

KURUKSHETRA UNIVERSITY

KURUKSHETRA

(Established by the state legislature Act XII of 1964)
A⁺ Grade NAAC Accredited)



**Revised Scheme of Examination and
Syllabus for**

Under-Graduate Programme

Subject: Chemistry

**Under Multiple Entry-Exit, Internship and
CBCS-LOCF in accordance to NEP-2020
w.e.f. 2025-26 (in phased manner)**

**DEPARTMENT OF CHEMISTRY, KURUKSHETRA UNIVERSITY,
KURUKSHETRA**

FIRST YEAR: SEMESTER-1									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme A & C	CC-1	B23 CHE-101	Chemistry-I	3	3	20	50	70	3 hrs.
	MCC-1		Practical	1	2	10	20	30	3 hrs.
Scheme C only	MCC-2	B23 CHE-102	Physical Chemistry-I	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A & D	CC-M1	B23 CHE-103	Minor Chemistry-I	1	1	10	20	30	2 hr
			Practical	1	2	05	15	20	2 hrs
Scheme A, C & D	MDC-1	B23 CHE-104	Introductory Chemistry-I	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	3 hrs.
Scheme C only	CC-M1	From Available CC-I/MCC-I of 4 credits as per NEP							
FIRST YEAR: SEMESTER-2									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme A & C	CC-2	B23 CHE-201	Chemistry-II	3	3	20	50	70	3 hrs.
	MCC-3		Practical	1	2	10	20	30	3 hrs.
Scheme C only	DSEC-1	B23 CHE-202	Chemistry Skill-I	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A & D	CC-M2	B23 CHE-203	Minor Chemistry-II	1	1	10	20	30	2 hrs.
			Practical	1	2	05	15	20	2 hrs

Scheme A, C & D	MDC-2 3 credits	B23 CHE- 204	Introductory Chemistry-II	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	3 hrs.
Scheme C only	CC-M2 4 credit	From Available CC-2/MCC-3 of 4 credits as per NEP							
Internship of 4 credits of 4-6 weeks duration after 2 nd Semester									

SECOND YEAR: SEMESTER-3									
Remark s	Cours e	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme A, B & C	CC-3 MCC-4 4 credit	B23 CHE-301	Chemistry-III	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	MCC-5 4 credit	B23 CHE-302	Inorganic Chemistry-I	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A, B, C & D	MDC-3 3 credits	B23 CHE-303	Introductory Chemistry-III	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	3 hrs.
Scheme A, C & D	CC-M3 4 credits	B23 CHE-304	Minor Chemistry-III	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B only	MCC-2	MCC-2 FROM SCHEME C OF FIRST SEMESTER Physical Chemistry-I							
SECOND YEAR: SEMESTER-4									
Remark s	Cours e	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme	CC-4	B23	Chemistry-IV	3	3	20	50	70	3 hrs.

A, B & C	MCC-6 4 credit	CHE-401	Practical	1	2	10	20	30	3 hrs.
Scheme B & C	MCC-7 4 credit	B23 CHE-402	Organic Chemistry-I	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	MCC-8 4 credit	B23 CHE-403	Physical Chemistry-II	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	DSE-1 4 credit Select one option	Elective Chemistry(Select One option)							
		B23 CHE-404	Elective Chemistry -I	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE-405	Elective Chemistry -II	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE-406	Elective Chemistry -III	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		Internship of 4 credits of 4-6 weeks duration after 4th Semester (if not done after second semester)							

THIRD YEAR: SEMESTER-5									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/Week	Internal marks	External Marks	Total Marks	Examination Duration
Scheme A, B & C	CC-5 MCC-9 4 credit	B23 CHE-501	Chemistry-V	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	MCC-10 4 credit	B23 CHE-502	Inorganic Chemistry-II	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	DSE-2 4 credit Select one Option	Elective Chemistry(Select One option)							
		B23 CHE-503	Elective Chemistry-IV	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE-504	Elective Chemistry-V	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE-505	Elective Chemistry-VI	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	DSE-3 4 credit Select one Option	Elective Chemistry (Select One option)							
		B23 CHE-506	Elective Chemistry-VII	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE-507	Elective Chemistry-VIII	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE-	Elective Chemistry-IX	3	3	20	50	70	3 hrs.

