Scheme A

Chaudhary Ranbir Singh University, Jind

Scheme of Examination for the Chemistry Subject in Under Graduate Programmes

As per NEP 2020 Curriculum and Credit Framework for Undergraduate Programmes

(Multiple Entry- Exit, Internships and Choice Based Credit System LOCF) with effect from the session 2023-24 (in phased manner)

Semester	Course Type	Applicable Scheme	Course Code	Nomenclature of course	Credits			Contact hours L: Lecture P: Practical T:Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
					Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
1	CC-1	Scheme A	B-23-CHE-101	**Chemistry-I**	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M1	Scheme A & D	B-23-CHE-102	**Minor Chemistry-I**	2	2	0	2	0	2	15	0	35	00	50	3	0
	MDC-1	Scheme A & D	B-23-CHE-103	**Introductory Chemistry-I**	3	2	1	2	2	4	15	5	35	20	75	3	3
2	CC-2	Scheme A	B23-CHE-201	**Chemistry-II**	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M2	Scheme A & D	B23-CHE-202	**Minor Chemistry-II**	2	2	0	2	0	2	15	0	35	00	50	3	0

	MDC-2	Scheme A & D	B-23-CHE-203	**Introductory Chemistry-II**	3	2	1	2	2	4	15	5	35	20	75	3	3
	Internship of 4 credits of 4-6 weeks duration after 2nd Semester																
3	CC-3	Scheme A	B-23-CHE-301	**Chemistry-III**	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M3	Scheme A & D	B-23-CHE-301	**Chemistry-III**	4	3	1	3	2	5	20	10	50	20	100	3	3
	MDC-3	Scheme A & D	B23-CHE-302	**Introductory Chemistry-III**	3	2	1	2	2	4	15	5	35	20	75	3	3
4	CC-4	Scheme A	B-23-CHE-401	**Chemistry-IV**	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M4(V)	Scheme A	**From The Available pool of Vocational courses of 4 credits of University as per NEP**		4	3	1	3	2	5	20	10	50	20	100	3	3
	Internship of 4 credits of 4-6 weeks duration after 4th Semester (if not done after second semester)																

	C-5	Scheme A	B23-CHE-501	**Chemistry-V**	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M5 (V)	Scheme A	**From The Available pool of Vocational courses of 4 credits of University as per NEP**		4	3	1	3	2	5	20	10	50	20	100	3	3
6	CC-6	Scheme A	23-CHE-601	**Chemistry-VI**	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M6(V)	Scheme A	**From The Available pool of Vocational courses of 4 credits of University as per NEP**		4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M7(V)	Scheme A	**From The Available pool of Vocational courses of 4 credits of University as per NEP**		4	3	1	3	2	5	20	10	50	20	100	3	3

Note: Four Credits of Internship Earned By a Student during Summer Internship after 2nd Semester or 4th Semester Will Be Taken Into Account In Fifth Semester of a Student Who Pursue 3 Year UG Programme Without Taking Exit Option

Coursecomposition-Theory/Theory+Tutorial			
Course Credit	InternalAssessmentmarks	Endtermexammarks	Totalmarks
2	15	35	50
3	25	50	75
4	30	70	100

Coursecomposition-Theory+Practical					
Course Credit	Theory		Practical		Totalmarks
Theory+Practical	InternalAssessmentmarks	Endtermexammarks	InternalAssessmentmarks	Endtermexammarks	
1+1	10	20	5	15	50
2+1	15	35	5	20	75
2+2	15	35	15	35	100
3+1	20	50	10	20	100
0+4	NA	NA	30	70	100

1. Internal assessment(30%)shallbebroadlybasedonthefollowingdefinedcomponentsof;
   a. Classparticipation
   b. Seminar/Presentation/Assignment/Quiz/classtest,etc.
   c. MidTermExam

Total InternalAssessmentMarks(Theory)	ClassParticipation	Seminar/Presentation/Assignment/Quiz/classtest,etc.	Mid-TermExam
10	4	-	
15	4	4	6
20	5	5	7
25	5	7	10
30	5	10	13
			15

