Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Mathematics **Year: First/ Semester: First (Odd Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B020101T/CH151	Fundamentals of Chemistry-I	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4 QUALITY EDUCATION
2	B020102P/CH134	Quantitative Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4 QUALITY EDUCATION
3	B030101T/MT136	Differential Calculus & Integral Calculus	T		3	1	-	15	10	25	75	100	04								-
4	B030102P/MT137	Practical using Mathematica/MATLAB	P		-	-	4	15	10	25	75	100	02								-
5	• B000101V/CH137 • --	• Plastic Waste Management • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√			4 QUALITY EDUCATION 13 CLIMATE ACTION
6	Z010101T/BE105	Food Nutrition and Hygiene	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√			3 GOOD HEALTH AND WELL-BEING 4 QUALITY EDUCATION
7	A050101T/HM101	Rashtra Gaurav*	T	Audit Course	2	-	-	-	-	-	100	100	00					√	√	√	4 QUALITY EDUCATION
				TOTAL	**11**	**02**	**10**	**75**	**50**	**125**	**575**	**700**	**17**								

*Qualifying (Non-Credit Course)

Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Physics **Year: First/ Semester: First (Odd Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B020101T/CH151	Fundamentals of Chemistry-I	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4
2	B020102P/CH134	Quantitative Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4
3	B010101T/PY113	Mathematical Physics & Newtonian Mechanics	T		3	1	-	15	10	25	75	100	04								-
4	B010102P/PY114	Mechanical Properties of Matter	P		-	-	4	15	10	25	75	100	02								-
5	• B000101V/CH137 • --	• Plastic Waste Management • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√			4, 13
6	Z010101T/BE105	Food Nutrition and Hygiene	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√			3, 4
7	A050101T/HM101	Rashtra Gaurav*	T	Audit Course	2	-	-	-	-	-	100	100	00					√	√	√	4
				TOTAL	11	02	10	75	50	125	575	700	17								

*Qualifying (Non-Credit Course)

Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Zoology **Year: First/ Semester: First (Odd Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	20101T/CH151	Fundamentals of Chemistry-I	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4
2	B020102P/CH134	Quantitative Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4
3	B050101T/BS164	Cytology, genetics & infectious diseases	T		3	1	-	15	10	25	75	100	04								-
4	B050102P/BS165	Cell Biology & Cytogenetics lab	P		-	-	4	15	10	25	75	100	02								-
5	• B000101V/CH137 • --	• Plastic Waste Management • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√			4, 13
6	Z010101T/BE105	Food Nutrition and Hygiene	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√			3, 4
7	A050101T/HM101	Rashtra Gaurav*	T	Audit Course	2	-	-	-	-	-	100	100	00					√	√	√	4
		TOTAL			**11**	**02**	**10**	**75**	**50**	**125**	**575**	**700**	**17**								

*Qualifying (Non-Credit Course)

Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Botany **Year: First/ Semester: First (Odd Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B020101T/CH151	Fundamentals of Chemistry-I	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4
2	B020102P/CH134	Quantitative Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4
3	B040101T/BS166	Microbiology & Plant Pathology	T		3	1	-	15	10	25	75	100	04								-
4	B040102P/BS167	Techniques in Microbiology & Plant Pathology	P		-	-	4	15	10	25	75	100	02								-
5	• B000101V/CH137 • --	• Plastic Waste Management • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√	√	√		√			4, 13
6	Z010101T/BE105	Food Nutrition and Hygiene	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√			3, 4
7	A050101T/HM101	Rashtra Gaurav*	T	Audit Course	2	-	-	-	-	-	100	100	00					√	√	√	4
			TOTAL		11	02	10	75	50	125	575	700	17								

*Qualifying (Non-Credit Course)

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	B020101T/CH151	**Title of the Course**	Fundamentals of Chemistry-I	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	5	1	0	4
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	To impart fundamental knowledge of chemical bonding and periodic properties and trends across the periodic table, enabling students to predict elemental properties based on their position in periods and groups, and to develop a comprehensive understanding of stereochemistry, organic reaction mechanisms, and other fundamental concepts in organic chemistry.						

Course Outcomes	
CO1	Learners will be able to **explain** molecular polarity and weak chemical forces such as van der Waals forces, ion-dipole forces, dipole-dipole interactions, and induced dipole interactions, and **apply** current bonding models to predict the structures and bonding parameters of simple inorganic and organic molecules.
CO2	Learners will be able to **analyze** the periodic table as a tool for predicting elemental properties and **demonstrate** detailed insights into periodic trends.
CO3	Learners will be able to **evaluate** the fundamentals of chemical reactions, including reactive intermediates, transition states, and factors influencing bond formation, and **interpret** reactors, catalysts, stereochemistry, and the formation of major and minor products in organic reactions.
CO4	Learners will be able to **explain** stereochemistry, including two-dimensional and three-dimensional structures of molecules, and **analyze** their roles in reaction mechanisms.
CO5	Learners will be able to **describe** solutions and colligative properties, including Raoult's law, relative lowering of vapour pressure, molecular weight determination, and osmosis, and **apply** these principles in relevant contexts.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Molecular polarity	van der Waals forces, ion-dipole forces, dipole dipole interactions, induced dipole interaction, dipole moment and molecular Structure (Diatomic and polyatomic molecules), Percentage ionic character from dipole moment, polarizing power and polarizability. Fajan's rules and consequences of polarization.	8	1
2	General Periodic Properties	Electronic configurations of elements, types of radii (covalent, crystal and Vander Waal's radii), electron affinity, electronegativity, and ionization potential. Pauling scale, Mulliken electronegativity scale, Slater rules, Allred and Rochow scale, diagonal relationship.	8	2
3	Periodic properties of Atoms (with reference to s & p-block)	Brief discussion, factors affecting and variation trends of following properties in groups and periods (with reference to s & p-block) such as effective nuclear charge, shielding or screening effect, Atomic and ionic radii, Electronegativity, Ionization enthalpy, Electron gain enthalpy.	8	2
4	Mechanism of Organic Reactions	Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents electrophiles and nucleophiles.	6	3
5	Essentials of Isomerism	Concept of isomerism, Different types of isomerism, their nomenclature and associated physico chemical properties. Structural isomerism: chain isomerism, positional isomerism, functional isomerism and metamerism, keto-enol tautomerism.	6	3
6	Stereochemistry-I	Optical isomerism: elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, disasteromers, threo and erythro diastereomers, meso compounds, resolution of enantionmer, inversion, retention and recemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.	8	4
7	Stereochemistry-II	Geometric isomerism: determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism: 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, Difference between configuration and conformation.	8	4
8	Solutions and Colligative Properties	Dilute Solutions, Colligative Properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.	8	5

Reference Books:

Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010

Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.

Carey, F. A., Guiliano, R. M. Organic Chemistry, Eighth edition, McGraw Hill Education, 2012.