		508	Practical	1	2	10	20	30	3 hrs.
Scheme A, B & C	Internship 4 credits	Internship#4 credit after 4 th semester							
THIRD YEAR: SEMESTER-6									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	Externa l Marks	Total Marks	Exam Duration
Scheme A, B & C	CC-6 MCC-11 4 credit	B23 CHE- 601	Chemistry-VI	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	MCC-12 4 credit	B23 CHE- 602	Organic Chemistry-II	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	DSE-4 4 credit Select one Option	Elective Chemistry(Select One option)							
		B23 CHE- 603	Elective Chemistry-X	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE- 604	Elective Chemistry-XI	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE- 605	Elective Chemistry- XII	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	DSE-5 4 credit Select one Option	Elective Chemistry (Select One option)							
		B23 CHE- 606	Elective Chemistry- XIII	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.

		B23 CHE- 607	Elective Chemistry- XIV	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23 CHE- 608	Elective Chemistry- XV	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A only	CC-M6 4 credits	B23 CHE- 609	Minor Chemistry-IV	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.

FOURTH YEAR: SEMESTER-7 (FOR HONOURS/HONOURS WITH RESEARCH IN Chemistry)									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
for Honours in Chemistry/Ho nours with Research in Chemistry (For Scheme B & C)	CC-H1 4 credit	B23 CHE -701	Physical Chemistry-III	4	4	30	70	100	3 hrs.
	CC-H2 4 credit	B23 CHE -702	Inorganic Chemistry-III	4	4	30	70	100	3 hrs.
	CC-H3 4 credit	B23 CHE -703	Organic Chemistry-III	4	4	30	70	100	3 hrs.
	Select any one option								
	DSE-H1 4 credit Select one Option	B23 CHE -704	Advanced Chemistry-I	4	4	30	70	100	3 hrs.
		B23 CHE -705	Advanced Chemistry-II	4	4	30	70	100	3 hrs.
		B23 CHE -706	Advanced Chemistry-III	4	4	30	70	100	3 hrs.

	PC-H1 4 credit	B23 CHE -707	Practical Chemistry	4	8	30	70	100	6 hrs.
	CC-HM1 4 credit	B23 CHE -708	Advanced Minor Chemistry – I	4	4	30	70	100	3 hrs.
SEMESTER-8 (FOR HONOURS in Chemistry)									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
Honours in Chemistry (For Scheme B & C)	CC-H4 4 credit	B23 CHE -801	Physical Chemistry-IV	4	4	30	70	100	3 hrs.
	CC-H5 4 credit	B23 CHE -802	Inorganic Chemistry-IV	4	4	30	70	100	3 hrs.
	CC-H6 4 credit	B23 CHE -803	Organic Chemistry-IV	4	4	30	70	100	3 hrs.
	DSE-H2 4 credit Select one option	Elective (Select any one)							
		B23 CHE -804	Advanced Chemistry-IV	4	4	30	70	100	3 hrs.
		B23 CHE -805	Advanced Chemistry-V	4	4	30	70	100	3 hrs.
		B23 CHE -806	Advanced Chemistry-VI	4	4	30	70	100	3 hrs.
	PC-H2 4 credit	B23 CHE -807	Practical Chemistry	4	8	30	70	100	6 hrs.
	CC-HM2 4 credit	B83 CHE -808	Advanced Minor Chemistry - II	4	4	30	70	100	3 hrs.
OR SEMESTER-8 (FOR HONOURS WITH RESEARCH IN Chemistry)									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration

Honours with Research in Chemistry (For Scheme B & C)	CC-H4 4 credit	B23 CHE -801	Physical Chemistry-IV	4	4	30	70	100	3 hrs.
	CC-H5 4 credit	B23 CHE -802	Inorganic Chemistry-IV	4	4	30	70	100	3 hrs.
	Project/Dissertati on 12 credit	B23 CHE -809	Dissertation/proj ect in chemistry	8+4	-	-	-	300	-
	CC-HM2 4 credit	From Available Minor of 4 credits as per NEP							

CC-M3

Session: 2025-26			
Part A - Introduction			
Subject	Chemistry		
Semester	III		
Name of the Course	Minor Chemistry-III		
Course Code	B23-CHE-304		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M3		
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: 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 electrochemistry-I and know about their thermodynamic properties. 3. To understand the concepts of thermodynamics. 4. To understand and apply the fundamental concepts and thermodynamic properties of reactions/systems involved in physical/chemical transformations including types of reactions and reactive intermediates. 5.* To understand and apply the laboratory skills to make common chemical products and simple inorganic compounds in the lab and gain practical skills by measuring things like solubility and heat changes in chemical reactions.		
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		
<u>Instructions for Paper- Setter</u> 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 Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded). Structure, preparation and properties of Diborane and Borazine. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine and comparison of acidic strength of oxyacids. low chemical reactivity of noble gases,	12
II	Electrochemistry-I 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, Concepts of pH, Buffer solution (Numericals)	11
III	Thermodynamics-I Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Thermodynamic equilibrium, Concept of heat and work. First law of thermodynamics: statement, concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.	11
IV	Mechanism of Organic Reactions Curved arrow notation, homolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization and Pericyclic reactions. Reactive intermediates: Carbocations, carbanions, free radicals, carbenes (structure & stability).	11

CC-M4

Session 2025-26			
Part A- Introduction			
Subject	Chemistry		
Semester	VI		
Name of Course	Minor Chemistry-IV		
Course Code	B23 CHE-609		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M6		
Level of 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. Understand the chemistry of d-block elements. 2. To learn about fundamentals of photochemistry and photophysical processes. 3 To understand the nature of chemical bonding, resonance, and electronic effects, and apply these concepts to predict the reactivity and orientation of aromatic compounds in electrophilic substitution reactions. 4. To understand the classification, structure, and biological roles of key biomolecules such as carbohydrates, proteins, and nucleic acids, and learn how these molecules function in living organisms 5*. Students will gain hands-on experience in classical and instrumental analytical techniques such as conductometry, potentiometry, polarimetry, organic and inorganic synthesis, and photochemical analysis.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max marks:70+30* Internal Assessment Marks:20+10*	Examination Time:03+03* Hours		

End Term Exam Marks:50+20*		
Part B- Contents of the Course		
<u>Instructions for Paper-Setter</u> 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 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-FeCl ₃ , CuCl ₂ and Ni(CO) ₄ .	12
II	Photochemistry Interaction of radiation with matter, difference between thermal and photochemical process, Law of photochemistry: Lambert-Beer Law, Grotthus-Draper Law, Stark Einstein Law (Law of photochemical equivalence), concept of singlet and triplet states, Jablonski diagram – depicting various process occurring in excited states including fluorescence, phosphorescence and non-radiative processes (internal conversion, intersystem crossing).	11
III	Structure and Bonding Localized and delocalized chemical bond, Van der Waals interactions. Concept of resonance and its applications, hyperconjugation, inductive effect, Electromeric effect and their comparison. Benzene and its derivatives: Nomenclature, Aromatic nucleus and side chain, Huckel's rule of aromaticity. Aromatic electrophilic substitution, mechanism of nitration, halogenation and Friedel- Crafts reaction. Energy profile diagrams. Activating and deactivating substituents.	11
IV	Biomolecules: Definition, classification of biomolecules, importance of biomolecules in living organisms. Carbohydrates: Classification, structure and properties of monosaccharides, disaccharides structure and bonding (lactose and sucrose).	11

