attempting one),
Section C - five question (one from each unit and three questions are to be attempted)

Section	Types of questions	Number of question	Marks	Difficulty Level	Learning outcome
A	5 Objective questions and 5 one line answer questions *(Word limit – one line ; 10 words)*	5+5 = 10 (two questions will be asked from each unit and all questions are to be attempted)	10 (1 marks for each question)	3 Easy 4 moderate 3 Tough	Critical thinking, Analytical ability, Judgment and exploration ability
B	Subjective questions with short answer (50-100 words) and or Questions based on diagrams / equation / AR	5 questions are to be attempted out of 10 questions (from each unit two questions will be asked with internal choice)	25 (5 marks for each question)	2 Easy 2 moderate 1 Tough	Accuracy, Precision and Phrase understanding with summary writing skill

C	Subjective questions with long answer / Descriptive diagram questions / Model designing questions / Project designing questions (400-1000 words)	3 questions are to be attempted out of 5 questions (from each unit one question will be asked with overall choice)	45 (15 marks for each question)	1 Easy 1 moderate 1 Tough	Writing and understanding, Proposal designing, Analytical skill and writing

Note : The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, project work, student fest, association / club activities etc.

A proper record of each student should be maintained with the concerned faculty / department. The marks given for each activity will be uploaded only once with term end semester examination. (A tentative marks distribution scheme may be considered as – Total internal 20 marks (4 marks for internal tests conducted with a gap of 40 days may be termed as internal test I and internal test II, 4 marks for weekly / periodic class tests, 4 marks for seminars, 4 marks for quizzes / activities, 4 marks for projects etc.)

The marks of internal assessment should not be based on merely two term tests.

SYLLABUS

Choice-Based Credit System (CBCS)

Maharaja Ganga Singh University

Bachelor of Science (B.Sc.) Chemistry

(Semester) 2025-26

Semester V

Department of Chemistry

Undergraduate Programme

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

Semester V Chemistry

Total 6 credits ; 150 marks

Type of Course	**Course Code**	**Title**	**Credit**	**Marks (External + Internal**	**Hours in a week**
Paper I Core course (DCC) (Theory) **[CHY-T-5]**	**CHY-T-5-A-** 5.5DCC**T**53	**Chemistry- V**	4	100 (80 + 20)	6
Paper II Core course (DCC) (Lab) **[CHY-L-5]**	**CHY-L-5-** 5.5DCC**P**53	CHEMISTRY LAB - 5	2	50 (40 + 10)	4
	Total		**6**	**150 (120 + 30)**	**10**

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination.

For semester I, III and V no external examiner will be appointed by University. Instead, the examiners will be appointed by the Head of the institute / Principal of the college and both marks, term end practical and internal examination will be submitted to the university.

Course Code	**CHY-T-5 -**5.5DCC**T**53
Type of the course	Core course (D CC) (Theory) course I of Semester V
Title of the Course	**CHEMISTRY – V**
Level of the Course	NHEQF5.5
Credit of the Course	**4**
Delivery sub-type of the course	Theory 6h Lecture per week
Pre-requisites and requisites of the course	Student enrolled and registered in UG Programme fifth semester.
Course Objectives	➢
Course Outcome	➢

Semester V

PAPER-I

Chemistry V - CHY-T-5 -5.5DCC**T**13

90 Hours (6 Hour/ week)

Unit-I

(a) Hard and Soft Acids and Bases (HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and Softness. Lux-Flood concept of acid base and its limitation. Lewis concept and its limitation Usanovich concept. A generalized acid –base concept.

(b) Non-aquenous Solvents:

Physical properties of a solvent, types of solvent and their general characteristics reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Unit-II

Heterocyclic Chemistry

Nomenclature , preparation and properties of compounds having one heteroatom with five and six member ring (Pyrrole, Thiophene, Furan and Pyridine)

Organic Synthesis Via Enolates

Acidity of □-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate:, the Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes.Alkylation and acylation of enamines.