Clayden, J., Greeves, N. &Warren, S. Organic Chemistry, 2nd edition, Oxford University Press, 2012.
Mukeherji, Singh, Kapoor, Organic Chemistry, Vol 1, New Age International 2014
e-Learning Source:
http://heecontent.upsdc.gov.in/Home.aspx
https://nptel.ac.in/courses/104/106/104106096/
http://heecontent.upsdc.gov.in/Home.aspx
https://nptel.ac.in/courses/104/106/104106096/
https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
Activities: Assignments, quiz, discussion, presentation, etc.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	SDGs Mapping
CO1	3	-	-	-	-	1	3	3	2	1	2	3	4 (Quality Education)
CO2	2	-	-	-	-	1	3	2	2	1	2	2	
CO3	1	-	-	-	-	1	3	3	2	1	3	3	
CO4	3	-	-	-	-	1	3	2	2	1	2	3	
CO5	2	-	-	-	-	1	3	2	2	1	3	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	B020102P/CH134	**Title of the Course**	Quantitative Analysis	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	4	2
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	To impart essential knowledge of laboratory techniques and tests for estimating metal ions, estimating the concentrations of acids and alkalis in commercial products, and evaluating the portability of water samples.						

Course Outcomes	
CO1	Learners will have the knowledge and skills to **understand** the laboratory methods and tests related to the estimation of metal ions and the estimation of acids and alkali contents in commercial products.
CO2	Learners will be able to **understand** and perform the portability tests of water samples.
CO3	Learners will be able to **estimate** metal ions.
CO4	Learners will be able to **estimate** the alkali and acid contents of samples.
CO5	Learners will be able to **estimate** the inorganic salts and hydrated water in samples.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Estimation of one Anion and Cation	To analyse the given salt for one cation and anion.	15	1,2
2	Estimation of Metals Ions	To estimate ferrous and ferric by dichromate method. To estimate copper using thiosulphate.	15	2,3
3	Estimation of Acids and Alkali Contents	Determination of acetic acid in commercial vinegar using NaOH. Determination of alkali content – antacid tablet using HCl. To estimate oxalic acid by titrating it with KMnO4.	15	2,4
4	Estimation of Inorganic Salts and Hydrated Water	To estimate sodium carbonate and sodium hydrogen carbonate present in a mixture. To estimate calcium content in chalk as calcium oxalate by permanganometry. To estimate water of crystallization in Mohr's salt by titrating with KMnO4.	15	2,5

Reference Books:

Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.

Harris, D.C.Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.

Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.

Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning, India

e-Learning Source:

https://www.labster.com/chemistry-virtual-labs/

https://www.vlab.co.in/broad-area-chemical-sciences

http://chemcollective.org/vlabs

Activities: Assignments, quiz, discussion, presentation, viva-voce, lab manual preparation, group exercise etc.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	**SDGs Mapping**
CO1	3	1	1	1	1	2	2	3	2	-	1	2	**4 (Quality education)**
CO2	3	1	1	1	1	2	2	3	2	2	2	3	
CO3	3	1	-	1	1	2	2	3	2	-	1	2	
CO4	3	1	-	1	1	2	2	3	2	-	3	1	
CO5	3	1	-	1	1	2	2	3	2	2	2	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	B000101V/CH137	**Title of the Course**	Plastic Waste Management	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	1	0	2	3
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	To equip students with fundamental knowledge of laboratory operations, including equipment calibration, preparation of standard solutions and solutions of various concentrations, and to develop their ability to solve qualitative and quantitative problems both independently and collaboratively, particularly in relation to the treatment of wastes such as plastics, pharmaceuticals, agrochemicals, and household wastes.						

Course Outcomes	
CO1	Learners will be able to **analysis** of plastic and industrial wastes qualitatively, along with comprehension of the fundamentals of their treatment, would enable students to evaluate their physical parameters effectively.
CO2	Learners will be able to **handle** and performance of sampling of plastic and industrial wastes following standard procedures would enable students to collect representative samples for analysis.
CO3	Learners will be able to **understand** of the handling and disposal of radioactive waste, along with measurement of conductivity, would enable students to interpret its significance in waste analysis.
CO4	Learners will be able to **conduct** electroanalytical procedures and performing potentiometric measurements would enable students to characterize wastes effectively.
CO5	Learners will be able to **perform** recycling processes and sustainability practices would enable students to apply environmental management strategies efficiently.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Managerial Skill on Waste Treatment/Water Treatment	Theory: Introduction of plastic and its classification; waste focusing on metal deduction. Practical: Qualitative Analysis	10	1,2
2	Supervisory and Technician Skill For Pharma/Chemical Industries	Theory: Sampling and handling of Industrial waste/ plastic waste. Practical: Sampling and digestion	10	1,2
3	Managerial (QA/QC) Skill for Cement/Plastic/Textile Industries /Waste Treatment Plant Industries	Theory: Principles of industrial waste treatment/ plastic waste treatment. Practical: Physical parameters of waste	10	1,2
4	Technician Skill/Radioactive Waste Handling Expertise for Nuclear Power Plant	Theory: Radioactive waste and its disposal, conductivity and its measurements. Practical: Conductivity measurement of different samples	10	1,3
5	Technician Skill for Sugar, Cement, Pharma Steel/Iron Foundries	Theory: Potentiometric measurements, electro analytical methods. Practical: pH measurement & Electrochemical measurements	10	1,4
6	QC Managerial Skill for Cosmetic/Pharma/Steel/Polymer/ Textile/Food and Dairy Products	Theory: Sustainability and the chemical industry. Practical: Recycle of wastes	10	1,5

Reference Books:

Industrial Chemistry by B.K Sharma, By Krishna Publications, GOEL Publishing House

Environmental Chemistry by H. Kaur, Pragati Prakashan, Meerut.

Water Pollution by V.P. Kudesia, 4th edition, (latest) Pragati Prakashan, Meerut.

Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education, sixth edition

e-Learning Source:

https://www.researchgate.net/publication/320360474_Metal_Recovery_from_Industrial_and_Mining_Wastewaters

https://www.routledge.com/Metal-Recovery-from-Industrial-Waste/Brooks/p/book/9781315895352

Activities: Assignments, quiz, discussion, presentation, viva-voce, lab manual preparation, group exercise etc.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	**SDGs Mapping**
CO1	3	2	3	3	-	3	3	3	3	3	2	1	4 (Quality education), & 13 (Climate Change)
CO2	3	2	3	3	-	2	3	2	3	2	2	2	
CO3	2	2	3	2	-	2	3	2	1	3	2	1	
CO4	3	2	3	3	-	2	3	2	3	3	2	2	
CO5	3	2	3	3	-	3	3	3	2	3	2	2	

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	Z010101T/BE105	**Title of the Course**	Food, Nutrition and Hygiene	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	0	2
Pre-Requisite	-	**Co-requisite**	-				
Course Objectives	To learn the basic concept of food, nutrition, hygiene, common diseases prevalent in society along with 1000 days nutrition concept.						