	Proteins: Amino acids, structure, classification and properties, peptide bond and elementary idea of structure of proteins.	
V*	1. To determine the strength of given acid solution (mono acid only) conductometrically. 2. Identification of carbohydrates (glucose/fructose/sucrose) 3. To determine the molecular weight of organic compound by Rast method. 4. To determine the specific rotation of an optically active substance by polarimeter. 5. To prepare a sample of cuprous chloride. 6. To study the photochemical reaction of benzophenone and isopropyl alcohol. 7. To prepare <i>m</i> -dinitrobenzene from nitrobenzene.	30
Suggested Evaluation Methods		
Internal Assesment: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. Mukherji, Singh, Kapoor and Dass, Organic Chemistry Volume II & III, New Age International Pvt. Ltd., New Delhi. 2. Huheey, J.E.; Keiter, E.A., Keiter; R. L.; Medhi, O.K. (2009), Inorganic Chemistry Principles of Structure and Reactivity, Pearson Education. 3. Lee, J.D.; (2010), Concise Inorganic Chemistry, Wiley India. 4. Ahluwalia, V.K., Parashar, R.K. (2011), Organic Reaction Mechanisms, 4th Edition, Narosa Publishing House. 5. Horspool, W.M. (1976) Aspects of Organic Photochemistry, Academic Press. 6. Kapoor, K.L. (2015), A Textbook of Physical Chemistry, Vol 3, 6th edition, McGraw Hill Education. 7. Kuashik, S., Singh, A. (2023), Biomolecules: From Genes to Proteins, First Edition, Berlin, Boston: De Gruyter. 8. Pandey, O.P.; Bajpai, D.N.; Giri S.; A Textbook of Practical Chemistry, S. Chand & Company. 9. Furniss, S.; Hannaford, A.J.; Smith, P.W.G.; and Tatchell A.R. Vogel's Textbook of		

Practical Organic Chemistry, (Pearson Education).

10. David L. Nelson and Michael M. Cox, **Lehninger Principles of Biochemistry**, W.H. Freeman and Company.

*Applicable for courses having Practical component

VOC

Session: 2025-26			
Part A – Introduction			
Subject	Chemistry		
Semester	III, V		
Name of the Course	Chemistry of Fertilizers and Pesticides		
Course Code	B23-VOC-122		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)	-----		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Know about fertilizers and nutrients; 2. Understand types of nitrate fertilizers; 3. Understand types of phosphate fertilizers; 4. Get the knowledge about pesticides. 5*. Understand the issues involved in pesticides and fertilizers		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90
Max. Marks: 50 + 50* Internal Assessment Marks: 15 + 15* End Term Exam Marks:Theory: 35 + 35*		Time: Theory: Three Hours Practicum: Three Hours	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u> 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.		
Unit	Topics	Contact Hours
I	Methods and time of fertilizer applications, fertilizers and its relations to plant nutrients, Factors effecting optimum fertilizer dose.	8 Hrs
II	Classification and types of fertilizers, Nitrogenous fertilizers: Ammonium nitrate, Urea, Calcium Cyanamide, Ammonium Chloride, Action of as a fertilizers.	7 Hrs
III	Phosphate fertilizers: Normal super phosphate, Triple Super Phosphate, Ammonium Phosphate.	7 Hrs
IV	pesticides: Classification, mode of action, uses and adverse effects of representative pesticides in the following classes: Organochlorines (DDT, Gammaxene); Organophosphates (Malathion); Quinones (Chloranil), Anilides	8 Hrs
V*	- To carryout market survey of potent pesticides with details as follows: - Name of pesticide - Chemical name, class and structure of pesticide - Type of formulation available and Manufacturer's name - Useful information on label of packaging regarding: Toxicity, LD50 ("Lethal Dose, 50%"), Side effects and Antidotes. - To carryout market survey of potent botanical pesticides with details as follows: - Botanical name and family; - Chemical name (active ingredient) and structure of active ingredient; - Type of formulation available and Manufacturer's name; - Useful information on label of packaging regarding: Toxicity, LD50 ("Lethal Dose, 50%"), Side effects and Antidotes. - Preparation of Carbamates (anilides)_ - To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications. - To calculate active ingredient in given sample of pesticide formulations as per BIS specifications. - Preparation of Neem based botanical pesticides. - To study about identification of crops, seeds. - To carry out marked survey for integrated nutrient management.	60 Hrs
Suggested Evaluation Methods Short Answer and MCQ Type QUESTIONS		