TotalInternalAssessmentMarks(Practicum)	ClassParticipation	Seminar/Demonstration/Viva-Voce/Labrecord,etc.	Mid-TermExam
5		5	NA
10		10	NA
15	5	10	NA
30	5	10	15

CC-3

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	III		
Name of the Course	**Chemistry-III**		
Course Code	B-23-CHE-301		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1.To learn about the structure of S and P-block elements, their properties and discuss their use in daily life as well as industrial applications. 2.To understand about various laws and theories related to eletrochemistry-I and know about their thermodynamic properties. 3.To understand about variation of conductance studies with concentration and explain with many phenomenon. 4.The fundamental properties, structures and reactivity of organic compounds such alkene,alkyne arenes,alkyl and aryl halide etc. 5.* Learning about reaction mechanism and predict the outcome of the reactions. 6. How to distinguish between the organic compounds by use of different chemical tests.		
Credits	Theory	Practical	Total
	3	1	4

Contact Hours	45	30	75
Max. Marks:70+30* **Internal Assessment Marks:20+10*** **End Term Exam Marks:** 50+20*		**Time:03+03***	

Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics & Contact Hours
I	**s and p-Block Elements** **11hours** Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded). Structure, preparation and properties of Diborane and Borazine. Catenation, carbides, fluorocarbons, silicates (structural aspects), structure of oxides of Nitrogen and Phosphorous, structure of white and red phosphorus. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine and comparison of acidic strength of oxyacids. low chemical reactivity of noble gases, chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon.
II	**Electrochemistry-I** **11hours** Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Application of Kohlrausch' s Law in calculation of conductance of weak electrolytes at infinite dilution (Numericals) Concepts of pH and pK_a, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action. **Electrochemistry-II** Reversible & irreversible cells, Calculation of thermodynamic quantities of cell reaction (▲G, ▲H & K). Types of reversible electrodes – metal- metal ion, gas electrode, metal – insoluble salt-anion and redox electrodes. Nernst equation, Standard Hydrogen electrode, reference electrodes, Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode.
III	**Alkynes** **11hours** Nomenclature and its structure. Methods of formation: using Calcium carbide,dehydrohalogenation, Kolbe's electrolysis. Chemical reactions: Mechanism of electrophilic and nucleophilic addition reactions, formation of metal acetylides.

	addition of bromine and alkaline KMnO4, ozonolysis. Acidity of alkynes. **Stereochemistry of Organic Compounds** Concept of isomerism: Structural and Stereoisomerism. Symmetry elements, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules (up-to 2 asymmetric centres), diastereomers, threo- and erythro- nomenclature, meso-compounds, Relative and absolute configuration, sequence rules, R and S system of nomenclature. Cis- Trans isomerism, E & Z system of nomenclature, Conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds. Newman and Sawhorse projection formulae.
IV	**Benzene and its derivatives:** **12 hours** Nomenclature, Aromatic nucleus and side chain, Huckels' rule of aromaticity. Aromatic electrophilic substitution, mechanism of nitration, halogenation, sulphonation, and Friedel- Crafts reaction. Energy profile diagrams. Activating, deactivating substituents and orientation. **Alkyl halides:** Nomenclature, methods of formation: from alkenes and alcohol, nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. **Aryl halides**: Methods of formation: halogenation, Sandmeyer reaction. The addition-elimination, and the elimination- addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl, and aryl halides.
V*	**30 hours** 1. **Gravimetriic Analysis:** Estimation of Ni^{2+} as Ni-dimethylglyoxime and Al^{3+} as Al-oxinate. 2. **Colorimetry:** To verify Beer-Lambert law for $KMnO_4$ /$K_2Cr_2O_7$ and determine the unknown concentration of the given solution of $KMnO_4$ /$K_2Cr_2O_7$ solution. 3. To prepare acidic and basic buffer solutions of pH 5 and 9 respectively. 4. Preparation of Cuprous chloride, tetra ammine cupric sulphate. 5. To determine the CST of phenol-water system. 6. To determine the solubility of Benzoic acid at various temperatures and to determine the ΔH of the dissolution process. 7. To determine the Enthalpy of neutralisation of strong base Vs strong acid and weak acid/weak base Vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base 8. Determine the rate constant of hydrolysis of ethyl acetate.
Suggested Evaluation Methods	