Course Outcomes	
CO1	Learners will be able to understand the basic concept of the Food and Nutrition, and meal planning.
CO2	Learners will be able to analyse the macro and micronutrients and its RDA, sources, functions, deficiency, and excess.
CO3	Learners will be able to understand and evaluate the 1000 days Nutrition Concept and study the nutritive requirement during special conditions like pregnancy and lactation.
CO4	Learners will be able to manage common health issues in the society and to learn the special requirement of food during common illness.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Concept of Food and Nutrition	(a) Definition of Food, Nutrients, Nutrition, Health, balanced Diet (b) Types of Nutrition- Optimum Nutrition, under Nutrition, Over Nutrition (c) Meal planning- Concept and factors affecting Meal Planning (d) Food groups and functions of food	8	1
2	Nutrients: Macro and Micro RDA, Sources, Functions, Deficiency and excess of	(a) Carbohydrate (b) Fats (c) Protein (d) Minerals Major: Calcium, Phosphorus, Sodium, Potassium Trace: Iron, Iodine, Fluorine, Zinc (e) Vitamins Water soluble vitamins: Vitamin B, C Fat soluble vitamins: Vitamin A, D, E, K (f) Water (g) Dietary Fiber	7	2
3	1000 days Nutrition	(a) Concept, Requirement, Factors affecting growth of child. (b) Prenatal Nutrition (0 - 280 days): Additional Nutrients' Requirementand risk factors during pregnancy (c) Breast / Formula Feeding (Birth – 6 months of age) Complementary and Early Diet (6 months – 2 years of age)	8	3
4	Community Health Concept	(a) Causes of common diseases prevalent in the society and Nutrition requirement in the following: Diabetes Hypertension (High Blood Pressure) Obesity Constipation Diarrhea Typhoid (b) National and International Program and Policies for improving Dietary Nutrition. (c) Immunity Boosting Food	7	4

Reference Books:

Singh, Anita, "Food and Nutrition", Star Publication, Agra, India, 2018.

Sheel Sharma,Nutrition and Diet Therapy,Peepee Publishers Delhi,2014,First Edition.

1000Days-Nutrition Brief Brain-Think Babies FINAL.pdf

https://pediatrics.aappublications.org/content/141/2/e20173716

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750909/

e-Learning Source:

https://www.udemy.com/course/internationally-accredited-diploma-certificate-in-nutrition Diploma in Human Nutrition-Revised Offered by Alison

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	SDGs Mapping
CO1	1	-	-	2	2	3	2	3	3	2	2	-	3 (Good Health and Well-being), & 4 (Quality education)
CO2	1	-	-	3	2	3	2	3	3	2	2	-	
CO3	1	-	-	3	3	2	3	3	-	-	2	-	
CO4	2	-	3	3	3	3	3	3	3	2	3	-	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	A050101T/ HM101	**Title of the Course**	RASHTRA GAURAV	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	0	2
Pre-Requisite	10+2	**Co-requisite**	-				
Course Objectives	The objective of the course on "Rashtra Gaurav" is to explore and critically analyze the multifaceted dimensions of national pride and glory, as depicted in the paper. Participants will delve into the historical, cultural, social, and political aspects that contribute to the concept of "Rashtra Gaurav" (National Pride) in the context of the specific themes and perspectives presented in the paper. Through in-depth discussions, readings, and interactive sessions, participants will gain a comprehensive understanding of the factors that shape and define a nation's sense of pride, and how these factors influence individual and collective identities. The course aims to foster a nuanced appreciation for the significance of "Rashtra Gaurav" in contemporary society, encouraging participants to critically evaluate its implications and applications within diverse global contexts.						

Course Outcomes	
CO1	Learners will be able to understand the basics of Indian Society and culture.
CO2	Learners will be able to analyze the fundamental issues in India.
CO3	Learners will be able to understand Indian Heritage.
CO4	Learners will be able to examine the philosophical and spiritual developments in India.
CO5	Learners will be able to evaluate the contributions of Major National Characters and Personalities.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Indian society & culture	• Unity in Diversity • Art forms, Literature, Culture from Ancient to Modern time. • National and International Awards & Awardees	05	01
2	Issues in India	• Issues of Gender Equality and role of Women Organisations • Issues of Poverty and Development • Social Empowerment through Social Movements in India	05	02
3	Indian heritage	• Cultural Heritage in India: Buddhist Monuments at Sanchi, Ajanta & Ellora Caves, Khajuraho, Taj Mahal • Tourist Places in India: Red Fort, Ambar Palace, Kaziranga National Park, Ram Mandir (Ayodhya)	04	03
4	Philosophical and spiritual developments	• Sufism & Bhakti Movement: Bulleh Shah, Data Ganj Baksh, Khwaja Moinuddin Chishti, and Nizamuddin Auliya.Tulsidas, Surdas, Meera, Nank & Kabir • Jainism: Mahavir's biography and education • Buddhism: The life of Buddha, Contributions of Buddhism to India's Culture	05	04
5	Major national characters and personalities	• Ashoka the Great and His Dhamma • Raja Ram Mohan Roy & Brahmo Samaj • Savitribai Phule: A Social Reformer and contribution in Women Education • Swami Vivekanand and his philosophies • Mahatma Gandhi: Role of Gandhi in Indian National Movement • Dr. Bhimrao Ambedkar: A Chief architect of the Indian Constitution	06	05

Reference Books:

Jawaharlal Nehru - "The Discovery of India"
B.R. Ambedkar - "Annihilation of Caste"
Ramachandra Guha - "India After Gandhi: The History of the World's Largest Democracy" Mahatma Gandhi – "My Experiment with Truth"
S C Dubey- "Indian Society"
Nadeem Hasnain – "Indian Society and Culture" G Shah- "Social Movements in India"

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	P05	PSO1	PSO2	PSO3	PSO4	PSO5	SDGs Mapping
CO1	2	1	3	3	2	2	3	2	1	2	4 (Quality education)
CO2	3	2	2	3	1	2	3	1	2	1	
CO3	1	2	2	2	2	3	2	3	3	2	
CO4	1	3	2	3	2	3	2	3	1	3	
CO5	2	3	1	2	2	3	1	3	2	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign and seal of HoD**

Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Mathematics **Year: First/ Semester: Second (Even Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B020201T/CH139	Bioorganic and Materials Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4
2	B020202P/CH141	Biochemical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4
3	B030201T/MT138	Matrices and Differential Equations & Geometry	T		5	1	-	15	10	25	75	100	06								-
4	• A040209T/LN109 • B150203T/ES135; B150204P/ES136 • -	• Basics of Communication • Eco-restoration and Invaded Ecosystems; Ecosystems Dynamic Lab • BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√	-
5	• I030202V/MT14 • B000201V/CH144 • --	• LaTeX -Scientific Writing • Laboratory Safety & Sample Handling • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√		√		√	√	√	4, 13
6	Z020201T/NS110	First Aid and Health	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√	3, 4
7	B020205T/CH159	Advanced Application of Artificial Intelligence in Chemical Sciences*	T	Audit Course	2	-	-	-	-	-	100	100	00	√	√	√					4, 9
				TOTAL	16	03	10	75	50	125	575	700	23								

*Qualifying (Non-Credit Course)

Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Physics **Year: First/ Semester: Second (Even Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B020201T/CH139	Bioorganic and Materials Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4
2	B020202P/CH141	Biochemical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4
3	B010201T/PY115	Thermal Physics & Semiconductor Devices	T		3	1	-	15	10	25	75	100	04								-
4	B010202P/PY116	Thermal Properties of Matter & Electronic Circuits	P		-	-	4	15	10	25	75	100	02								-
5.	• A040209T/LN109 • B150203T/ES135; B150204P/ES136 • -	• Basics of Communication • Eco-restoration and Invaded Ecosystems; Ecosystems Dynamic Lab • BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√	-
6.	• I030202V/MT14 • B000201V/CH144 • --	• LaTeX -Scientific Writing • Laboratory Safety & Sample Handling • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√		√		√	√	√	4 13
7.	Z020201T/NS110	First Aid and Health	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√	3 4
8.	B020205T/CH159	Advanced Application of Artificial Intelligence in Chemical Sciences*	T	Audit Course	2	-	-	-	-	-	100	100	00	√	√	√					4 9
TOTAL					**14**	**03**	**14**	**90**	**60**	**150**	**650**	**800**	**23**								

*Qualifying (Non-Credit Course)

Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Zoology **Year: First/ Semester: Second (Even Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B020201T/CH139	Bioorganic and Materials Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4 QUALITY EDUCATION
2	B020202P/CH141	Biochemical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4 QUALITY EDUCATION
3	B050201T/BS175	Biochemistry & Physiology	T		3	1	-	15	10	25	75	100	04								-
4	B050202P/BS176	Physiological, Biochemical & Haematology Lab	P		-	-	4	15	10	25	75	100	02								-
5.	• A040209T/LN109 • B150203T/ES135; B150204P/ES136 • -	• Basics of Communication • Eco-restoration and Invaded Ecosystems; Ecosystems Dynamic Lab • BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√	-
6.	• I030202V/MT14 • B000201V/CH144 • --	• LaTeX -Scientific Writing • Laboratory Safety & Sample Handling • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√		√		√	√	√	4 QUALITY EDUCATION 13 CLIMATE ACTION
7.	Z020201T/NS110	First Aid and Health	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√	3 GOOD HEALTH AND WELL-BEING 4 QUALITY EDUCATION
8.	B020205T/CH159	Advanced Application of Artificial Intelligence in Chemical Sciences*	T	Audit Course	2	-	-	-	-	-	100	100	00	√	√	√					4 QUALITY EDUCATION 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
			TOTAL		14	03	14	90	60	150	650	800	23								

*Qualifying (Non-Credit Course)

Department of Chemistry

Evaluation Scheme of Undergraduate & Post Graduate Program as per NEP-2020 Guidelines

B.Sc. (Hons) Chemistry Four Year program with Double Majors (Physics/Mathematics/Zoology/Botany)

w.e.f. Session 2024-25

B.Sc. (Hons) Chemistry with Botany **Year: First/ Semester: Second (Even Semester)**

S. N.	Course Code	Course Title	Theory (T) / Practical (P)	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B020201T/CH139	Bioorganic and Materials Chemistry	T	Core Major	3	1	-	15	10	25	75	100	04	√		√					4
2	B020202P/CH141	Biochemical Analysis	P		-	-	4	15	10	25	75	100	02	√	√	√					4
3	B040201T/BS177	Archegoniates & Plant Architecture	T		3	1	-	15	10	25	75	100	04								-
4	B040202P/BS178	Land Plants Architecture	P		-	-	4	15	10	25	75	100	02								-
5.	• A040209T/LN109 • B150203T/ES135; B150204P/ES136 • -	• Basics of Communication • Eco-restoration and Invaded Ecosystems; Ecosystems Dynamic Lab • BS	T	Minor Course	3	1	4	15	10	25	75	100	06	√	√	√		√	√	√	-
6.	• I030202V/MT14 • B000201V/CH144 • --	• LaTeX -Scientific Writing • Laboratory Safety & Sample Handling • MOOCs/SWAYAM etc.	T + P	Vocational	1	-	2	-	-	-	100	100	03	√		√		√	√	√	4 13
7.	Z020201T/NS110	First Aid and Health	T	Co-curricular	2	-	-	15	10	25	75	100	02	√		√		√	√	√	3 4
8.	B020205T/CH159	Advanced Application of Artificial Intelligence in Chemical Sciences*	T	Audit Course	2	-	-	-	-	-	100	100	00	√	√	√					4 9
				TOTAL	**14**	**03**	**14**	**90**	**60**	**150**	**650**	**800**	**23**								

*Qualifying (Non-Credit Course)

B.Sc. Chemistry

Effective from Session: 2025-26							
Course Code	B020101T/CH139	**Title of the Course**	Bioorganic and Materials Chemistry	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	5	1	0	4
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	To provide the students with a basic theoretical and experimental understanding of carbohydrates, amino acids, proteins, nucleic acids, and medicinal chemistry along with the solid state, basic chemical calculation, units and dimensions, material balance, energy balance, and the basics of medicinal chemistry.						

Course Outcomes	
CO1	Learners will be able to **understand** the significance of biomolecules in the functioning of living organisms and explain the chemistry of carbohydrates.
CO2	Learners will be able to **explain** the physiological functions that regulate human growth and development and demonstrate understanding of the chemistry of proteins and nucleic acids.
CO3	Learners will be able to **understand** the fundamentals of solid-state chemistry, including space lattice, unit cells, laws of crystallography, and X-ray diffraction by crystals.
CO4	Learners will be able to **understand and apply** basic chemical calculations, including the concepts of atoms, moles, mole fractions, and methods of expressing composition; demonstrate knowledge of units, dimensions, and conversions; and perform material balance calculations for processes with and without chemical reactions, including multiple unit operations, recycle, and bypass systems.
CO5	Learners will be able to **understand** the forms of energy and perform energy balance calculations, including evaluating energy changes in physical processes and chemical reactions for various industrial and laboratory applications.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Chemistry of Carbohydrates-I	Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Mechanism of mutarotation Determination of configuration of Glucose (Fischer's proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Inter conversions of sugars (ascending and descending of sugar series, conversion of aldoses to ketoses).	8	1
2	Chemistry of Carbohydrates-II	Lobry de Bruyn-van Ekenstein rearrangement; stepping–up (Kiliani Fischer method) and stepping–down (Ruff's &Wohl's methods) of aldoses; end-group interchange of aldoses Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose.)	8	1
3	Chemistry of Proteins	Classification of amino acids, zwitter ion structure and isoelectric point. Overview of primary, secondary, tertiary and quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C– terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection & C-activating groups and Merrifield solid phase synthesis. Protein denaturation/ renaturation. Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions).	8	2
4	Chemistry of Nucleic Acids	Constituents of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), Nucleosides and nucleotides (nomenclature), Synthesis of nucleic acids, Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation	8	2
5	Solid State	Definition of space lattice, unit cell. Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices and iii) Symmetry elements in crystals and law of symmetry .X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl and CsCl (powder method).	8	3
6	Basic Chemical Calculation, Units and Dimensions	Introduction, Concept of atom, Mole and mole fraction, Methods of expressing the composition of mixtures (mass percent, volume percent, mole percent), equivalent weight, normality, molarity, molality. Introduction, Dimensions & Systems of Units, Fundamental quantities, Derived Quantities, Conversions & Problems.	8	4
7	Material Balance	Process classification, Choice of system and basis of molecular processes with chemical reactions, Material balance calculations, multiple unit processes, Recycle and bypass.	6	4
8	Energy Balance	Energy balance: Forms of energy, Energy balance, Energy changes in physical processes, Energy changes in reactions, Energy balance Calculations.	6	5

Reference Books:

Davis, B. G., Fairbanks, A. J., Carbohydrate Chemistry, Oxford Chemistry Primer, Oxford University Press.

Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).

Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.

Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Singh, H. & Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi, 2012.

e-Learning Source:

http://heecontent.upsdc.gov.in/Home.aspx

https://nptel.ac.in/courses/104/105/104105124/

https://nptel.ac.in/courses/103/106/105106204/
https://nptel.ac.in/courses/104/105/104105034/
https://nptel.ac.in/courses/104/103/104103121/
Activities: Assignments, quiz, discussion, presentation, etc.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	SDGs Mapping
CO1	3	-	-	-	-	3	2	3	-	-	2	2	
CO2	3	-	-	-	-	2	2	2	-	2	1	1	
CO3	3	-	-	-	-	3	2	3	-	-	2	1	**4 (Quality education)**
CO4	2	-	-	-	-	1	2	1	-	-	1	2	
CO5	3	-	-	-	-	3	2	3	2	-	2	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-26							
Course Code	B020102P/CH141	**Title of the Course**	Biochemical Analysis	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	0	0	4	2
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	To introduce students to the fundamental qualitative and quantitative experimental understanding of biomolecules, including simple drug creation and molecules made of carbohydrates, proteins, amino acids, and nucleic acids.						

Course Outcomes	
CO1	Learners will be able to development of qualitative and quantitative experimental skills for the analysis of biomolecules such as carbohydrates, proteins, amino acids, and nucleic acids would enable students to analyze their structural and chemical properties effectively.
CO2	Learners will be able to perform qualitative and quantitative analysis of carbohydrates would enable students to determine their composition and reactivity systematically.
CO3	Learners will be able to perform of qualitative and quantitative analysis of proteins, amino acids, and fats would enable students to evaluate their structural features and chemical behaviour.
CO4	Learners will be able to determine an identification of nucleic acids and their constituent components would enable students to understand their biological significance and chemical structure.
CO5	Learners will be able to perform synthesis of simple drug molecules would enable students to apply basic organic synthesis techniques in pharmaceutical chemistry.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Qualitative and Quantitative Analysis of Carbohydrates	Separation of a mixture of two sugars by ascending paper chromatography Application of TLC and PC for the identification of natural coloring materials such as Lycopene from Tomato and Chlorophyll from Spinach Differentiate between a reducing/ non reducing sugar Synthesis of Osazones.	15	1,2
2	Qualitative and Quantitative Analysis of Proteins, Amino Acids and Fats	Isolation of protein. Determination of protein by the Biuret reaction. TLC separation of a mixture containing 2/3 amino acids Paper chromatographic separation of a mixture containing 2/3 amino acids 5. Action of salivary amylase on starch To determine the concentration of glycine solution by formylation method. To determine the saponification value of an oil/fat. To determine the iodine value of an oil/fat	15	1,3
3	Determination and Identification of Nucleic Acids	Determination of nucleic acids Extraction of DNA from onion/cauliflower	15	1,4
4	Synthesis of Simple Drug Molecules	To synthesize aspirin by acetylation of salicylic acid and compare it with the ingredient of an aspirin tablet by TLC. Synthesis of barbituric acid Synthesis of propranolol	15	1,5

Reference Books:

1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education.
3. G. Svehla, Vogel's Qualitative Inorganic Analysis, 7e Pearson (2008).
4. Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, ELBS.
5. Wilson, K. & Walker, J. Practical Biochemistry. Cambridge University Press (2009). 9. Varley, H., Gowenlock, A.H & Bell, M.: Practical Clinical
6. Biochemistry, Heinemann.

e-Learning Source:

1. https://www.labster.com/chemistry-virtual-labs/
2. https://www.vlab.co.in/broad-area-chemical-sciences
3. http://chemcollective.org/vlabs

Activities: Assignments, quiz, discussion, presentation, viva-voce, lab manual preparation, group exercise etc.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	**SDGs Mapping**
CO1	2	1	1	1	1	2	2	2	2	1	1	1	**4 (Quality education)**
CO2	3	-	1	-	1	1	2	2	2	1	1	2	
CO3	3	1	1	1	1	2	2	2	2	2	1	1	
CO4	2	1	-	1	1	1	2	2	2	1	2	1	
CO5	3	1	1	1	-	1	2	2	2	1	1	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-2026							
Course Code	B000201V/CH144	**Title of the Course**	Laboratory Safety & Sample Handling	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	1	0	2	3
Pre-Requisite	10+2 with Chemistry	**Co-requisite**	-				
Course Objectives	To impart the fundamental understanding of laboratory safety, managerial abilities for waste reduction, a basic understanding of chemistry, laboratory equipment, reagents, and solutions, as well as expertise in using high- tech equipment for any pharma/chemical company/testing lab, etc.						

Course Outcomes	
CO1	Learners will be able to understand an adherence to safety procedures and protocols in a science laboratory would enable students to perform experiments safely and confidently.
CO2	Learners will be able to understand the application of waste management skills in laboratory practices would enable students to handle and dispose of chemical wastes effectively.
CO3	Learners will be able to demonstrate elementary knowledge of chemistry concepts would enable students to explain fundamental principles in theoretical and practical contexts.
CO4	Learners will be familiar with laboratory instruments, reagents, and solutions, along with working confidently in a chemistry laboratory, would enable students to perform experiments efficiently.
CO5	Learners will be able to handle of sophisticated instruments used in pharmaceutical industries, chemical companies, and testing laboratories would enable students to operate analytical equipment with competence.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Safety In Science Laboratory	Theory: General Safety; Safe Handling of Chemicals and Glass wares; Working in Chemo-Safety/ Bio-Safety areas. Practical: Quantitative analysis; Determination of physical parameters of wastewater and solid waste. Temperature, Colour, Odour, pH, etc.	10	1
2	Managerial Skill in Minimizing Wastes	Theory: Four "Rs"- Reuse, Rework, Reduce, Recycle. Practical: Handling of different kinds of wastes and reuse. BOD, COD, & DO measurement.	10	1,2
3	Elementary Knowledge of Chemistry	Theory: Elementary knowledge of inorganic chemistry; Elementary knowledge of organic chemistry; Elementary knowledge physical chemistry. Practical: Study of Physico- chemical characteristics of e waste.	10	3
4	Laboratory Instruments	Theory: Principle and working of basic laboratory instruments Autoclave, Hot air oven, Incubator, pH meter, water bath, centrifuge, Refrigerator, colorimeter, Balance, Flame photometer, Microscope, Electrophoresis etc. Practical: Wastewater analysis and its treatment including primary, secondary, and tertiary treatment.	10	1,4
5	Reagents and Solutions	Theory: Molar solutions, normal solutions; Buffer solutions, solutions, saturated solutions, standard solutions. Dilution of the concentrated solution to desired concentration. Practical: Soil Sampling and its digestion; Physico-chemical characteristics of soil.	10	1,4
6	Handling Sophisticated Instruments	Expertise in Handling Sophisticated Instruments for Any Pharma/Chemical Companies/ Testing Labs etc.: Theory: Sustainability and the Chemical Industry; Chromatography and separation Techniques. Practical: TLC and Paper chromatographic techniques	10	1,5

Reference Books:

Industrial Chemistry by B.K Sharma, By Krishna Publications, GOEL Publishing House

Environmental Chemistry by H. Kaur, Pragati Prakashan, Meerut.