Unit-III

Polymers

General Classification of Natural and Synthetic Polymers. Concept of molecular weight of polymer. Chemical and Physical properties of polymers. Addition of chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegier-Natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides, phenol- formaldehyde resins, urea- formaldehyde resins, epoxy resins and polyurethanes.

Synthetic Dyes

Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolpthalein, Fluorescein, Alizarin and Indigo.

Unit-IV

Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect.

De Brogile hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiitonian operator, Schrodinger wave equation and its importance, physical interpretation of the **wave** function, postulates of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit-V

Basic chemistry in everyday life: Structure of matter in Nature, molecule stability check by Born-Haber Cycle, solubility check by fajan's rule. Mg in chiorophyll and Li in lithium ion batteeries, Na-K pump in nervous system. Si and Ge in semiconductors. Ozone deplection by CFCs, free radicals in aging, medicine, cosmetics, various fuels and fabrics. isomers in human body through enzymatic reactions. 50% drugs as optical isomers. Cis platin as anticancer drug. LPG, CNG, Biogas as hydrocarbon, ethylene in fruits ripening, polythene bags, pvc, Acetylene in welding torch, fuel and plastic industry.

CHEMISTRY LAB - 5

PRACTICAL

60 hours (4 h per week)

Course Code	**CHY-L-5-** 5.5DCC**P**53
Type of the course	Core course (DCC) (Practical)
Title of the Course	**CHEMISTRY LAB - 5**
Level of the Course	NHEQF5.5
Credit of the Course	**2**
Delivery sub-type of the course	**Practical 4h Laboratory per week**
Course Objectives	➢
Course Outcome	➢

A. Synthesis & Analysis

(i)Inorganic Synthesis

(a) Sodium trioxalato ferrate (III), Na_3 $[Fe(C_2O_4)_3]$

(b) Ni-DMG complex, $[Ni\ (DMG)_2]$

(c) Copper tetrammine complex $[Cu(NH_3)]_4\ SO_4$.

(d) Cis-and trans-bisoxalato diaqua chromate (III) ion.

(ii) Analysis

Semi micro and Macro analysis , Separation and Identification of

Six radicals - three acidic and three basic from a mixture with one interfering radicals and/or combinations of radicals.

B. Utilization of Laboratory Techniques

(i)Laboratory Techniques

(a) Steam Distillation

(b) Naphthalene from its suspension in water

(c) Clove Oil form Cloves

(d) Separation of o-and p-nitrophenols

(e) Column Chromatography

(f) Separation of fluorescene and methylene blue

(g) Separation of leaf pigments form spinach leaves

(h) Resolution of racemic mixture of (±) mandelic acid

(ii) Stereochemical Study of Organic Compounds via Models

(a) R and S configuration of optical isomers.

(b) E and Z configuration of geometrical isomers.

(c) Conformational analysis of cyclohexanes and substituted cyclohexanes.

C. Physical Chemistry Experiments

1. To determent the strength of the given acid conductometrically using standard alkali solution.
2. To determime the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
3. To study the saponification of ethyl acetate conductometrically.
4. To determint the ionisation constant of a weak acid conductometrically.
5. To tirate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4$/$K_2Cr_2O_7$ /$CuSO_4$ as titrant calculate the redox potential of Fe++/Fe+++ system on the hydrogen scale.
6. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.