Internal Assessment: 20+10*	End Term Examination:
Theory • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	50+20*

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Lee, J.D.; (2010), **Concise Inorganic Chemistry**, Wiley India.
2. Kapoor, K.L. (2015), **A Textbook of Physical Chemistry**, Vol 1, 6 th Edition, Mc Graw Hill Education.
3. Morrison, R. N.; Boyd, R. N. **Organic Chemistry**, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. **Organic Chemistry** (Volume 1& 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
5. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016), **Organic Chemistry**, 12th Edition, Wiley.
6. Clayden, J.; Greeves, N.; Warren, S. (2012), **Organic Chemistry**, Oxford.
7. Nasipuri, D. (2018), **Stereochemistry of Organic Compounds: Principles and Applications**, 3rd Edition, New Age International.
8. Gunstone, F. D. (1975), **Guidebook to Stereochemistry**, Prentice Hall Press.

***Applicable for courses having practical component.**

MDC-3

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	III		
Name of the Course	**Introductory Chemistry-III**		
Course Code	B-23-CHE-303		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course (As per Annexure-I	0-99		
Pre-requisite for the course (if any)	Higher secondary other than science discipline		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. To learn about different energy resources. 2. To learn about the purification process of water quality 3. To Know more about Pesticides and their bad impacts on health 4. To get more knowledge on the impacts of pollution on environment 5*. To get acquaint about the pH of different food items.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks:50+25* **Internal Assessment Marks:15+5*** **End Term Exam Marks:** 35+20*		**Time:03+03***	
Part B- Contents of the Course			
Instructions for Paper- Setter **Note:** The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all			

selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics&Contact Hours
I	**8 hours** Pollution and their types: Plastic and polyethene pollution, pollution sources, Recycling of plastic, greenhouse effect, ozone depletion
II	**8 hours** Energy: Energy sources, renewable and non-renewable sources, cells and batteries, fuel cell, solar cell, polymer cell
III	**7hours** Water: Sources of drinking water and uses, water conservation, Permissible TDS, Techniques of purification of water, R.O. water purification process (Osmosis and Reverse Osmosis), wastewater management
IV	**7hours** Pesticides and Herbicides: General introduction and definition, biological control and chemical control: natural and synthetic pesticides, benefits and adverse effects of DDT, BHC, malathion.
V*	**Practicals:** **30hours** 1. To check the TDS of different samples of water. 2. Purify the given sample of water using different purification techniques. 3. Identify the pH of different samples of food items. 4. Nutralize the given samples of base using acids

30

Suggested Evaluation Methods

Internal Assessment: 15 + 5* **Theory** • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam: NA	**End Term Examination:** **35+20***

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. **Zero Waste: Management Practices for Environmental Sustainability** by Ashok K. Rathoure
2. **Sustainable Solid Waste Management** by Ni-Bin Chang
3. **Handbook of Advanced Industrial and Hazardous Wastes Treatment** by Lawrence K. Wang (Editor); Nazih K. Shammas (Editor); Yung Tse Hung (Editor)
4. Pesticides and Insecticides, Development and Use, Bobby Jones|2018
5. WATER TREATMENT, How To Make Water Safe To Drink, David Holman
6. Energy,A Beginner's Guide,Vaclav Smil,2017
7. Advanced Physical Chemistry, Practical Handbook, Gurdeep Raj, Edition (2016)
8. Advanced Practical Physical Chemistry, Handbook, J.B.Yadav, Edition (2016)
9. Goyal, P K, Water Pollution Causes, Effects and Control New age International Publishers

***Applicable for courses having practical component.**

CC-4

Session: 2023-24			
Part A - Introduction			
Subject	Chemistry		
Semester	IV		
Name of the Course	**Chemistry-IV**		
Course Code	B-23-CHE-401		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Classify d block and f block elements and also know their properties 2. Learn about the basic idea of analysis with respect to qualitative as well as quantitative measures 3. Know about the first and second law of thermodynamics and also their implications and also know about the concept of chemical equilibrium 4. Know about the alcohols, phenols, aldehydes and ketones with respect to their generalcharacteristics and their important reactions 5*. To get knowledge about identification and confirmation of acidic and basic radicals in a given inorganic salts/mixtures		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks:70+30* **Internal Assessment Marks:20+10*** **End Term Exam Marks:** 50+20*		**Time:03+03***	

Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner is requested to set nine questions in all, selecting two questions from each SECTION and one question (Question No.1 based on entire syllabus will consist of short answer type. All questions carry equal marks. The candidate is required to attempt five questions in all selecting one from each SECTION. Question No.1 is compulsory. Log table and non-programmable calculator is allowed.