Environmental Chemistry by A. K.De , New Age International Publishers, (9th edition)

Water Pollution by V.P. Kudesia, 4th edition, (latest) Pragati Prakashan, Meerut.

e-Learning Source:

https://www.researchgate.net/publication/320360474_Metal_Recovery_from_Industrial_and_Mining_Wastewaters

https://www.routledge.com/Metal-Recovery-from-Industrial-Waste/Brooks/p/book/9781315895352

https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	**SDGs Mapping**
CO1	3	1	2	1	1	3	3	3	3	3	3	3	**4 (Quality Education) 13 (Climate Action)**
CO2	3	1	2	1	1	3	3	3	2	3	3	3	
CO3	2	1	1	1	1	1	3	3	3	-	3	3	
CO4	3	1	1	1	1	1	3	3	3	-	2	2	
CO5	3	2	1	1	1	2	3	3	3	3	3	3	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Effective from Session: 2024-2025							
Course Code	A040209- LN109	**Title of the Course**	Basic of Communication	**L**	**T**	**P**	**C**
Year	First	**Semester**	Second	**3**	**1**	**0**	**4**
Pre-Requisite		**Co-requisite**					
Course Objectives	To enhance basic communication skill among the students. Students will also learn about the fundamentals of linguistics and Grammars.						

Course Outcomes	
CO1	Basic understanding of Communication and professional communication
CO2	Basic knowledge of structural and functional Grammar. Learning language through literature.
CO3	Basic tools of communication and improvement in communicative competence.
CO4	Understanding the basic grammar and basic structure of language.
CO5	Students will gain a fundamental understanding of the nature, branches, and history of Linguistics.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Professional Communication	Professional Communication: Its Meaning and Importance, Essentials of Effective Communication, Barriers to Effective Communication.	8	1
2	Language through Literature	A. Essays: 1. The Effect of Scientific Temper on Man by Bertrand Russell, 2. The Aim of Science and Humanities by Moody E Prior. B. 1. The Meeting Pool by Ruskin Bond, 2. The Portrait of a Lady by Khushwant Singh	8	2
3	Basic Vocabulary	Euphemism, One-word Substitution, Synonyms, Antonyms, Homophones, Idioms and Phrases, Common Mistakes, Confusable Words and Expressions.	8	3
4	Basic Grammar	Articles, Prepositions, Tenses, Concord, (Subject-Verb agreement), Modal Auxiliaries, Verbs: its Kinds and uses, Degrees of Comparison, Punctuation	8	4
5	Language and Linguistics	Language: Definition, characteristics and importance of Language Linguistics: Definition, nature, scope, branches, levels and types of Linguistics, Linguistics versus Traditional Grammar.	8	5

Reference Books:
Effective Communication Skills
Improve Your Communication Skills
Communication Skills Training
e-Learning Source:
www.ignou.com
www.swayam.com
www.coursera.com

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)											
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	-	-	2	3	3	2	-
CO2	2	3	1	2	3	-	-	2	3	3	1	-
CO3	1	3	1	2	3	-	-	3	3	2	2	-
CO4	3	3	2	2	3	-	-	2	2	3	1	-
CO5	2	3	2	3	3	-	-	3	3	2	3	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2024-2025							
Course Code	**B150203T/ES135**	**Title of the Course**	**Eco-Restoration and Invaded Ecosystems**	**L**	**T**	**P**	**C**
Year	**1st**	**Semester**	**II**	**4**	**0**	**0**	**4**
Pre-Requisite	10+2	**Co-requisite**	NONE				
Course Objectives	The aim of the course is to define the principles of ecological restoration and ecotourism and investigate the complex and dynamic interactions between humans and their environment. This advanced ecosystem management course will begin with an overview of the ecological basis for plant invasions in managed forests and terrestrial ecosystems, and then focus on methods for restoration of invaded and formerly invaded systems. Management tools and techniques for prevention, control, and restoration will be discussed, and plant invasions						

Course Outcomes

CO1	Be able to interpret and critically assess theories related to restoration ecology, biotic interactions, and ecological succession
CO2	Predict the issues related to the environmental ecosystem degradation and Eco restoration
CO3	Understand how to use modern tools, methods, and traditional knowledge to prevent and control plant invasions and to restore formerly invaded ecosystems.
CO4	Predict the issues related to the environmental ecosystem degradation and Eco restoration
CO5	Develop skills and demonstrate how to integrate ecological concepts into management efforts

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Restoration Concept**	Concepts of restoration, single vs. multiple endpoints; ecosystem reconstructions; physical, chemical, biological, and biotechnological tools of restoration. Various approaches to Restoration Ecology of Disturbed Ecosystems: disturbance and its impact on the structure and functioning of terrestrial and aquatic ecosystems.	8	CO1
2	**Restoration of Ecosystems & Biodiversity**	Ecology of Disturbed Ecosystems: disturbance and its impact on the structure and functioning of terrestrial and aquatic ecosystems. Restoration of biological diversity: Acceleration of ecological succession, reintroduction of biota. Restoration of contaminated soils and soil fertility, mine spoil restoration. Restoration in the context of Sustainability, Globalization and Sustainability	8	CO2
3	**Role of Local people, Organization, and collaboration**	Community participation in eco-restoration traditional sacred land restoration, water restoration its techniques, practices regulation concept of traditional knowledge and transmission and maintenance of traditional knowledge on eco restoration over generations, ecosystem services and human wellbeing, NGO's, educational, research institutions and other agencies.	8	CO3
4	**Eco restoration Ethics**	Ethics in Eco-restoration: virtue, utilitarian and deontological theories; Religion and ethics; Political ecology; Ownership and intellectual property rights; Codes of conduct.	6	CO3
5	**Invasion theories and mechanism**	Introduction, Theories and Mechanisms for Invasion, Dispersal Mechanisms, Dispersal Mechanisms, Biotic interactions (competition, facilitation, mutualism)	6	CO4
6	**Ecological Impacts following Invasion and Ecosystem reclamation**	Impacts to ecological processes (nutrient cycles), Impacts to ecological processes (fire and water), Impacts to plant communities (biodiversity vs saturation), Eco remediation techniques, general principles, bioremediation, phytoremediation in eco-restoration	8	CO4
7	**Management and Restoration of Invaded Ecosystems**	Management and Restoration of Invaded Ecosystems, Techniques for control I- Integrating plant biology into control, Restoration of invaded ecosystem I- restoring plant communities, Restoration of invaded systems II- restoring ecosystem function, Restoration of invaded systems II- case studies and efficacy, Invasive species management and restoration in a changing environment	8	CO5
8	**Case Studies**	Ecological Restoration of Lantana-Invaded. Landscapes in Corbett Tiger Reserve, Restoration of Lake Kukkarahalli in Mysore, Mangrove restoration, Land reclamation and restoration of natural ecosystem: a case study from opencast mines of northeastern Coalfields of India.	8	CO5