Seminar and Project work

A seminar and Project work should be allotted to each student. Marks will be awarded by panel of examiners / experts (who will conduct seminars) constituted internally and panel will submit the marks in sealed envelope to HOD who will hand over it to external examiner during final University examination.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic Analysis, revised, Svehta, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimental inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
6. Inorganic Synthesis, McGraw Hill.
7. Experimental Organic Chemistry Vol. l&ll, P.R.Singh, D.S.Gupta and K.S. Bajpai, Tata McGraw Hill.
8. Laboratory Mannual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
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10. Experiments in General Chemistry, C.N.R; and U.C. Agarwal, East-West press.
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12. Advanced Practical Physical Chemistry, Vol. I-Physical, J.B. Yadav, Goel Publishing House.
13. Advanced Experimental Chemistry, Vol. I-Physical, J.N. Gurju and R. Kapoor, S Chand & Co.
14. Selected Experiments in Physical Chemistry, N.G. Mukherjee. J.N. Ghose & Sons.
15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

PRACTICAL-SCHEME OF EXAMINATION

Max. Marks: 50 (including 10 marks of internal) **Min. Marks: 18** **Time: 5 Hours**

Exercise

Experiment	Marks
A Instrumentation (any one)	**8**
B Applied Chemistry Experiments (any one)	**8**
C Physical Chemistry Experiments (any one)	**8**
Seminar and Project work	**6**
Viva	**5**
Record	**5**

Note :-

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination.

For semester I, III and V no external examiner will be appointed by University. Instead, the examiners will be appointed by the Head of the institute / Principal of the college and both marks, term end practical and internal examination will be submitted to the university.

Theory (term end paper)-SCHEME OF EXAMINATION

Max. Marks: 100 (including 20 marks of internal) **Min. Marks: 36** **Time: 3 Hours**

There will be three sections in each theory paper
Section A – 10 questions (two questions from each unit),
Section B – 5 question (two questions from each unit with an internal choice of attempting one),
Section C - five question (one from each unit and three questions are to be attempted)

Section	Types of questions	Number of question	Marks	Difficulty Level	Learning outcome
A	5 Objective questions and 5 one line answer questions *(Word limit – one line ; 10 words)*	5+5 = 10 (two questions will be asked from each unit and all questions are to be attempted)	10 (1 marks for each question)	3 Easy 4 moderate 3 Tough	Critical thinking, Analytical ability, Judgment and exploration ability
B	Subjective questions with short answer (50-100 words) and or Questions based on diagrams / equation / AR	5 questions are to be attempted out of 10 questions (from each unit two questions will be asked with internal choice)	25 (5 marks for each question)	2 Easy 2 moderate 1 Tough	Accuracy, Precision and Phrase understanding with summary writing skill
C	Subjective questions with long answer / Descriptive diagram questions / Model designing questions / Project designing questions (400-1000 words)	3 questions are to be attempted out of 5 questions (from each unit one question will be asked with overall choice)	45 (15 marks for each question)	1 Easy 1 moderate 1 Tough	Writing and understanding, Proposal designing, Analytical skill and writing

Note : The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, project work, student fest, association / club activities etc.

A proper record of each student should be maintained with the concerned faculty / department. The marks given for each activity will be uploaded only once with term end semester examination. (A tentative marks distribution scheme may be considered as – Total internal 20 marks (4 marks for internal tests conducted with a gap of 40 days may be termed as internal test I and internal test II, 4 marks for weekly / periodic class tests, 4 marks for seminars, 4 marks for quizzes / activities, 4 marks for projects etc.)

The marks of internal assessment should not be based on merely two term tests.

SYLLABUS

Choice-Based Credit System (CBCS)

Maharaja Ganga Singh University

Bachelor of Science (B.Sc.) Chemistry

(Semester) 2025-26

Semester VI

Department of Chemistry

Undergraduate Programme

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

Semester VI Chemistry

Total 6 credits ; 150 marks

Type of Course	**Course Code**	**Title**	**Credit**	**Marks (External + Internal**	**Hours in a week**
Paper I Core course (DCC) (Theory) **[CHY-T-6]**	**CHY-T-6-** 5.5DCC**T**63	**Chemistry- VI**	4	100 (80 + 20)	6
Paper II Core course (DCC) (Lab) **[CHY-L-6]**	**CHY-L-6-** 5.5DCC**P**63	CHEMISTRY LAB - 6	2	50 (40 + 10)	4
	Total		**6**	**150 (120 + 30)**	**10**

The marks of Internal Examination should be given on the basis of two term tests (should be conducted within a minimum gap of 40 days), regular class tests, seminar, quizzes, artwork, model preparations, student fest, chemistry association / science club activities etc.)