Internal Assessment: 15+15*=30 ➤ Theory: 15 ● Class Participation: 02 ● Seminar/presentation/assignment/quiz/class test etc.:03 ● Mid-Term Exam: 10 ➤ Practicum:15 ● Class Participation: 10 ● Seminar/Demonstration/Viva-voce/Lab records etc.: 05 ● Mid-Term Exam: N. A.	End Term Examination:35+35*
Part C-Learning Resources	
Recommended Books/e-resources/LMS: ✓ Gopal Rao: Outlines in Chemical Technology. ✓ Shukla and Pandey: Introduction to Chemical Technology ✓ Perry, A.S.; Yamamoto, I.; Ishaaya, I.; Perry, R.Y.(1998),Insecticides in Agriculture and Environment, Springer-Verlag Berlin Heidelberg. ✓ Kuhr, R.J. ;Derough, H.W.(1976),Carbamate Insecticides: Chemistry, Biochemistry and Toxicology, CRC Press,USA.	

*Applicable for courses having practical component.

VOC

Session: 2025-26			
Part A – Introduction			
Subject	Chemistry		
Semester	III, V		
Name of the Course	Cosmetic Chemistry		
Course Code	B23-VOC-123		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)	--		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Get the knowledge of cosmetics; 2. Logically think regarding preparation strategies and uses of cosmetic products; 3. Understand about preparation strategies and uses of cosmetic creams; 4. Get to know about the essential oils preset in nature & their importance towards industrial uses. 5*. learn about practical hands involved in preparation of cosmetic products.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90
Max. Marks: 50 + 50* Internal Assessment Marks: 15 + 15* End Term Exam Marks:35 + 35*		Time: Theory: Three Hours Practicum: Three Hours	
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.		
Unit	Topics	Contact Hours
I	Cosmetics- Definition, History, Classification, Ingredients, Nomenclature, A general study including preparation and uses of the following: Hair dye, Hair spray, Shampoo, conditioners.	8 Hrs
II	Preparation and uses of Face powder, Lipsticks, Talcum powder, Nail enamel.	7Hrs
III	Preparation and uses of creams (cold, vanishing, and shaving creams), Antiperspirants and Artificial flavours.	7 Hrs
IV	Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, Sandalwood oil, Eucalyptus, Rose oil, Jasmone, Civetone.	8 Hrs
V*	1. Preparation of Talcum powder. 2. Preparation of Shampoo. 3. Preparation of Enamels. 4. Preparation of Hair remover. 5. Preparation of Face cream. 6. Preparation of Nail polish. 7. Preparation of Nail polish remover.	60 Hrs
Suggested Evaluation Methods Short Answer and MCQ Type QUESTIONS		
Internal Assessment: 15+15*=30 ➤ Theory: 15 ● Class Participation: 02 ● Seminar/presentation/assignment/quiz/class test etc.:03 ● Mid-Term Exam: 10 ➤ Practicum:10 ● Class Participation: 05 ● Seminar/Demonstration/Viva-voce/Lab records etc.: 10 ● Mid-Term Exam: N. A.		End Term Examination: 35+35*
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