Reference Books:

1. Agarwal, A. N (1980) Indian Agriculture, Vikas publishing House, New Delhi,
2. Weaver, D. B (2001) The Encyclopedia of Ecotourism, CABI, Publishing, U.K.
3. Byrne, P. 1999. The Philosophical and Theological Foundations of Ethics. 2d ed. Palgrave Macmillan, London, UK.
4. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000282/M027568/ET/1519296718Paper12_EM_Module28_etext.pdf
5. Sinha, P. C (2003) Encyclopedia of Ecotourism, Vol – I, II & III, Anmol publications Pvt. Ltd, New Delhi.
6. Ecological Restoration, Second Edition: Principles, Values, and Structure of an Emerging Profession (Society for Ecological Restoration) Paperback – Import, 28 February 2013 by Andre F. Clewell (Author), James Aronson (Author)
7. Google book: International principles and standards for the practice of ecological restoration. Second edition George D. Gann ,Tein McDonald ,Bethanie Walder ,James Aronson ,Cara R.Nelson ,Justin Jonson ,James G. Hallett ,Cristina Eisenberg ,Manuel R. Guariguata ,Junguo Liu ,First published: 04 September 2019,https://doi.org/10.1111/rec.13035

e-Learning Source:

1. SWAYAM
2. Virtual Labs
3. MOOC

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	1	1	3	2						3	3	3	2	1	-
CO2	3	2	2	1	1	3	2						3	3	3	2	1	-
CO3	3	2	2	2	2	3	2						3	3	3	2	1	-
CO4	3	2	2	1	1	3	2						3	3	3	2	2	-
CO5	2	3	1	1	1	3	2						3	3	3	2	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2024-2025							
Course Code	**B150204P/ES136**	**Title of the Course**	**Ecosystem Dynamic Lab**	**L**	**T**	**P**	**C**
Year	**Ist**	**Semester**	**II**	**0**	**0**	**4**	**2**
Pre-Requisite	10+2	**Co-requisite**	None				
Course Objectives	This course provides knowledge about the various type of invasive species its establishment, area extent, influence of biotic and abiotic factor etc. Further, student will explore the advance tool and techniques of eco restoration of terrestrial and aquatic ecosystem.						

Course Outcomes	
CO1	To identify the invasive plant species.
CO2	Student will explore the landscape ecology in term of degraded area extant, population and community ecological changes.
CO3	To study about the ecological succession steps.
CO4	Students will explore the advance techniques for environmental monitoring.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Field visit**	Explore the invasive species in the focused area	15	CO1
2	**Landscape Ecosystem**	Identification of degraded areas/landscape/ecosystems Study the population and community ecology changes in the area	15	CO2
3	**Ecological Succession**	Specific areas of focus include effects of abiotic and biotic disturbances on vegetation and animals.	15	CO3
4	**Ecosystem Disturbance**	Identify the disturbing factors in and ecosystem viz. natural disasters, climate change, invasion, anthropogenic activities. To study about the forest fire area extent using environmental monitoring techniques namely RS and GIS, ecological methods, surveys, and ground studies	15	CO4

Reference Books:

1. Gardner, R.H., Robert,V., O'Neill, T.irner,M.G. 2001. Landscape Ecology in Theory & Practice. Pattern and Process. Springer-Verlag, USA
2. Agarwal, A. N (1980) Indian Agriculture, Vikas publishing House, New Delhi,
3. Bharucha, E. 2003. Biodiversity of India. The. Mapin Publishing, India
4. Egan,D. and Howell, E.A. (eds.) 2001. The Historical Ecoogy Handbook : A Restorationist's Guide to Reference Ecosystems. Island Press, Washington DC USA

e-Learning Source:

1. SWAYAM
2. MOOC
3. https://www.youtube.com/watch?v=3GfoRRxpVVA

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	3	2						2	3	3	2	1
CO2	3	2	2	1	2	3	2						3	3	3	1	1
CO3	2	1	1	1	1	3	1						3	3	3	1	1
CO4	3	2	1	1	1	3	2						3	3	3	1	3

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-2026							
Course Code	Z020201T/NS110	**Title of the Course**	First Aid and Health	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	2	0	0	2
Pre-Requisite	10+2	**Co-requisite**	-				
Course Objectives	This course aims to educate fundamental and essential understanding of first aid and sex education.						

Course Outcomes	
CO1	Learn the skill needed to assess the ill or injured person and learn the skills to provide CPR to infants, children and adults.
CO2	Learn the skills to handle emergency childbirth and learn the Basic sex education help young people navigate thorny questions responsibly and with confidence.
CO3	Learn the Basic sex education help youth to understand Sex is normal. It's a deep, powerful instinct at the core of our survival as a species. Sexual desire is a healthy drive.
CO4	Help to understand natural changes of adolescence
CO5	Learn the skill to identify Mental Health status and Psychological First Aid

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fundamentals of First Aid-I	A. Basic First Aid • Aims of first aid & First aid and the law. • Dealing with an emergency, Resuscitation (basic CPR). • Recovery position, Initial top to toe assessment. • Hand washing and Hygiene • Types and Content of a First aid Kit B. First AID Technique • Dressings and Bandages. • Fast evacuation techniques (single rescuer). • Transport techniques. C. First aid related with respiratory system • Basics of Respiration • No breathing or difficult breathing, Drowning, Choking, Strangulation and hanging, • Swelling within the throat, Suffocation by smoke or gases and Asthma. D. First aid related with Heart, Blood and Circulation • Basics of The heart and the blood circulation. • Chest discomfort, bleeding. E. First aid related with Wounds and Injuries • Type of wounds, Small cuts and abrasions • Head, Chest, Abdominal injuries • Amputation, Crush injuries, Shock F. First aid related with Bones, Joints Muscle related injuries • Basics of The skeleton, Joints and Muscles. • Fractures (injuries to bones).	8	1,2
2	Fundamentals of First Aid-II	G. First aid related with Nervous system and Unconsciousness • Basics of the nervous system. • Unconsciousness, Stroke, Fits – convulsions – seizures, Epilepsy. H. First aid related with Gastrointestinal Tract • Basics of The gastrointestinal system. • Diarrhea, Food poisoning. I. First aid related with Skin, Burns • Basics of The skin. • Burn wounds, Dry burns and scalds (burns from fire, heat and steam). • Electrical and Chemical burns, Sun burns, heat exhaustion and heatstroke. • Frost bites (cold burns), Prevention of burns, Fever and Hypothermia. J. First aid related with Poisoning • Poisoning by swallowing, Gases, Injection, Skin K. First aid related with Bites and Stings • Animal bites, Snake bites, Insect stings and bites L. First aid related with Sense organs • Basic of Sense organ. • Foreign objects in the eye, ear, nose or skin. • Swallowed foreign objects. M. Specific emergency satiation and disaster management • Emergencies at educational institutes and work • Road and traffic accidents. • Emergencies in rural areas. • Disasters and multiple casualty accidents. • Triage. • Emergency Child birth	8	2.3
3	Fundamentals of Sex Education-I	Basic Sex Education • Overview, ground rules, and a pre-test • Basics of Urinary system and Reproductive system. • Male puberty — physical and emotional changes • Female puberty — physical and emotional changes • Male-female similarities and differences	7	4