For Term end practical examination board of examiner (Two members one external and one internal) will conduct the examination.

Course Code	**CHY-T-6 -**5.5DCC**T**63
Type of the course	Core course (DCC) (Theory) course I of Semester V
Title of the Course	**CHEMISTRY – VI**
Level of the Course	NHEQF5.5
Credit of the Course	**4**
Delivery sub-type of the course	Theory 6h Lecture per week
Pre-requisites and requisites of the course	Student enrolled and registered in UG Programme fifth semester.
Course Objectives	➢
Course Outcome	➢

Semester VI

PAPER-I

Chemistry VI

90 Hours (6 Hour/ week)

Unit-I

Spectroscopy

Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum

Diatomic molecules, Energy levels of arigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell- Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

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 an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selction rules.

Unit-II

NMR Spectroscopy

Nucelear Magnetic resonance (NMR) spectroscopy. Paramagnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and NMR spectroscopic techniques.

Unit-III

Bioinorganic Chemistry

Essential and trace elements in biological processes, metallporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}, nitrogen fixation.

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behavior, electrophoresis. Preparation and reactions of □-amino acids, structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure .determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis. solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/renaturation.

Nucleic acids: Introduction, Constitution of nucleic acids-Ribnonucleosides and ribonucleotides. The double helical structure of DNA. '

Unit-IV

Carbohydrates

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

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides e.g. starch and cellulose (without involving structure determination.)

Unit-V

Synthetic drugs: Introduction, medicinal value, precautions, pharmacology - mechanism of action, merits and demerits. Green Synthesis. Green Chemistry & Pharmacy, Drugs acting on brain and nervous system, psychoactive drugs. Depressants, Stimulants, hallucinogens – sources, effects, basic mechanism of action.

Scope of medicinal chemistry, indigenous medical system, Ayurveda, Siddha, Unani, Homeopathy, Tibetian & folklore system of medicine, need to preserve knowledge system. Green Extraction

CHEMISTRY LAB – 6

PRACTICAL

60 hours (4 h per week)

Course Code	**CHY-L-6-** 5.5DCC**P**63
Type of the course	Core course (DCC) (Practical)
Title of the Course	**CHEMISTRY LAB - 6**
Level of the Course	NHEQF5.5
Credit of the Course	**2**
Delivery sub-type of the course	**Practical 4h Laboratory per week**
Course Objectives	➢
Course Outcome	➢

CHEMISTRY LAB - 6

PRACTICAL

60 hours (4 h per week)

A. Instrumentation

(i) Colorimetry

(a)To determine Metal- Ligand ratio of complexes by Jobs method

(b) To determine Metal- Ligand ratio of complexes by Mole Ratio method

(c) Determination of adulteration in Food Stuffs.

(d) Effluent or waste water analysis.

(e) Ground Water Analysis.

(ii) Solvent Extraction: Separation and estimation of Mg(II) and Fe(II) ions.

(iii) Exchange Method: Separation and estimation Mg(II) and Zn(II) ions.

B. Applied Chemistry Experiments

(i) Determination of following parameters of oils & fats

(a) Saponification Value

(b)Iodine Value and /or

(c)R.M. Value

(ii) Green Chemistry Synthesis – Solventless synthesis of aldol derivative or any other compound

C. Physical Chemistry Experiments

1. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
2. To determine the specific rotation of a given optically active compound.

3. Determination of molecular weight of a non-violatile solute by Rast method/Backmann freezing point method.

4. Determination of the apparent degree of dissociation of an electolyte (e.g- Na Cl) in aqueous solution at different concentrations by ebullioscopy.

5. To verify Beer-Lambert law for $KMnO_4/K_2$, Cr_2, O_7 and determine the concentration of the given solution of the substance.

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