- ✓ E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK.
- ✓ P.C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
- ✓ B.K. Sharma: *Industrial Chemistry*, Goel Publishing House, Meerut.
- ✓ Textbook of Cosmetics; M Vimaladevi; CBS Publishers & Distributors; 2015, ISBN 81-239-1103-3
- ✓ TextBook of Cosmetics; Dr Akanksha Garud, Dr PK Sharma, Dr Navneet Garud; Pragati Prakashan; 2012, ISBN 978-93-5006-691-1
- ✓ Pharmaceutics and Cosmetics; Praveen K. Gupta, Sanjeev K. Gupta; Pragati Prakashan; 2011, ISBN 978-81-8398-995-4
- ✓ Chemistry of Cosmetics; R. Kumari; Prestige Publisher, 2018, ISBN 978-81-936512-3-0
- ✓ Formulation Guide For Cosmetics; The Nisshin Oillio Group, Ltd.

*Applicable for courses having practical component.

VOC

Session: 2025-26			
Part A – Introduction			
Subject	Chemistry		
Semester	III,V		
Name of the Course	Business Chemistry		
Course Code	B23-VOC-125		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)	--		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the concepts of business; 2. Logically think about role of chemistry in emerging global economies; 3. Get to know about the case-studies of successful business ideas in chemistry; 4. Deeply learn about intellectual property rights and patents. 5*. Understand way to deal with industrial market working principles.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90
Max. Marks: 50 + 50* Internal Assessment Marks: 15 + 15* End Term Exam Marks:35 + 35*		Time: Theory: Three Hours Practicum: Three Hours	
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.		
Unit	Topics	Contact Hours
I	Business Basics Key business concepts, Business plans, Market need, Concept of entrepreneurship, different fields explorable as entrepreneurship in chemistry	8 Hrs
II	Chemistry in Industry Current challenges and opportunities for the chemistry-using industries, Role of chemistry in India and global economies, opportunities in Green Chemistry and business	7 Hrs
III	Making money Treasures hidden in Chemistry (project), Case study of Successful business ideas in chemistry, Pharmaceutical Chemistry, Plastic Industry, Nutritional Chemistry, financial aspects of business with case studies	7 Hrs
IV	Intellectual property Concept of intellectual property, Novelty, State of Art, Innovations, Technology Transfer, Geographical Indicators, Traditional Knowledge, Introduction to Patents, Careers in Intellectual property Rights.	8 Hrs
V*	A visit to any one Industry/Plant 1. Pharmaceutical Industry to analyse financial layout of project and markets. 2. Paint Industry to analyse financial layout of project and markets. 3. Milk Plant to analyse financial layout, different milk products and markets. 4. Any two Industry to analyse financial layout of project and markets.	60 Hrs
Suggested Evaluation Methods Short Answer and MCQ Type QUESTIONS		

Internal Assessment: 15+15*=30 ➤ Theory: 15 • Class Participation: 02 • Seminar/presentation/assignment/quiz/class test etc.:03 • Mid-Term Exam: 10 ➤ Practicum:15 • Class Participation: 05 • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: N. A.	End Term Examination: 35+35*
Part C-Learning Resources	
Recommended Books/e-resources/LMS: ✓ Lawerence I. Nwaeke, Business Concepts and Perspectives ✓ Titus De Silva, Essential Management Skills for Pharmacy and Business Managers ✓ N.K. Acharya: Textbook on intellectual property rights, Asia Law House (2001).	

*Applicable for courses having practical component.