Unit	Topics&Contact Hours
I	**Chemistry of d-Block elements** **12hours** Definition of transition elements, General characteristic properties of d-Block elements, Comparison of ionic radii 3d, 4d and 5d series elements, magnetic properties, Stability of various oxidation states and Latimer and Frost diagrams, Structure of some compounds of transition elements- TiO_2, $VOCl_2$, $FeCl_3$, $CuCl_2$ and $Ni(CO)_4$. **Chemistry of f-Block elements** Lanthanide contraction, oxidation states, magnetic properties, complex formation, colour and ionic radii. Actinides: General characteristics of actinides, Transuranic elements, comparison of properties of Lanthanides and actinides with transition elements.
II	**Theory of Qualitative and Quantitative Analysis** **11hours** Chemistry of analysis of various groups of basic and acidic radicals, chemistry of identification of acid radicals in typical combination, common ion effect, solubility product, theory of precipitation, co-precipitation, post precipitation, purification of precipitates.
III	**Thermodynamics-I** **11hours** First law of thermodynamics: statement, concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule– Thomson coefficient for ideal gas and real gas and inversion temperature. Calculation of w, q, dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Second law of thermodynamics, Carnot cycles and its efficiency, Concept of entropy, entropy as a function of V & T, entropy as a function of P & T. **Chemical Equilibrium** Concept of Equilibrium constant, Temperature dependence of equilibrium constant, Clausius–Clapeyron equation and its applications.
IV	**Alcohols** **11hours** Monohyric alcohols: nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids, and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols. **Phenols** Nomenclature, structure, and bonding. Preparation: Cumene hydroperoxide method, from diazonium salts, physical properties, and acidic character. Chemical Reactions: — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen

	rearrangement, Reimer-Tiemann reaction, Kolbe's reaction. **Aldehydes and Ketones** Nomenclature and structure of the carbonyl group. Preparation: oxidation of alcohols, from acid chlorides and from nitriles, Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group: benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction, Baeyer–Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmenson and Wolff-Kishner reductions.
V*	**30hours** **Practicals:** 1. To prepare salicylic acid from Aspirin. 2.To prepare m-nitroaniline from m-dinitrobenzene. 3. Semimicro qualitative analysis of mixture containing not more than four radicals (excluding interfering, Combinations and insoluble):Pb^{2+}, Cu^{2+}, Fe^{3+}, Ni^{2+}, Ca^{2+} , NH_4^+, CO_3^{2-}, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, PO_4^{3-}, SO_4^{2-}

Suggested Evaluation Methods

Internal Assessment:20+10* **Theory** • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 **Practicum** • Class Participation: NA • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: NA	**End Term Examination:** 50+20*

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. 009), **Inorganic Chemistry-Principles of Structure and Reactivity**, Pearson ucation.
2. Atkins, P.W.; Paula, J.de. (2014), **Atkin's Physical Chemistry Ed.**, 10th Edition, Oxford University Press.
3. Kapoor, K.L.(2015), **A Textbook of Physical Chemistry**,Vol 1, 6 thEdition, McGraw Hill Education.
4. Clayden, J.; Greeves, N.; Warren, S. (2012), **Organic Chemistry**, Oxford.
5. Morrison, R. N.; Boyd, R. N. **Organic Chemistry**, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Nasipuri, D.(2018), **Stereochemistry of Organic Compounds: Principles and Applications**, 3 rd Edition, New Age International.
7. Gunstone, F. D. (1975), **Guidebook to Stereochemistry**, Prentice Hall Press.

***Applicable for courses having practical component.**