		• Sexual intercourse, pregnancy, and childbirth • Facts, attitudes, and myths about LGBTQ+ issues and identities • Birth control and abortion • Sex without love — harassment, sexual abuse, and rape • Prevention of sexually transmitted diseases.		
4	Fundamentals of Sex Education-II	• Mental Health and Psychological First Aid • What is Mental Health First Aid? • Mental Health Problems in the India • The Mental Health First Aid Action Plan • Understanding Depression and Anxiety Disorders • Crisis First Aid for Suicidal Behavior & Depressive symptoms • What is Non-Suicidal Self-Injury? • Non-crisis First Aid for Depression and Anxiety • Crisis First Aid for Panic Attacks, Traumatic events • Understanding Disorders in Which Psychosis may Occur • Crisis First Aid for Acute Psychosis	7	5

Reference Books:

Indian First Aid Mannual-https://www.indianredcross.org/publications/FA-manual.pdf

Red Cross First Aid/CPR/AED Instructor Manual

https://mhfa.com.au/courses/public/types/youthedition4

Finkelhor, D. (2009). The prevention of childhood sexual abuse. Durham, NH: Crimes Against Children Research Center.

Orenstein, P. (2016). Girls and sex: Navigating the complicated new landscape. New York, NY: Harper.

e-Learning Source:

https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online

www.unh.edu/ccrc/pdf/CV192. pdf

https://www.firstaidforfree.com/

https://www.coursera.org/learn/psychological-first-aid

https://www.coursera.org/learn/mental-health

Activities: Assignments, quiz, discussion, presentation, etc.

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)												
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	SDGs Mapping
CO1	3	1	-	-	-	-	-	2	-	-	2	1	3 (Good Health and Well-being), & 4 (Quality education)
CO2	1	3	-	-	-	-	-	2	-	-	3	3	
CO3	2	3	-	-	-	-	-	3	-	-	2	2	
CO4	3	2	-	-	-	-	-	1	-	-	3	3	
CO5	3	3	-	-	-	-	-	3	-	-	2	3	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

B.Sc. Chemistry/B.Sc. Industrial Chemistry

Effective from Session: 2025-2026							
Course Code	B020205T/CH159	**Title of the Course**	Advanced Application of Artificial Intelligence in Chemical Sciences	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	3	1	0	4
Pre-Requisite	10+2	**Co-requisite**	-				
Course Objectives	To explain the students with the origin of artificial intelligence, its evolution, scope, and significance. The idea is to know about the probable applications of AI in chemical sciences and how they can be implemented in reaction designing, synthesis, molecular prediction, reaction outcome prediction, template selection, molecular designing, and property prediction.						

Course Outcomes	
CO1	Learners will be able to acquire knowledge of the history, evolution, scope, and significance of Artificial Intelligence would enable students to describe its fundamental concepts and development.
CO2	Learners will be able to apply problem-solving techniques using Artificial Intelligence which would enable students to solve complex tasks efficiently.
CO3	Learners will be able to analysis and evaluate different types of neural networks and deep learning approaches, including supervised and unsupervised learning, feature selection and engineering, and learning from observation, would enable students to select appropriate AI models for specific problems.
CO4	Learners will be able to understand an application of machine learning and data analysis techniques in chemistry, including database utilization and deep learning applications, would enable students to interpret chemical data effectively.
CO5	Learners will be able to design and implement AI applications in chemical synthesis, molecular prediction, prediction of reaction outcomes, designing of new reactions, reactant and template selection, molecular designing, and property prediction would enable students to innovate in chemical research and development.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to artificial intelligence and problem solving through AI	*Introduction:* History and evolution of AI, comparison of human and computer skill, Component of AI, Scope and significance in different domains, Ethical considerations in AI development and deployment, Intelligent Agent, logical agent. *Problem solving through AI:* Defining problem as a state space search, analyzing the problem, solving problem by searching, informed search and Uninformed Search.	7	1, 2
2	Machine Learning Basics and Natural Language Processing	*Machine Learning:* Neural networks and deep learning, Supervised and unsupervised learning, feature selection and engineering, learning from observation, knowledge in learning. *Natural Language Processing:* Brief history of NLP, Text processing, Sentiment analysis, language translation, Early NLP system, ELIZA system, LUNAR system, General NLP system.	8	2,3
3	AI in Chemistry	Concept of Artificial intelligence, machine learning, Machine learning applications to data analysis in chemistry, databases, deep learning in chemistry, cheminformatics, molecular dynamics and simulation, chemical representation of atoms and molecules with molecular graph representation and Simplified Molecular Input Line Entry System (SMILES)	7	4
4	Applications of AI in Synthetic and Medicinal Chemistry and ethical issues:	Artificial intelligence in synthesis, molecular prediction, prediction of reaction outcomes and designing of new reactions, reactant and template selection, molecular designing and property prediction, computer-assisted synthesis design and prediction of biochemical pathways and new drug targets. Regulatory science, ethical consideration related to use of AI in chemical sciences	8	5

Reference Books:

Artificial Intelligence with Python: A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers by Prateek Joshi

Hands-On Artificial Intelligence for Beginners: An introduction to AI concepts, algorithms, and their implementation By Patrick D. Smith

Machine Learning in Chemistry: The Impact of Artificial Intelligence Edited by Hugh M Cartwright

Artificial Intelligence in Chemistry: Structure Elucidation and Simulation of Organic Reactions, Volume 73 Z. Hippe

e-Learning Source:

https://www.youtube.com/watch?v=Q_gWTkh5pEY

https://www.youtube.com/watch?v=HbfFS7bA5M0

Activities: Assignments, quiz, discussion, presentation, etc.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	**SDGs Mapping**
CO1	2	-	-	-	-	2	3	2	2	2	1	2	**4 (Quality Education), & 9 (Industry, Innovation, and Infrastructure)**
CO2	2	-	-	-	-	2	3	1	2	2	1	1	
CO3	2	-	-	-	-	2	3	1	2	2	1	2	
CO4	2	-	-	-	-	2	3	2	2	2	2	1	
CO5	2	-	-	-	-	2	3	2	2	2	2	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**