VOC

Session: 2025-26			
Part A – Introduction			
Subject	Chemistry		
Semester	IV		
Name of the Course	Agriculture chemistry		
Course Code	B23-VOC-222		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	100-199		
Pre-requisite for the course (if any)	---		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1 Thinks about chemistry involved in agriculture 2 Know about chemical composition of soils; 3 Understand impacts of pollutions on soils and its productivity; 4 Critically think regrading sewage effluents. 5*. Practical training of soil analysis		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90
Max. Marks: 50 + 50* Internal Assessment Marks: 15 +15* End Term Exam Marks:35 + 35*		Time: Theory: Three Hours Practicum: Three Hours	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u> 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.		
Unit	Topics	Contact Hours
I	Plants as producers: Photosynthesis, pesticides, herbicide, insecticide, fungicide, storage and preservation of agriculture produce, food processing, use of polymers in agriculture	8 Hrs
II	Soil fertility and soil productivity: urea cycle, Organic and inorganic nitrogen (Haber Bosch Process), nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms. Micronutrients : factors affecting their availability and correction of their deficiencies in plants.	7 Hrs
III	Chemical (elemental) composition of the earth's crust and soils, Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity.	7 Hrs
IV	Nature and sources of pollutants acid rains, oil spills etc.; air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings. Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as sink for waste disposal.	8 Hrs
V*	1. pH of Soil 2. determine carbonate and bicarbonate in soil 3. Determine chloride in the soil sample 4. Determine starch in organic manure 5. Determine nitrate in the soil 6. Determine sulphate in the soil 7. To study Seed germination and viability test.	60Hrs
Suggested Evaluation Methods Short Answer and MCQ Type QUESTIONS		
Internal Assessment: 15+15*=30 ➤ Theory: 15 ● Class Participation: 02 ● Seminar/presentation/assignment/quiz/class test etc.:03 ● Mid-Term Exam: 10 ➤ Practicum:15 ● Class Participation: 05 ● Seminar/Demonstration/Viva-voce/Lab records etc.: 10 ● Mid-Term Exam: N. A.		End Term Examination: 70 (35+35*)

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- ✓ Bear RE. 1964. Chemistry of the Soil. Oxford and IBH. Bolt GH & Bruggenwert MGM. 1978. Soil Chemistry. Elsevier. Greenland DJ & Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons.
- ✓ Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13 Ed. Pearson Edu.
- ✓ Kabata-Pendias A & Pendias H. 1992. Trace Elements in Soils and Plants. CRC Press.
- ✓ Kannaiyan S, Kumar K & Govindarajan K. 2004. Biofertilizers Technology. Scientific Publ.
- ✓ Leigh JG. 2002. Nitrogen Fixation at the Millennium. Elsevier.
- ✓ Mengel K & Kirkby EA. 1982. Principles of Plant Nutrition. International Potash Institute, Switzerland.
- ✓ Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. Micronutrients in Agriculture. 2 Ed. SSSA, Madison.
- ✓ Pierzinsky GM, Sims TJ & Vance JF. 2002. Soils and Environmental Quality. 2 Ed. CRC Press.
- ✓ Stevenson FJ & Cole MA. 1999. Cycles of Soil: Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons.
- ✓ Tisdale SL, Nelson SL, Beaton JD & Havlin JL. 1999. Soil Fertility and the Fertilizers. 5 Ed. Prentice Hall of India.
- ✓ Troeh FR & Thompson LM. 2005. Soils and Soil Fertility. Blackwell.

*Applicable for courses having practical component.

VOC

Session: 2025-26			
Part A – Introduction			
Subject	Chemistry		
Semester	VI		
Name of the Course	Green laboratory practices		
Course Code	B23-VOC-321		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC		
Level of the course (As per Annexure-I	0-99		
Pre-requisite for the course (if any)	--		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. learn about green chemistry; 2. describe, how injudicious use of chemicals can have an adverse/potentially damaging effect on humans and the environment. 3. propose ideas for innovative approaches to energy challenges. 4. convert biomass into valuable chemicals through green technologies. 5*. Hands on training towards green chemistry		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	30	60	90
Max. Marks: 50 + 50* Internal Assessment Marks: 15 + 15* End Term Exam Marks:35+ 35*		Time: Theory: Three Hours Practicum: Three Hours	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u> 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.		
Unit	Topics	Contact Hours
I	Scheme for the traditional as well as green method for the synthesis of ibuprofen. Compare the amount and hazards of waste generated in both Green Methods in Chemistry. Preparation of propene by two methods can be studied (I) Hoffman elimination (II) Dehydration of propanol	7 Hrs
II	Prevention/ minimization of hazardous/ toxic products reducing toxicity. Risk = (function) hazards exposure: (a) Preparation of dibenzalacetone by cross aldol condensation reaction using base catalysed green method (b) Acetylation of primary aromatic amine using the green method. Use of Green solvents and comparison of greenness of solvents: (a) Introduction to water as a solvent for chemical reactions. preparation of Manganese (III) acetylacetonate using green method (b) Advantages and application of solventless processes in organic reactions.	8 Hrs
III	Energy requirements for reactions – alternative sources of energy: use of microwaves and photochemical energy. (a) Photoreduction of benzophenone to benzopinacol in the presence of sunlight. (b) Microwave assisted ammonium formate-mediated Knoevenagel reaction: p-anisaldehyde.	7 Hrs
IV	Importance of using catalytic reagents in preference to stoichiometric reagents; green chemistry, comparison of heterogeneous and homogeneous catalysis, asymmetric catalysis. , Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide	8 Hrs
V*	1. Dehydration of propanol 2. Nitration of salicylic acid using calcium nitrate 3. Photoreduction of benzophenone to benzopinacol in the presence of sunlight 4. Microwave assisted solvent free synthesis of aspirin 5. Synthesis of vitamin D3 using photochemical energy 6. benzil-benzilic acid rearrangement in solvent free condition.	60 Hrs

Suggested Evaluation Methods Short Answer and MCQ Type QUESTIONS	
Internal Assessment: 15+15*=30 > Theory: 15 • Class Participation: 02 • Seminar/presentation/assignment/quiz/class test etc.:03 • Mid-Term Exam: 10 > Practicum:15 • Class Participation: 05 • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam: N. A.	End Term Examination: 70 (35+35*)
Part C-Learning Resources	
Recommended Books/e-resources/LMS: Theory: ✓ Anastas, P.T., Warner, J.C. (2014), Green Chemistry, Theory and Practice, Oxford University Press. ✓ Lancaster, M. (2016), Green Chemistry: An Introductory Text, 3rd Ed., RSC Publishing. ✓ Cann, M.C., Connely, M. E. (2000), Real-World cases in Green Chemistry, American Chemical Society, Washington. ✓ Matlack, A.S. (2010), Introduction to Green Chemistry, 2nd Ed., CRC Press. ✓ Alhuwalia, V.K.; Kidwai, M.R. (2012), New Trends in Green chemistry, Kluwer Academic Publishers, Springer. ✓ Sidhwani, I.T; Sharma, R.K. (2020), An Introductory Text on Green Chemistry, Wiley India Pvt Ltd. ✓ Etzkorn, F. A . (2019), Green Chemistry: Principles and Case Studies, Royal Society of Chemistry. Practicals: ✓ Kirchoff, M., Ryan, M.A. (2002), Greener approaches to undergraduate chemistry experiment, American Chemical Society, Washington DC. ✓ Sharma, R.K., Sidhwani, I.T., Chaudhari, M.K. (2013), Green Chemistry Experiments: A monograph, I.K. International Publishing House Pvt Ltd. New Delhi. ✓ Pavia, D.L., Lamponam, G.H., Kriz, G.S.W. (2006), Introduction to organic Laboratory Technique- A Microscale approach, 4th Edition, Brooks-Cole Laboratory Series for Organic chemistry. ✓ Sidhwani, I.T. ; Saini, G.; Chowdhury, S. Wealth from Waste: A green method to produce biodiesel from waste cooking oil and generation of useful products from waste further generated. University of Delhi, Journal of Undergraduate Research and Innovation, Volume 1, Issue 1, February 2015, ISSN: 2395-2334. ✓ Sharma, R. K., Gulati, S., Mehta, S. (2012), Preparation of Gold Nanoparticles Using Tea: A Green Chemistry Experiment, Journal of Chemical Education, 89 (10), 1316-1318.	

*Applicable for courses having practical component.